

Mr. Keeree Kanjanapas Group holds 36.89% of Tanayong Public Company Limited. Tanayong Public Company Limited (Tanayong) was established in March, 1968 to operate the property development business. Tanayong was listed on the Stock Exchange of Thailand in March, 1991. Tanayong has three core businesses, i.e., i) property development, ii) hotel, hospitality, property management and services, and iii) project management. In the area of property development, Tanayong develops residential and commercial projects including apartments, condominiums, offices, restaurants, hotels, and clubs. Tanayong suffered from the economic crisis in 1997. Tanayong finalized the debt restructuring in 2006. Since 2007, Tanayong has been actively developing projects in the area of property and hotel development over the country. As of the year ended March 31, 2009, Tanayong held 15 subsidiaries.

## 2.6 Lessons from Blue Line and BTSC

### 2.6.1 Implementation Scheme

The implementation schemes for these two lines were generated as pioneers for urban city railway in Thailand. Therefore, needless to say, much of the issues concerning the implementation schemes are in the detail contents of how public and private agreed to work together. The role sharing did not specify action commitments and left behind little clues to check whether the public side or the private side has complied with the agreement. Also, despite the uncertainties of pioneering MRT, the risk sharing was too heavy on the private side to bear. Network considerations to agree on extension conditions and linkages with other lines and modes are also areas requiring further clarity. In addition, the areas of KPI target setting and detail contractual terms need improvements for future lines.

**Table 2.5-27: Observations Regarding Implementation Scheme (BMCL)**

Category	Observed Issues
Role sharing	<ul style="list-style-type: none"> <li>- Action commitment from both party not clearly defined. For example, i) Capability building plan commitment by private consortium (to build domestic industry), ii) Network building plan commitment by government (as basis for ridership forecast)</li> <li>- Government intervention rights (to ensure public service) in case of non-performance not clear. For example, how to intervene during debt restructuring.</li> </ul>
Risk sharing	<ul style="list-style-type: none"> <li>- Revenue risk too heavy on private party, despite controlling factors on the government side (i.e. build up of network)</li> </ul>
Target setting	<ul style="list-style-type: none"> <li>- Standard cost, service level KPI not agreed in detail. Therefore, government monitoring lacks spike.</li> </ul>
Network consideration	<ul style="list-style-type: none"> <li>- Inadequate considerations on extension arrangements and linkages with other lines (e.g. AFC, Signal). Blue line extension could be costly and inconvenient.</li> </ul>
Other contractual terms	<ul style="list-style-type: none"> <li>- Lack flexibility despite early stages of mass transit network building. For example, revision clause not clearly defined.</li> </ul>

Source: JICA Study Team

### 2.6.2 Performance

In terms of observed performance issues, there are four areas: i) financial performance of railway business; ii) financial performance of non-railway; iii) operational performance; and iv) supplier management.

Table 2.5-28: Observations Regarding Performance (Case of BMCL)

Category	Observed Issues
Financial performance (railway)	<ul style="list-style-type: none"> <li>- Ridership assumption too optimistic, actual less than 50% of forecast</li> <li>- Maintenance cost too high compared to other country standards, for track, rolling stock and systems. For example, as a percentage of total operating cost and as a percentage of annual depreciation amount</li> </ul>
Financial performance (non-railway)	<ul style="list-style-type: none"> <li>- Business handled by subsidiary. There is a room for disproportionate dividend payment from subsidiaries to BMCL although profit sharing of non-fare revenue is clearly described in the agreement.</li> <li>- In future, non-rail revenue must be clearly considered and described in the agreement.</li> </ul>
Operational performance	<ul style="list-style-type: none"> <li>- Access to other modes of transport not fully integrated</li> <li>- Common ticketing not planned upfront, creating passenger inconvenience</li> <li>- Fare integration not planned yet. Short distance trip (with change from Blue line to Sky train) can be quite expensive for mass segment.</li> </ul>
Supplier Management	<ul style="list-style-type: none"> <li>- Lack strategic view to obtain bargaining power vis-à-vis supplier (e.g. contractual commitment for maintenance capability building, periodic cost review to bring down maintenance service fee )</li> </ul>

Source: JICA Study Team

Financial performance of railway business by operating companies clearly performed below target mainly due to overly optimistic assumptions. In addition, maintenance cost seems high and requires further benchmarking to ensure competitive cost levels. Financial performance of non-railway does not contribute much directly to the P&L of operating companies. It is worth considering the managing non-rail businesses as a part of the operating entity. This allows cashflow to be much more stable, especially as railway profits take many years to reach positive profits. On management topics, supplier management stands out as most important area for future improvement. This is especially important as the MRT sector in Thailand is new and it is obliged to depend largely on overseas suppliers for its initial capability building. In addition, network building requires avoiding the over-dependence on suppliers.

## CHAPTER 3 SYNTHESIS OF CURRENT ISSUES REGARDING DEVELOPMENT OF URBAN RAILWAY SYSTEM IN THAILAND

### 3.1 Three Tier Structure Approach Adopted for Identifying Issues

As we have described, characteristics of urban railway in Thailand are quite sophisticated in terms of network, usage of PPP and organization. To synthesize current issues on urban railway in Thailand, the Study Team will use the ‘three-tiered’ structure.

- **Tier 1** is issues surrounding overall Urban Mass Transit Sector, including sector vision, governance, law and regulation.
- **Tier 2** is issues on MRT Network Master Plan, including integrated Bangkok city transit-oriented development (TOD) plan, integrated multi-modal plan and MRT network integration
- **Tier 3** is issues on each MRT line implementation scheme consisting of financial framework, concession agreement, supplier management and non-rail business management

Based on analysis of current situation described in the previous chapter, we have synthesized issues into the three tier structure shown in the figure below.

	Category	Key Issues
<b>Tier 1 Mass Transit Sector</b>	<ul style="list-style-type: none"> <li>• Sector Vision</li> <li>• Governance</li> <li>• Law and Regulation</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of clear vision on future mass transit sector structure</li> <li>• Weak governance structure of mass transit</li> <li>• Sector-specific law and regulation for urban mass transit does not exist</li> </ul>
<b>Tier 2 Integrated MRT Master Plan</b>	<ul style="list-style-type: none"> <li>• Integrated Bangkok City TOD Plan</li> <li>• Integrated Multi-modal Plan</li> <li>• MRT Network Integration</li> </ul>	<ul style="list-style-type: none"> <li>• Degree of integration is weak between MRT plan and city plan</li> <li>• Degree of integration is weak between MRT plan and other modes of transport</li> <li>• Degree of integration is weak between different MRT lines</li> </ul>
<b>Tier 3 Each MRT Line Implementation</b>	<ul style="list-style-type: none"> <li>• Financial Framework</li> <li>• Concession Agreement</li> <li>• Supplier Management</li> <li>• Non-rail Business Management</li> </ul>	<ul style="list-style-type: none"> <li>• There is a misperception that selection of financial framework alone can provide bias for efficiencies in construction, procurement and operations</li> <li>• Tender preparation and concession agreement were not optimal</li> <li>• Poor supplier management caused problems (e.g. line extension)</li> <li>• Full potential of non-rail business revenue has not been exploited</li> </ul>

Source: Study Team interviews and analysis

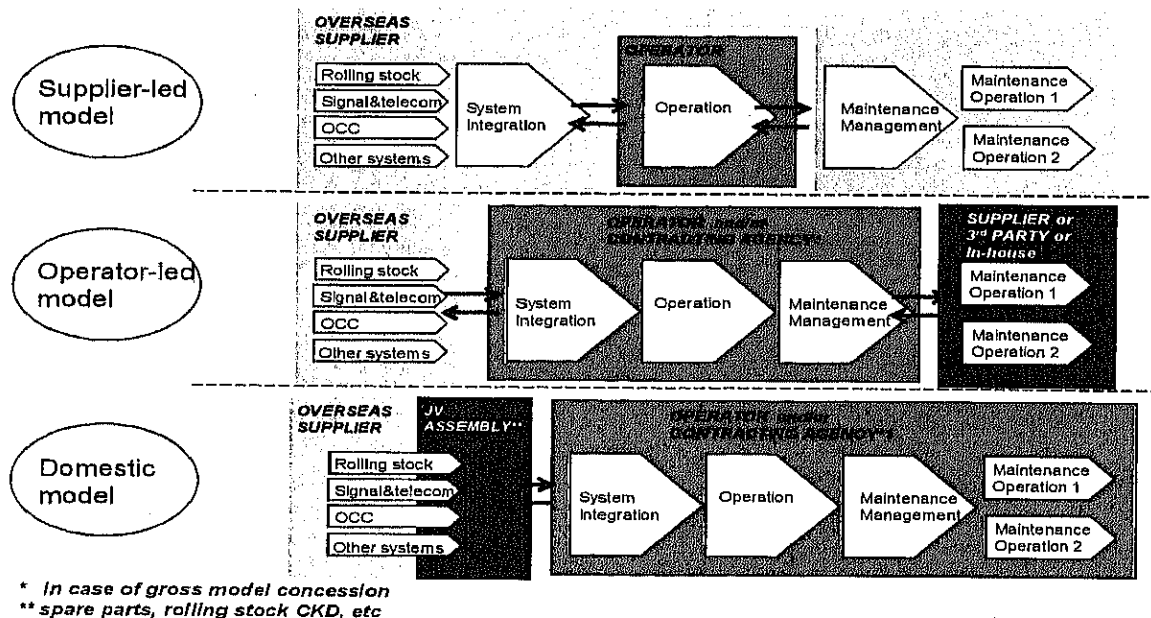
**Figure 3.1-1: Summary of Key Issues**

### 3.2 Details of Tier 1 Issues - Sector Vision, Governance, Law and Regulation

#### 3.2.1 Issues on Sector Vision

In the past, Thailand has developed BTS and BMCL in a mode of trial and error. This is because mass transit was just introduced to the country without any form of sector related institution. Now, after a decade, it seems quite timely to think through how to shape the mass transit sector in this country.

Figure 3.2-1 illustrates the simplified value chain of this sector. First, mass transit system components are manufactured and sourced. Then, there is system integration to enable the various system components into a cohesive, high performing and user-friendly system. Once all installments are made and construction activities are concluded with firm testing results, then, operation will start with close monitoring of service levels. Thereafter, maintenance management will need to decide the basic philosophy of equipment maintenance strategy. Following such strategy, actual maintenance operations are carried out in forms of A checks, B checks, overhauls, etc.



Source: Study Team

Figure 3.2-1: Sector View Value Chain

In shaping the mass transit sector, the key question is to think about who will own and drive each part of this value chain. Examples of three models are:

- **Supplier-led model:** One dominant supplier will provide a “turn-key” solution. Operator will only need to worry about day-to-day train operation and services. Maintenance activities are also managed by the supplier in a package.
- **Operator-led model:** Operator or the contracting agency will take initiative to manage both the system integration and maintenance management. Independent system integrator, consultants could be hired to augment lack of capacity.

- **Fully in-house model:** This model illustrates a value chain that is mostly done in-house, except for the high technology system sourcing. Economies of scale to justify in-house activity must be confirmed.

Selection of this value chain model is a critical element in developing a sector vision. This selection will have implications on contracting agency's (e.g. MRTA) function and capacity building requirements.

Based on interviews with Thai stakeholders, the Study Team has found that the vision on future Thai mass transit sector structure is unclear. Discussions on this sector vision are just starting to intensify within the Thai government. However, not much study has been done in this area thus far. It seems this is an area that external studies could have a true impact.

- "Sector vision is quite important and relevant. However, there is not much study on this topic" ▶
- "Development of local industry and capacity is just starting to be discussed, including Ministry of Industry and Science Technology Agency" ▶
- "We need to get out of the supplier-led model. Other models must be considered." ▶
- "Role of MRTA Will be different depending on sector vision" ▶
- "Politically-neutral institution must be involved in sector development"

Study on Sector Vision is seen to be quite relevant

There is a sense of urgency based on past experience

Sector Vision will have implications on sector governance

Source: JICA Study Team

Figure 3.2-2: Key Interview Comments on Sector Vision

### 3.2.2 Issues on Governance

#### (1) Problems of Responsibilities of Public Agencies

According to the MRTA Act, MRTA can be an operator of the MRT System in Thailand, i.e., MRT can create and hold shares of a company engaging in MRT business and grant its right to the private individual in the form of concession. The MRT Act authorizes MRTA to carry out a variety of roles and functions of MRT business in Thailand. However, there are several problems regarding the MRT Act as follow.

MRTA Act lacks the definition of MRT, which distinguish MRT from the and national railway system.

SRT's Red Line Project can be considered to be MRT System. However, MRTA is not a management body of Red Line. Red Line may be interpreted as a part of SRT network in the right of way of SRT. However, from the standpoint of general meaning of MRTA act, Red Line Project is to be under MRTA.

The same can be said for BTSC-SkyTrain. BTSC-SkyTrain is also MRT, but it is under BMA, which is the local government under the Ministry of Interior. The development of MRT System was initiated by BMA. BMA's role is to serve for the public interest of Bangkok citizens, which is the

legal basis of planning and implementing SkyTrain. BTSC-SkyTrain was planned and constructed by the private sector prior to the establishment of MRTA Act. BMA is now planning the extension of line to the north and the east of the boundary of Bangkok Metropolitan Area. BMA may justify the implementation of extension because it is a part of the existing system, but this would also raise a question, “who is the responsible public body for MRT System development?”

This situation can be allowed if the network consists of only one or two lines. But it is better to have common operation rules, operation plan, and/or safety standard, and fare standard for all the lines, in order to maintain adequate level of passengers’ affordability and quality of train services.

The stipulation which authorizes MRTA to be an operator, an owner of operator, and a shareholder of operator may cause a conflict of interest.

Currently MRTA grants the concession to BMCL, MRT-Initial Blue Line operating company. At the same time, MRTA is not the majority but the largest shareholder (having 25% of total shares) of BMCL, although MRTA is in the position to supervise and monitor MRT operation and has the authority to decide and cap MRT fare from a view point of public transportation. Issues on governance can be summarized as follows;

- 1) Integrated planning and mass transit sector regulator function are expected to be established
- 2) Independent PPP regulator is to be established
- 3) MRTA role and function are to be re-defined
- 4) SRT is revitalized to match sector vision

### **3.2.3 Issues on Law and Regulation**

#### Problems of the PPP Act

There are opinions pointing out an inadequacy of the PPP Act among officials and business people in Thailand.

For example, the Minister of Finance, Mr. Chalongphob Susangarn, pointed out the problems of the current PPP Act in his presentation at the Asia-Pacific Ministerial Conference on PPPs in Infrastructure in October 2007..

According to him, methods to assess project’s value, feasibility and value for money test should be standardized to reduce confusion. The PPP Act does not prescribe the methodology for project valuation nor procurement methods. The PPP Act is not based on the PPP principle of sharing burden between the public and private sectors but focuses on granting rights to operate or make use of state assets. He considered that more reasonable risk allocation between the public sector and private sectors was necessary because there is no scope for sharing risks and burdens with private sector for the case where projects are economically viable but not financially. The Thai Government had recently introduced a regulation of Public Service Obligation (PSO). Although PSO would help to meet some of the gap required to make PPP projects more viable, he considers that much remain to be done to ensure appropriate risk allocation.

He pointed out the following actions were needed for good use of PPP:

- To create a central agency to act as clearing house and provide technical and legal support to projects;
- To create a more acceptable rules for risk allocation and mitigation;
- To develop template documents for use in request for proposal, bidding, contract negotiation, model contract framework, etc.; and
- To develop guidelines such terms of references for project development studies, tools for financial assessment and management as well as value for money assessment PSO, etc.

It is recognized that the current PPP Act only stipulates procedures how to process the public project with private participation. This Act is not an act to define and/or promote PPP (public and private partnership). Therefore, the fundamental question is raised whether the Thai government is encouraging or supporting private the sector to participate in a state undertaking project or not. Another issue is that no clear indication to which sectors/types of project the government invites and encourages private participation.

Following these opinions, the Thai Government has been considering a revise of PPP Act.

MRT act should be established, together with improvements to PPP act and MRTA Act as shown below.

	Key Points of Improvement
<b>PPP Act</b>	<ul style="list-style-type: none"> <li>• Commitment of government support/subsidy guidelines (e.g. political risk guarantee)</li> <li>• Generate sector-specific regulations</li> <li>• Define PPP process guidelines in more detail (e.g. tender process, concession agreement)</li> </ul>
<b>MRT Act</b>	<ul style="list-style-type: none"> <li>• Clarify difference between urban mass transit and inter-city railway</li> <li>• Position integrated master plan to be stable and limit political intervention</li> <li>• Consider legal support for station and surrounding development (e.g. special land acquisition treatment)</li> <li>• Provide details of tariff policies, safety/security/ environmental standards</li> </ul>
<b>MRTA Act</b>	<ul style="list-style-type: none"> <li>• Clarify re-definition of MRTA's future functions according to sector vision</li> </ul>

Source: JICA Study Team

Figure 3.2-4: Key Comments of Improvement

### 3.3 Details of Tier 2 Issues - Integrated MRT Master Plan

#### 3.3.1 Issues on Integrated Bangkok City TOD Plan

##### Insufficient Coordination between Urban Railway Plan and Urban Plan/ Land Use Plan

Transportation and land use has a close relationship; transportation affects land use and land use

affects transportation. Accordingly, closed coordination between public transportation plan and land use plan is considered to be essential keys to alleviate traffic congestion in BMA.

The first master plan of Bangkok “Bangkok General Plan” was prepared by the Department of Town and Country Planning (DTCP) of MOI in 1992. Then major revisions of the plan were made by the City Planning Division of BMA in 1999 and 2006. BMA is the only local authority that has formulated a master plan for the development of the area under its administration (city planning in other cities are formulated by MOI). In order to ensure consistency of urban planning and transport plan, BMA and OTP held a joint meeting to report their plans when need arises.

Although information exchange of respective plans is currently made, more closed coordination is expected from inception stage of planning in the future.

Identified issues on the integration of MRT planning with Bangkok city planning are as follow:

- Lack of Legislation: Due to the insufficient legal support in city planning, both public and private sectors cannot work efficiently in developing the station surrounding area.
- Lack of Coordination Mechanism: Due to the lack of authorized coordination agency in developing the city planning and MRT planning, those plans are not well incorporated each other.
- Lack of Detailed Action Plan: City development requires the joint work between the Government and private. Due to the lack of the PPP scheme which enables joint development between the Government and private, public-commercial complex development cannot be implemented.
- Lack of Implementing Committee: Due to the lack of implementing committee for city development, the coordination work between stakeholders as well as financing the development work cannot be smoothly implemented.

### **3.3.2 Issues on Integrated Multi-Modal Plan**

#### Insufficient Coordination between Urban Railway Plan and Other Transport Plan

Several agencies are responsible for various aspects of transportation in Bangkok. Coordination has improved since the Government’s reforms announced in September 2002 whereby key road and rail functions of various government agencies were brought under the control of the MOT.

OTP acts as coordinating agency reporting, through MOT, to the Committee for Management of Land Transport (CMLT) which is chaired by the Prime Minister to achieve overall system integration and development. Although OTP has had some success in coordinating transport investment plans of agencies, there is still no agreed comprehensive transport framework for BMR. Each agency continues to develop its own budget requests. Furthermore, while MRTA and SRT receives approval of development plan from the MOT after the reforms of 2002, BMA still receives approval from the MOI.

Identified issues on the integration with other public transport modes are as follow:



- Integration of the Plan: Studies on other public transport mode are separately conducted from the MRT plan. To achieve the effective public transport network in Bangkok, the integration of those plans is necessary.
- Coordination with Public Transport Tariff Policy: To shift the private vehicle users to the public transport, consistent tariff structure across public transport systems should be developed by studying the ability to pay and willing to pay of target segment. It seems that study on the tariff of each transport mode has been prepared but overall transport tariff policy has not been developed yet.

### 3.3.3 Issues on MRT Network Integration

The existing masterplan covers issues, such as network development plan, cost estimate and investment plan, evaluation of financial and economic feasibility, and evaluation of potential environmental impact. In addition, various studies examined fare integration and ticket integration. Also concerned stakeholders in Thailand try to coordinate urban plan and transport plan. Although variety of efforts to improve urban railways have been made, the results are still far from desirable. Some of issues are not necessarily settled due to lack of sufficient budget, and insufficient coordination among the stakeholders having different interests.

Among the various issues regarding masterplan of urban railways, the Study Team extracted the following four issues, and explained other countries case as best practice at subsequent section.

#### (1) Insufficient Physical Network Integration among Urban Railways and Other Mode of Transport

##### 1) Fragmented Interchange Station between Urban Railways

Transfer among urban railways in Bangkok is not necessarily smooth. For example, at Mo Chit, the Blue Line is not directly connected to the BTS station. A passenger from Blue Line has to exit to the street and then walk a little and enter the BTS.

Blue line and BTS do not use the same names at interchanges. For example, passengers transfer Blue Line and BTS at Sukhumvit Station (Blue Line) and at Asoke (BTS). However there is another Sukhumvit Station of BTS next to Asoke Station, which is far away from Blue Line's Sukhumvit Station. Such naming often confuses passengers, particularly foreign tourists. Similar problems can be seen at interchange stations between Blue Line's Petchaburi Station and ARL's Makkasan City Air Terminal (CAT). Since designs of these stations are not well coordinated at the design stage, passengers have to exit to the street and then walk to transfer these stations with different names.

According to a newspaper, after the completion of the Makkasan CAT station, SRT is requesting additional 90 million baht (about US\$ 2.6 million) to the government for building sky walkway linking these stations. While underground structure (tunnel) has more advantages for passenger, SRT decided to construct sky walkway because high voltage underground power lines could be affected by the tunnel construction.

## 2) Fragmented Interchange Station between Bus and Urban Railway

Transfer between bus and BTS's Mochit station and Mochit bus terminal also can be pointed out as a bad example. Mochit bus terminal is Thailand's largest bus terminal. It serves commuter bus access to many different parts of Bangkok and also inter-city routes to the central, east, north and northeast areas of Thailand.

The Mochit bus terminal used to be located near from BTS's Mochit station. However, when BTS was built, the old Mochit terminal was relocated to make way for BTS's workshops and a park and ride facility for BTS system. As a result, current location of Mochit bus terminal is away from BTS's Mochit station (about 1.5km northwest to the station).

### (2) Insufficient Fare/Ticket System Integration among Urban Railways and Bus

Introduction of common ticket and fare integration are quite important to making public transport easy to use. Common ticketing system allows passengers to use more than one public transport with a single type of ticket. Fare integration allows passengers to transfer urban railways and or other mode of public transport without paying additional boarding charge.

Operators of BTS and Blue Line adopted different ticketing technologies. While BTS uses a magnetic stripe stored value ticket, BMCL uses a contact-less smart card system. In addition, passengers need to pay additional boarding charge when they transfer between these lines.

Several reports were submitted by ADB to ameliorate these conditions. Also, currently, the Office of Transport and Traffic Policy and Planning (OTP) executes a study for introduction of common ticketing and fare integration. However, neither common ticketing system nor fare integration among urban railways and other public transport systems has been introduced in Bangkok.

From the view point of Tier 2, there are several issues relating to the MRT masterplan and network integration as following:

- Continuity of the Masterplan: Due to the political intervention, mass transit network plan and its implementation program change constantly. To achieve the efficient mass transit network within the target period, the masterplan must have more stability and continuity.
- Network Integration: As a mass transit network, some part of railway facilities or management systems such as Operation Control Center, Workshop, Public Information System, Enterprise Resource Planning (ERP) and Common Ticket Management should be shared between the lines to reduce the investment cost and enhance the passenger's convenience.

### 3.3.4 Issues on Positioning of Plans

There have been many studies and reports on components of the integrated master plan. However, the positioning of the plans is not so clear. Some are just reference materials and some are plans that go through multiple institution review followed by cabinet approval.

The latest MRT master plan (so called URMAPP3) is currently being drafted and will go through cabinet approval. However, other components, such as city planning, are not reviewed as part of the

integrated plan for approval.

Even if the plan goes through cabinet approval, political change has triggered unnecessary interventions in the past. To summarize, the issues are:

- a) Lack of clear system to formalize and stabilize the plan: In some countries, mid-long term plans are well positioned within the legal framework and it is kept relatively stable. It seems such framework is weak in Thailand.
- b) Lack of appropriate scoping to properly integrate plans: Notion of TOD is still quite weak and the need to scope the plans to include all the components of integrated plans are non-existent.

### **3.3.5 Issues on Implementation Organization and Coordination Mechanism**

Today, each agency develops plan from its own viewpoint. MRT components are under OTP and city planning components are under BMA and Public Works. PDMO plans for funding and PPP financial framework.

The need for institution that can coordinate across ministries in this area has been discussed in the past. For example, IMAC report refers to the establishment of Urban Development Authority. However, no specific action has been observed.

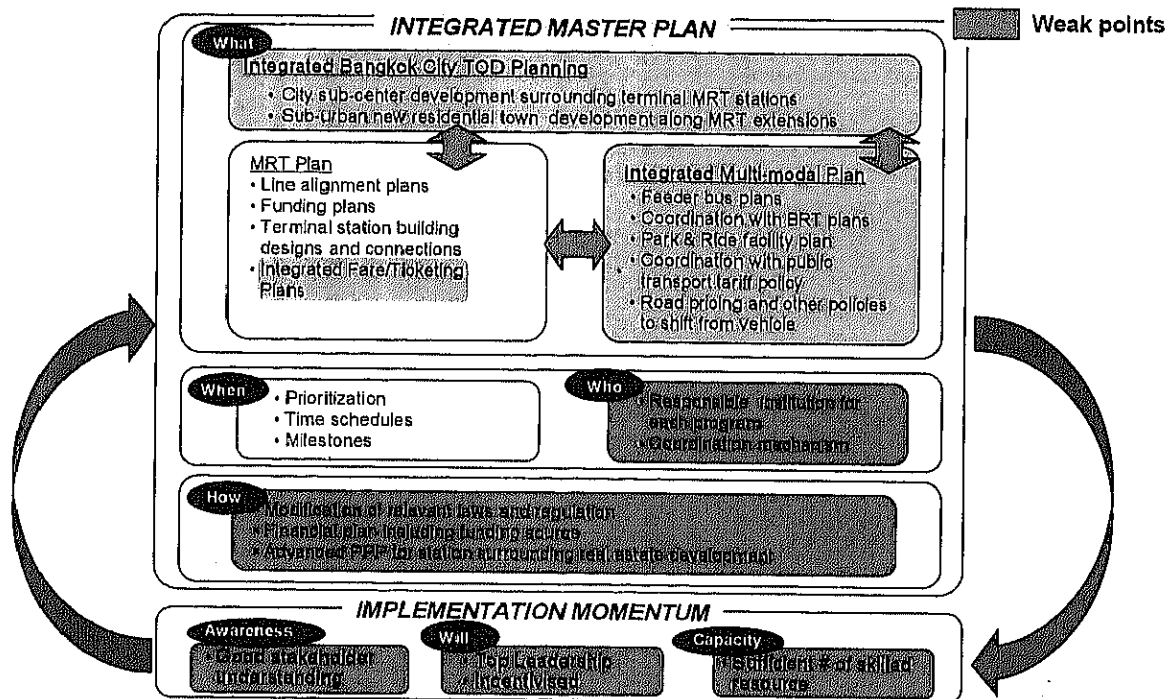
Identified issues on the organization and coordination mechanism are as follows:

- a) Lack of clear oversight organization and coordination mechanism for integrated implementation: For TOD implementation, value is created in the integration of MRT plans, other transport plans and city plans. If each agency continues to pursue with limited coordination, value creating opportunities will be lost.
- b) Lack of awareness and leadership to drive integration: Based on discussions with stakeholders on this topic, there is limited sense of urgency to improve integration. We suspect that the reason could be because a clear image of success is not shared across various stakeholders. This is understandable since the notion of TOD will only ring a bell when it is seen and experienced.

### **3.3.6 Summary of Tier 2 Current Situation, Issues and Gap from the Ideal State**

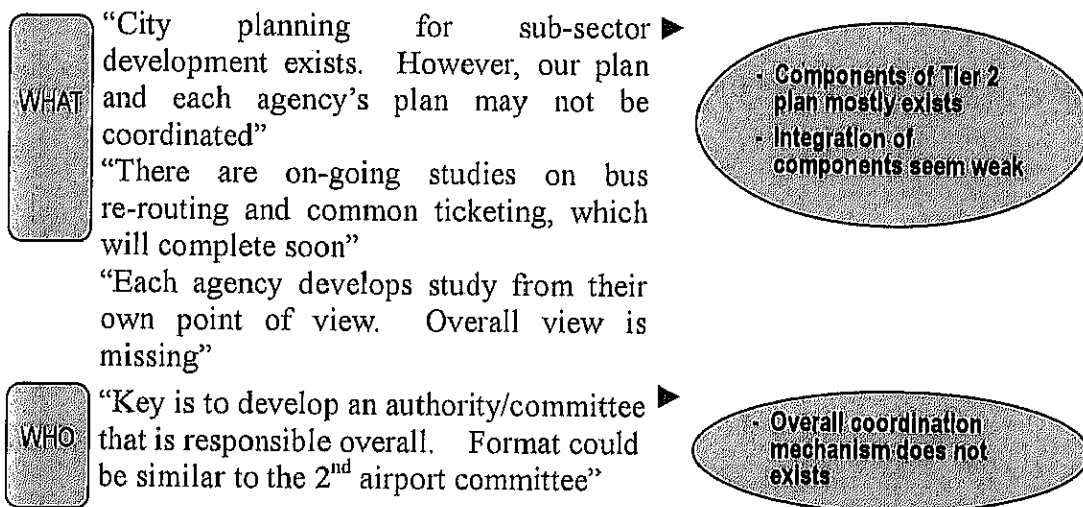
In summary, there are many past and on-going efforts on studies related to the “What” components of integrated master plan. While some weaknesses still remain in areas of network integration and transport policies, we view that most of the “What” components have been studied. However, due to a lack of total oversight, each agency has a tendency to develop plans from their own point of view with limited coordination. While information is shared across agencies, sharing of information will not lead to true integration. For example, town planning and transport related agencies have not really spent enough time discussing the plans for city sub-center development. The root cause of this is the lack of coordination mechanism. In other words, the “Who” dimension of plans. Also, some components lack the depth of “How” dimension which could cause implementation delays. This is apparent in the area of station and surrounding development, which requires government leadership and advanced PPP scheme development. Lastly, we must point out the lack of

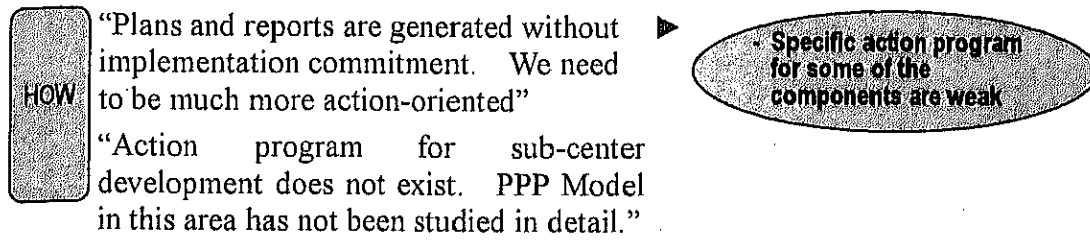
implementation momentum. While each line implementation is underway, the need for integration and coordinated implementation is not well understood and lacks top leadership to drive “Transit-oriented development”. Capacity for implementation is also a concern. PPP implementation is required not just for each line implementation but also for city sub-center development, especially around key terminal stations. This requires significantly more government agency staff with finance, legal and commercial expertise. Please refer to below Figure 3.3-1 and Figure 3.3-2 on explanation of current weak points and summary of key comments from Thai stakeholders.



Source: JICA Study Team

Figure 3.3-1: Weak Points of Current Plans (Tier2)





Source: JICA Study Team

Figure 3.3-2: Key Interview Comments on Tier 2

### 3.4 Details of Tier 3 Issues - Financial Framework, Concession and Supplier Management, Non-rail Business

#### 3.4.1 Issues of Financial Framework

There have been many discussions on financial framework for MRT development in Bangkok. Issue is that there seems to be several questions on perceptions shared by stakeholders.

1) Perception: Optimal financial framework exists

Question: Is there such thing as a best financial framework? (To be analyzed in Chapter 4)

2) Perception: Financial framework selection is the most important factor in solving the past issues related to BMCL and BTS

Question: Can financial framework alone solve all the issues? (Financial framework selection needs to be packaged with concession agreement, supplier management and non-rail business management)

3) Perception: Involvement of private party will achieve better construction efficiency and operation efficiency

Question: Is there such evidence that private party can better succeed in urban mass transit? (to be analyzed in Chapter 4 and 5)

#### 3.4.2 Issues of Concession Agreement

##### (1) Concession Related Issues on Existing Urban Railway Systems in Bangkok

On existing urban railways in Bangkok, the Study Team identified several concessionaire management issues to be improved for future lines.

1) In terms of financial framework of existing concession agreement, most key risks were allocated to the private sector, despite early stages of network establishment.

Both BTS and BMCL have huge amount of debt for their investment and their profit and loss statements have been red figured from the beginning. Their financial schemes and situations are as follows.

- For construction of BTS, all the construction cost was funded by the concessionaire, i.e., BTSC. With all the ridership risks of the first line of MRT network, capital cost burden was too heavy. This issue has led to debt restructuring in 2008.
- For Blue Line, civil work was funded by the central government. Construction cost of E&M was funded by the concessionaire, i.e., BMCL. With all ridership risk, BMCL has not been able to earn profit for interest and debt repayment. This issue has led to rescheduling of debt service.

2) Shareholder's healthy incentives to cherish operating company must be ensured.

In overseas case examples, the Study Team has observed issues from conflict of interest around the shareholders of concessionaire. If look at Bangkok case, there would be potentially similar conflicting interests.

- Italian Thai Public Company Ltd and Tanayong Public Company Ltd, who are construction companies and real estate developer, were shareholders of BTSC. Similarly, CH. Karnchang Public Company Ltd, who is also a construction company, is a shareholder of BMCL. In general, for construction companies, increase of construction cost brings about the increase of profit to their companies. On the contrary, for the concessionaire, this means increase of capital cost. Therefore, ensuring construction efficiency should have been an important part of this concession scheme.
- MRTA, which is the contracting agency of the concession, has acquired shares of BMCL which is the concessionaire. MRTA is the contracting agency for concession and also a shareholder of concessionaire. This is also potentially a conflict of interest.

3) Unclear conditions for the revision, extension of concession and extension of the routes are stipulated in the concession agreement.

SkyTrain and Blue Line are the initial urban railway concessions in Bangkok. The initial stage of these projects can be considered to be a learning period for the Thai government and it is natural that problems of concession agreement emerge after commencement. However, very limited attention has been paid on articles related to revision of concession agreement.

In the concession agreement between MRTA and BMCL, following improvement points have been identified.

- a. For a revision of agreement, only procedures are described with no clarity for timing and what triggers such discussions.
- b. For the extension of concession, there are no articles in the concession agreement.
- c. For the extension of routes, only the expression "to be practical for ease of expansion and interfacing between the projects" is described in the concession agreement and no concrete measures are described.

In the concession agreement between BMA and BTSC, following improvement points have been identified.

- a. There are no articles for the revision of concession agreement.
  - b. Regarding expansion of concession agreement, it is only specified in the concession agreement that it should be proposed from BTSC 3 or 5 years prior to the completion.
  - c. For new lines, BTSC has the right to refuse the negotiation on this issue but there is no article in the concession agreement on the matter for the extension of the existing line.
- 4) Revenue sharing mechanism of non-rail business are not clearly specified in Concession Agreement

As discussed in the following section, non-rail business is quite important for the sound operation of urban railway business.

In case of BMCL non-rail business is carried out at subsidiary companies. There is the possibility that receipt of profit sharing from non-rail business of the contracting agency according to the concession agreement can not be maximized. This is because in the concession agreement, there is no article which defines the revenue sharing of non-rail business between the concessionaire and its subsidiaries.

## (2) Reasons behind Concession Related Issues

Following are our understanding of reasons behind identified issues described above.

- a. Bangkok mass transit is the first challenge for Thailand, with limited direct overseas reference case.
  - Schemes of urban railway in the developed countries have gone through long history of evolution. They could not be a directly applicable model for the urban railways in Bangkok.
  - In Asia, Hong Kong and Singapore have pioneered ahead of Bangkok. Since no problems were raised on their management and operation, not much attention was paid on management issues.
- b. Lack of mindset to develop local capability

Most of equipments, especially electric & mechanical equipments for urban railways, are imported from foreign countries. Although most equipment or replacement parts are not produced in Thailand, daily or overhaul maintenance are carried out with local staff. However, there is a problem of capability of local staff due to the following reasons.

- Until recently, BTS and MRT have focused on new technologies and they have been satisfied with the "full turnkey" scheme.
  - It seems there is an organizational culture to depend on proposals from consultants without own independent thinking on long term vision.
- c. Future plan considerations are missing

The urban railway master-plans in Thailand cover extension plans for the future. However, once it comes to the implementation stage of each line, there is a tendency to focus on immediate projects.

- In concession agreement between BMA and BTSC, there are no articles on the future extension. This may be due to the scheme that the project was proposed from BTSC and extension of the line was regarded as a given condition. On the contrary, regarding a new line, the right of refusal was given to BTSC.
- Regarding concession agreement between MRTA and BMCL, it might be assumed in concession agreement that an entity other than BMCL could potentially be the concessionaire of the extension section. Therefore, no articles for extension of the line are stipulated in concession agreement. If this is true, disclosure of the technical conditions of existing section should be stipulated since it is required for the extension of the line.

### **3.4.3 Issues of Supplier Management**

#### **(1) Supplier Management Related Issues on Existing Urban Railways in Bangkok**

The concessionaires in Thailand, who procured equipment and rolling stock from suppliers, have preferred “full turnkey” scheme for steady operation and have not carried out supplier management sufficiently. Some observed issues are as follows.

- a. Increase of construction cost because of leaving all supplier management task to engineering design consultants
  - Engineering design consultants tend to manage their designs on safety side and are devoted to make advanced infrastructure and systems. This increases construction cost. (For example, wide underground station based on NFPA standard. Stations of Purple Line will become wider than those of Blue line.)
  - This is further exacerbated by the fact that their supervising fee increase in proportion to total amount of construction cost.
- b. Nondisclosure of specifications
  - Suppliers did not disclose the specifications of electric and mechanical equipments to concessionaires despite of concessionaires’ request.
    - Signal system for the extension section of BTS was changed to a new supplier.
    - BTSC and BMCL cannot maintain their systems by local staff even after 10 years of operation.

#### **(2) Reasons behind Supplier Management Related Issues**

Major reasons identified from interviews are as follows:

- a. Lack of mindset to optimize the construction cost among the concessionaires
  - Efforts of the concessionaires focused on introduction of new technologies.
  - Optimization of construction cost requires new concepts. This has been regarded too complex by the concessionaires.

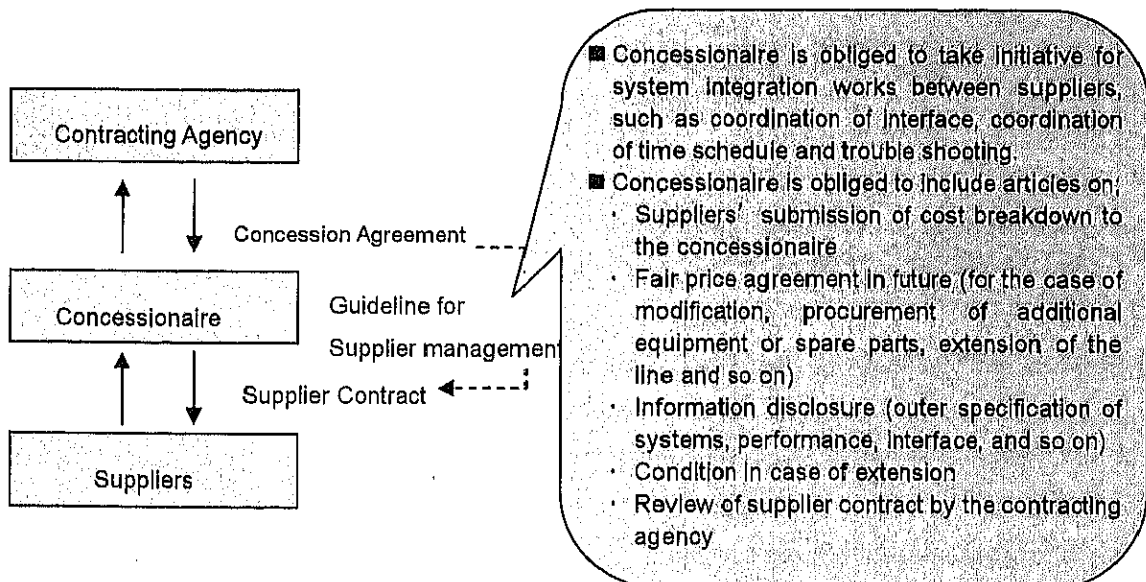


b. Lack of considerations on required information from suppliers

- When disclosure of information regarding electrical and mechanical system is discussed between concessionaire and supplier, software source code of the system is overly focused. The source code is the supplier's intellectual property and disclosure becomes costly. In maintenance work at railway operation, software source code is not needed. The role of maintenance is to find whether software has any defect. If a failure of equipment is caused by failure of software source code, suppliers may willingly fix the failure without charge. This procedure should be included in a supplier contract in detail.
- At the extension project of line or increase of train-sets, when a concessionaire tries to make other suppliers participate in the project, the performance and interface specifications of existing system are needed. Again, the software source code itself is not needed.
- As for rolling stock maintenance, technical knowledge to find a failed board computer is required. Procedure for repair should be included in a supplier contract in detail. To repair a failed board computer is not the business of railway operator in Japan (In most cases, the cause of failures is deterioration of condensers on board computers). Railway operators send failed board computers to the suppliers for repairing. In Thailand, this may be costly and there are a lot of skilled workers in Bangkok who can amend failed mobile computers and personal computers by themselves. To ask them to amend failed board computers may be a good way to reduce maintenance cost.

c. Lack of mindset to build local (in-house) capabilities

Mass transit development is a long-term business. Maintenance and some spare parts should be localized overtime. It seems there is still a lack of vision to develop such localized sector in Thailand.



Source: JICA Study Team

Figure 3.4-1: Supplier Management

### **3.4.4 Issues of Non-rail Business Management**

#### **(1) Issues for Operators**

- 1) The ratio of non-rail business of BMCL and BTSC matches MRT operators in other cities.

The ratio of non-rail business to total revenue of BMCL and BTSC is relatively high compared with other operators studied in the benchmark study except MTR (Hong Kong) and DMRC (New Delhi). However, one reason for this possibly is that the ridership of two companies is still small compared with other cities.

- 2) There are opportunities of diversifying non-rail business.

The scope of non-rail business of BMCL and BTSC is rather basic and narrow. There are lots of opportunities of non-rail business when reviewing MRT projects in other countries.

In the case of BMCL, the facilities which can be used for non-rail business are strictly limited by the concession agreement. When BMCL plans to start new business, it is necessary to fully negotiate with MRTA and receive approval of MRTA board.

- 3) Collaboration with affiliated companies should be pursued.

BMCL's parent company is a conglomerate in the construction sector and BTSC's related company is a conglomerate in the property development. Both operators can further pursue a synergetic effect of business operations with affiliated companies.

#### **(2) Issues for Project Implementation Body**

- 1) To maximize the benefit of MRT-related business

When MRTA or other project implementation body gives a concession of operation to a concessionaire, it should carefully consider which affiliated businesses it keeps and which are given to a concessionaire.

MRT currently operates the Lat Phrao parking building and telecommunication business based on facilities maintained by BMCL's subsidiary. The right to develop underground area outside the territory defined in the concession contract may belong to MRTA. It is considered that business opportunities of affiliated business will expand. Therefore, careful examination of affiliated businesses given to a concessionaire, based on the consideration of who can maximize the return of affiliated business, is necessary for new lines.

In addition, clauses of contract should be carefully examined when MRTA provides concession of affiliated businesses with a concessionaire. When BMCL established subsidiaries for related businesses, the percentage of revenue share from subsidiaries became the issue for negotiation between MRTA and BMCL.

- 2) To share the benefit of property development to MRT projects

In Thailand, MRTA, BMA and SRT are MRT project implementation bodies. While SRT has available land, MRTA does not possess land for property development. When MRTA formulated a development plan of inter-modal transfer facilities and station area for the Blue line, the developments of office buildings, commercial buildings and apartments as a mid and long term

plan. However, the land for these developments mostly belonged to the private. Therefore, there was little that MRT could do for large-scale property development.

Thus, MRTA or other project implementation body should elaborate possible potential of property development along MRT lines to be constructed. Possible measures are:

- a) A project implementation body estimates the possible return on facilities adjacent to stations and along lines and acquires wider areas to enable non-rail business, e.g., shops, at the acquisition of land.
- b) A project implementation body arranges the transfer of land from government ministries and agencies to the body.
- c) A project implementation body acquires a legal basis for property development and the responsibility and right to engage in property development.
- d) A project implementation body closely cooperates with central and/or local government bodies in charge of urban planning and development. If a government body establishes a public corporation for property development, a project implementation body should collaborate with this organization.



## CHAPTER 4 FINANCIAL SIMULATION AND ANALYSIS OF FINANCIAL FRAMEWORK OF URBAN RAILWAY DEVELOPMENT IN THAILAND

In this chapter, the Study Team considers conditions of successful pattern of financial framework for future MRT projects and alternatives of financial frameworks of MRT project by examining decisive factors. Then, the Study Team identifies factors which realize the value for money (VfM) of PPP scheme for MRT project. Finally, a trial simulation of the future three MRT projects in Thailand, namely Purple Line, Pink Line and Orange Line is conducted with the purpose of clarifying the conditions to achieve VfM.

### 4.1 Outline of the Financial Simulation of MRT Projects

#### 4.1.1 Purpose of the Financial Simulation

The Study Team carried out a financial simulation of future MRT projects in Thailand in order to understand the effects of different financial frameworks of private participation schemes as well as state operation scheme.

This simulation aims at examining a required level of efficiency achieved by the private sector under a private participation scheme to achieve public sector's VfM<sup>20</sup> on a basis of the existing financial framework under the MRT Assessment Standardization (MAS)<sup>21</sup>.

The Thai Government uses MAS as a guideline to evaluate a MRT project. MAS requires the comparison of five private participation schemes, and offers guidelines on how to quantify the difference of ridership demand, capital cost for E&M, and O&M cost, among the five private participation schemes. To differentiate assumptions of five schemes, MAS uses a concept of optimism bias. MAS assumed that private sector's implementation is more efficient than the public sector. For example, according to MAS, while capital cost of E&M under concessionaire (private sector) procurement is 15% higher than the best estimate, capital cost of E&M under government (public sector) procurement is as much as 45% higher than the best estimate. The optimism bias has significant influence on the result of calculation, while evidence of the figures are considered to be quite weak. Also, differences of private/ public sectors performance among patterns of financial framework are deemed to be quite difficult to generalize.

On the financial simulation of MRT projects, the following point should be understood. In implementing an urban railway project under the private sector participation through vertical separation scheme<sup>22</sup>, financial burden of the public sector is reduced during inception stage of the project. On the other hand, since many of urban railway projects are unprofitable, the public sector may need to assist the private sector through the provision of subsidy (or some kind of payment) after the commencement of commercial operation. Therefore, even though the public sector's financial

<sup>20</sup> Life-cycle cost levied on public sector under public participation scheme is smaller than the life-cycle cost levied on public sector under state operation scheme.

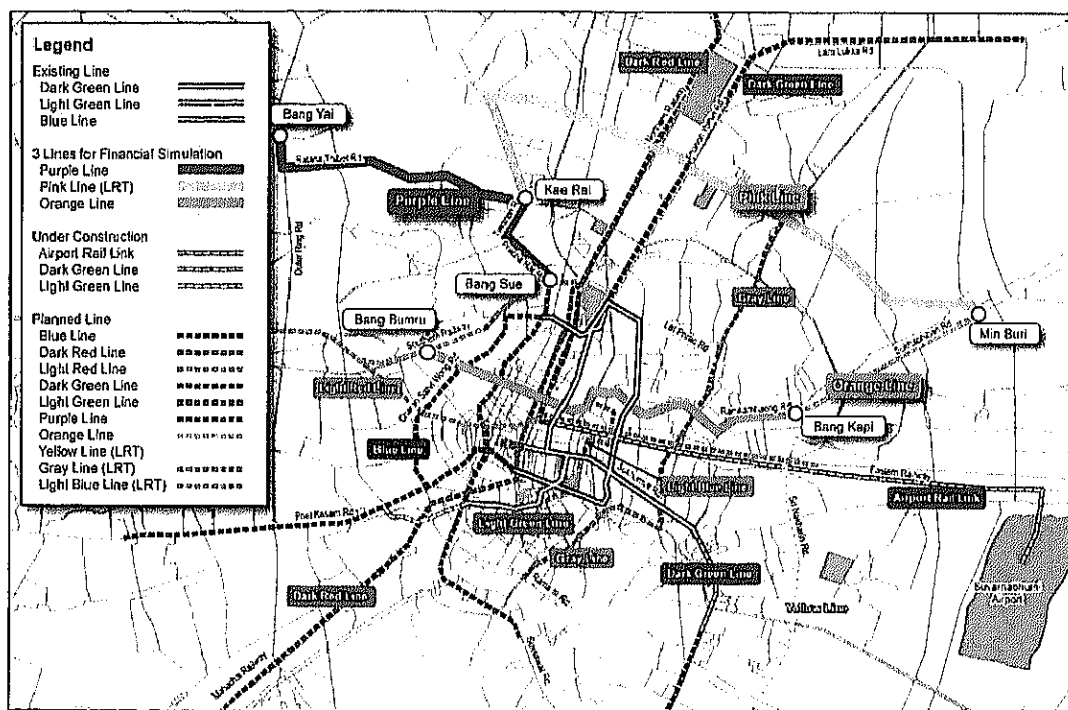
<sup>21</sup> MRT Assessment Standardization, ADB, 2007

<sup>22</sup> A private sector concessionaire finances all E&M and rolling stock investment and undertakes O&M, with the Government financing other infrastructure investment

burden for capital expenditure is smaller, continuous subsidy payment can result in larger financial burden for public sector in the long term. Degree of subsidy that government needs to pay is debatable. On one hand, it is government's responsibility to maintain public transportation operation. On the other hand, private investor (including financial institutions) should be responsible for the inherent risks involved in business investment. For the purpose of this simulation exercise, we took the view that public transportation must be maintained by government in the form of subsidy.

#### 4.1.2 Profile of the Analyzed 3 MRT/LRT Projects

After consultation with related organizations of Thai stakeholders and JICA, the Purple line (Bang Yai - Bang Sue Section), the Pink Line (Khae Lai – Minburi section) and the Orange Line (Bang Kapi - Bang Bamru Section) were selected for the target for financial simulation. The figure 4.2-1 illustrates planned alignments of the analyzed line.



Source: JICA Study Team modified based on M-MAP 2009, OTP, August 2009

Figure 4.1-1: Location Map of the 3 Analyzed Lines

The table 4.1-1 ~ 4.1-3 summarized major feature of the analyzed projects. The Orange line plans to align across from east to west, and run through the center of Bangkok city. Ridership of the Orange line was forecasted to be about 485,000 per day in the first year of its operation, which is more than twice of that of the Purple and the Pink Line. However, since most of alignment of the Orange line runs underground, the project cost per km of line length (4,612 million Baht/km) is highest among others.

On the other hand, the Pink line is planned to be situated in the northern suburbs of Bangkok City, and is planned as Monorail. The land acquisition cost, and the civil work cost are considerably lower than those of the Orange Line. The project cost per km of line length of the Pink Line (1,030 million Baht/km) is considerably lower than those of the others (Orange: 4,612 million Baht, Purple:

2,367 million Baht).

**Table 4.1-1: Profile of the Purple Line Project (Bang Yai – Bang Sue Section)**

Line Length	23 km, 16 stations (23 km: elevated, 0 km: underground)
Total Project Cost (2007 constant price)	Land Acquisition: 9,314 million Baht (17.4%) Civil Works: 29,495 million Baht (55.3%) M&E Equipment: 6,866 million Baht (12.9%) Rolling Stock: 5,578 million Baht (10.5%) <u>Detailed Design &amp; Consultation Fee: 2,097 million Baht (3.9%)</u> Total Project Cost: 53,350 million Baht (100%)
Project Cost per 1 km of line length	2,367 million Baht/ km (2008 constant price*) (including land acquisition, civil work, M&E equipment, rolling stock and detailed design & consultation fee)
Demand Forecast	Demand Forecast: 1st Year 195,505/day, 5th Year 220,116, 10th Year 250,879/day (without transfer fee)
Project Features	<p>Purple line aligns in northwestern suburb of Bangkok and in Nonthaburi Province, with the first stage of construction commencing in early 2010. The line will be in operation in 2013.</p> <p>The line starts from MRT's underground Bang Sue terminus and runs along Pracha Rat Sai 2 Road on elevated structure to Tao Pun junction, transfers to the western extension of the Blue Line. It continues north along Krung Thep-Nonthaburi Road, transfers to the Light Red Line at Bang Son, and approaches Mueang Nonthaburi district of Nonthaburi Province.</p> <p>The line goes further north and crosses the Chao Phraya River at Phra Nangklao Bridge, and then continues to a large residential area at Bang Yai junction in Bang Yai district. The line then goes north along Kanchanaphisek highway, passes Bang Yai market and reaches to the terminus at Khlong Bang Phai in Bang Bua Thong district.</p>

Source: Project Evaluation Report Bang Yai – Bang Sue Mass Transit Line, AEC, PCI, Chotichinda Mouchel Consultants Ltd., MRTA 2007

\*Note: Price level was adjusted using Consumer Price Index quoted from IMF, International Financial Statistics

**Table 4.1-2: Profile of the Orange Line Project (Bang Bamru – Bang Kapi)**

Line Length	24 km, 17 stations (3 km: elevated, 21 km: underground)
Total Project Cost (2005 constant price)	Land Acquisition: 10,772 million Baht (10.6%) Civil Works: 64,169 million Baht (63.1%) M&E Equipment: 14,913 million Baht (14.7%) Rolling Stock: 7,475 million Baht (7.4%) <u>Detailed Design &amp; Consultation Fee: 4,347 million Baht (4.3%)</u> Total Project Cost: 101,677 million Baht (100%)
Project Cost per 1 km of line length	4,612 million Baht/ km (2008 constant price*) (including land acquisition, civil work, M&E equipment, rolling stock and detailed design & consultation fee)
Demand Forecast	1st Year 485,256/day, 5th Year 544,473/day, 10th year 618,494/day (without transfer fee)
Project Features	<p>Orange Line aligns from west to east along Ramkamhaeng, Rajvithi and Sirindhorn Road. This line serves high density residential area and commercial area in the eastern suburbs. The line runs through Victory Monument and Sam Saen where are currently suffered from serious traffic congestion. The line also serves important large community space, such as BMA 2, Din Dang area, Thailand Cultural Center, Ramkamhaeng University, Chamber of Commerce, ABAC University, Rajamangala National Stadium and Hua Mak Stadium.</p>

Source: Feasibility Study, Detailed Design for the Remaining Extensions and New Routes, Total 3 Projects, Bangkok Mass Transit Design Consortium, MRTA, 2006

\*Note: Price level was adjusted using Consumer Price Index quoted from IMF, International Financial Statistics

**Table 4.1-3: Profile of the Pink Line Project (Kae Rai – Minburi Section)**

Line Length	36 km, 24 stations (36 km: elevated, 0 km: underground)
Project Cost (2008 constant price)	Land Acquisition: 4,458 million Baht (12.0%) Civil Work: 16,862 million Baht (45.4%) M&E Equipment: 7,857 million Baht (21.2%) Rolling Stock: 6,768 million Baht (18.2%) <u>Detailed Design &amp; Consultation Fee: 1,164 million Baht ( 3.1%)</u> Total Project Cost: 37,109 million Baht (100%)
Project Cost per 1 km of line length	1,030 million Baht/ km (2008 constant price) (including land acquisition, civil work, M&E equipment, rolling stock and detailed design & consultation fee)
Demand Forecast	Demand Forecast: 1st Year 167,000/day, 10th Year 264,000/day (without transfer fee)
Project Features	Pink Line is planned to develop as monorail, and serves for travel demand to the new Government Service Center on Chang Wattana Road, Nonthaburi Government Service Center, support the growth of cities in the north of Bangkok, provide linkage to community and commercial area in the north and north-east suburbs.  There area 4 interchange stations, Nonthaburi Government Center Station (Purple Line), Laksi Station (Red Line), Pitak Rattathamanoon Monument Circle Station (Dark Green Line), and Minburi Station (Orange Line)

Source: Feasibility Study and Preliminary Design of Yellow Line, Brown Line and Pink Line Mass Transit Projects, Thai MM Ltd., Mott MacDonald (Thailand) Co. Ltd., Epsilon Co. Ltd., Dhara Consultants Co. Ltd., Nippon Koei Co. Ltd., JARTS, Wishakorn Co. Ltd., OTP, 2009

The Purple line aligns in the northeastern suburb of Bangkok city and in Nonthaburi Province. The project cost per km and the forecasted ridership of the Purple line are almost half of the Orange line. While the project cost per km of the Purple line is about twice of that of Pink line, the forecasted ridership is almost same as the Pink line.

#### 4.1.3 Major Assumptions Adopted for the Financial Simulations

The financial simulation was made based on the existing feasibility study of each project. Regarding the project specific data (ridership demand forecast, capital cost of the project, operation and maintenance cost, etc.), same data used in existing reports were adopted for the simulations<sup>23</sup>. Other general assumptions basically follow MAS guideline (see the table 4.1-4).

Public sector's financial burden throughout the project cycle, namely public sector's net present value (NPV), was calculated for each pattern of financial framework based on the best estimate of the capital cost, O&M cost, forecast ridership demand, etc. as estimated in the existing studies.

In analyzing a project under private participation schemes and state operation scheme, one of the key points is how to estimate the difference of performance (such as ridership, capital cost, and O&M cost) between the public sector and the private sector. MAS guideline quantified such difference between the public and the private as "Optimism Bias". Although, as mentioned earlier, the

<sup>23</sup> Reference Reports: Purple line= "Project Evaluation Report, Bang Yai – Bang Sue Mass Transit Line, 28 August, 2007 Asian Engineering Consultant Corp. / Pacific Consultant International/ Chotichinda Mouchel Consultants". Orange Line= "Feasibility Study, Detailed Design for the Remaining Extensions and New Routes, Total 3 Projects, Bangkok Mass Transit Design Consortium, MRTA, 2006", Pink Line= "Feasibility Study and Preliminary Design of Yellow Line, Brown Line and Pink Line Mass Transit Projects, Thai MM Ltd., Mott MacDonald (Thailand) Co. Ltd., Epsilon Co. Ltd., Dhara Consultants Co. Ltd., Nippon Koei Co. Ltd., JARTS, Wishakorn Co. Ltd., OTP, 2009". Since same of the detailed data was not shown in these reports, some of the data was not necessary as same as the original report.



assumption given in MAS has significant influence on the result of calculation, evidence of the optimum bias is considered to be quite weak.

**Table 4.1-4: Major Assumptions adopted for the Simulation**

Basic Assumption	Currency Used: Baht Project Evaluation Period: 40 years Concession Duration: 40 years Corporate tax: 30% of profit before tax Base Year Price: early 2007	Inflation rate: 2.5% p.a. Price Level Used: Current Price Discount Rate: 5.0% Exchange Rate: 35 Baht/US\$
Fare	Boarding Charge: 10 Baht (2001 price) Distance Charge: 1.8 Baht/km (2001 price) Without transfer fee between lines (with each MRT boarding requiring payment of a fare)	
Debt Equity Ratio	Private Sector Financing - Net cost concession 2.0 times - Gross cost concession 6.0 times- - Modified gross cost concession 5.0 times	Public Sector Financing - All schemes: 3.0 times (except for land acquisition)
Interest Rate of Loan/Bond	Private Sector - Net cost concession 8.5% p.a. - Gross cost concession 7.5% p.a. - Modified gross cost concession 7.75% p.a.	Public Sector (for all schemes including swap rate)* - ODA Loan: 3.75% p.a. (civil work) - ODA Loan: 4.05% p.a. (E&M, rolling stock) - Baht Bond: 5.20% p.a.
Repayment period of Loan	Private Sector - Grace period: 2 years of service - Repayment Period: 15 years (incl. grace period)	Public Sector (for all schemes)* - Grace period: 6 years of service - Repayment Period: 20 years (incl. grace period)
Return on Equity for Private sector	- Net cost concession 13.50% - Gross cost concession 12.50% - Modified gross cost concession 12.75%	

Source: MRT Assessment Standardization, ADB 2007 and Project Evaluation Report, Bang Yai – Bang Sue Mass Transit Line, 28 August, 2007 AEC/ PCI/ Chotichinda Mouchel Consultants Ltd.

\* Following same assumption as used in the evaluation report of Purple Line, which was prepared based on the comments of the MRT Subcommittee and the MRTA Board.

In this simulation, optimism bias proposed under MAS was not adopted because of its weak evidence base. Instead of adopting optimism bias, another approach was employed in this simulation (details are mentioned in following section).

## 4.2 Methodology and Results of the Financial Simulations

Financial simulation was made for six potential financial framework, which consists of five private participation schemes (PPP net cost, PPP gross cost, PPP modified gross cost, PSC gross cost, and PSC modified gross cost) and a state operation scheme.

In this simulation, following two kinds of analyses were made. Detail method and results of the two analyses will be mentioned in the following sections.

### Analysis 1 (Public Sector's NPV Gap Calculation)

Analysis 1 aims to clarify the difference of public sector's NPV without adopting the "Optimism Bias". Under this analysis, performance of the private sector (such as ridership, operation and maintenance cost) is assumed the same as that of public sector.

### **Analysis 2 (Sensitivity Analysis)**

Analysis 2 aims to clarify degree of minimum performance to be achieved by the private sector under five private participation schemes, in order to achieve public sector's VfM (NPV under State Operation Scheme  $\leq$  NPV under private participation scheme). The Newton Raphson Method was adopted for this analysis.

## **4.2.1 Analysis 1 (Public Sector's NPV Gap Calculation)**

### **(1) Methodology of the Analysis 1**

"Analysis 1" aims to clarify the difference of public sector's NPV without adopting the "Optimism Bias". Under this analysis, performance of the private sector (such as ridership, operation and maintenance cost) is assumed as same as that of public sector.

Public sector's NPV under various financial frameworks can be formulated as follows;

$$NPV_X = \sum_{t=-5}^{40} \left\{ \frac{FR_{xt} + NFR_{xt} - OSC_{xt} - OM_{xt} - PP_{xt} - IP_{xt} - SB_{xt} + RS_{xt} - CI_{xt} - AR_{xt}}{(1+\phi)^t} \right\}$$

Here:

- NPV<sub>X</sub>: Public sector's present value of net cashflow under financial framework "X"
- FR<sub>X<sub>t</sub></sub>: Public sector's fare revenue in year "t" under financial framework "X"
- NFR<sub>X<sub>t</sub></sub>: Public sector's non-fare revenue in year "t" under financial framework "X"
- OSC<sub>X<sub>t</sub></sub>: Operator's service charge paid by public sector to private sector in year "t" under financial framework "X"
- OM<sub>X<sub>t</sub></sub>: Public sector's operation and maintenance cost in year "t" under financial framework "X"
- PP<sub>X<sub>t</sub></sub>: Principal repayment in year "t" under financial framework "X"
- IP<sub>X<sub>t</sub></sub>: Interest payment in year "t" under financial framework "X"
- SB<sub>X<sub>t</sub></sub>: Subsidy from public sector to private sector in year "t" under financial framework "X"
- RS<sub>X<sub>t</sub></sub>: Revenue Share and/or annuity paid by private sector to public sector in year "t" under financial framework "X"
- CI<sub>X<sub>t</sub></sub>: Initial Capital Investment Cost (public sector's equity portion) in year "t" under financial framework "X"
- AR<sub>X<sub>t</sub></sub>: Additional Investment and Refurbishment cost levied by public sector in year "t" under financial framework "X"
- φ: discount rate (5.0%)

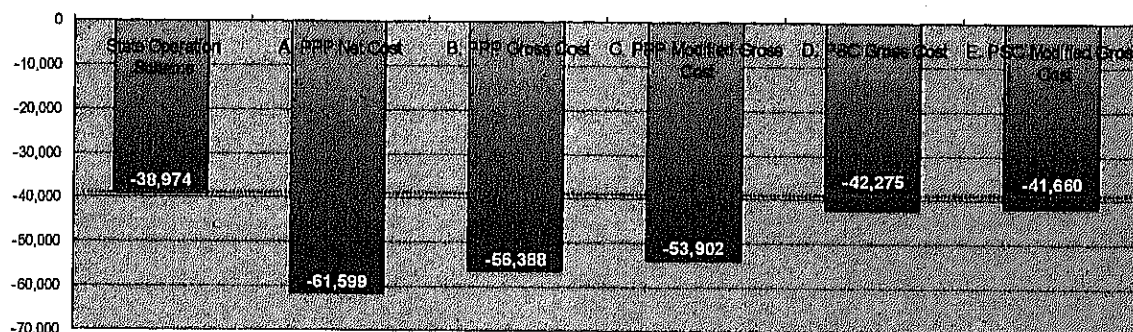
Here, subsidy to the private (SB) or revenue share from the private to public (RS) are calculated in order to fulfill the private sector's required return on equity (ROE) (ROE is 12.5% for gross cost concession, 12.75% for modified gross cost concession, and 13.5% for net cost concession).

### **(2) Results of the Analysis 1**

Figure 4.2-1~4.2-3 shows the present value of public sector's net cashflow during the whole project life (4 - 6 years project implementation period<sup>24</sup> + 30 years concession period), namely

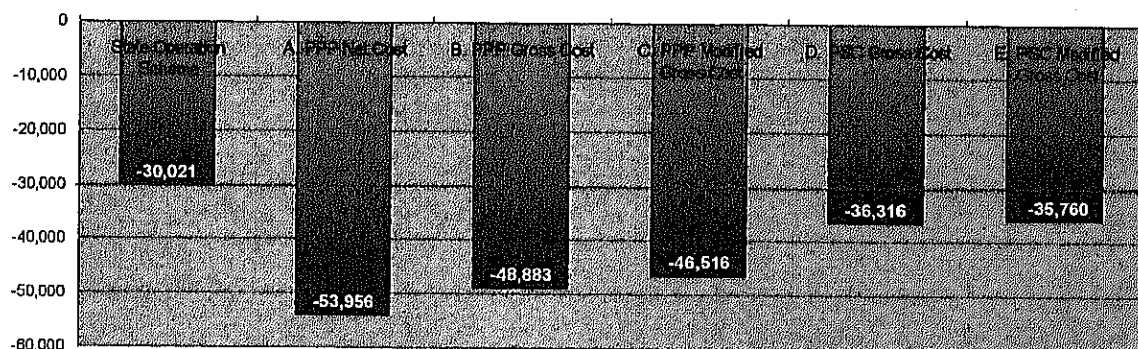
<sup>24</sup> As same as the feasibility study report of each line, Construction period of the Purple and Pink Lines are 4 years, and that of the Orange

net present value (NPV). Public sector's NPV were calculated based on 5% discount rate and best estimate assumptions made at feasibility study. Figure 4.2-4 ~ 4.2-6 illustrate the cash inflow/outflow and the net cashflow of each financial framework (also see Appendix 3 for detailed cashflow of public sector and private concessionaire).



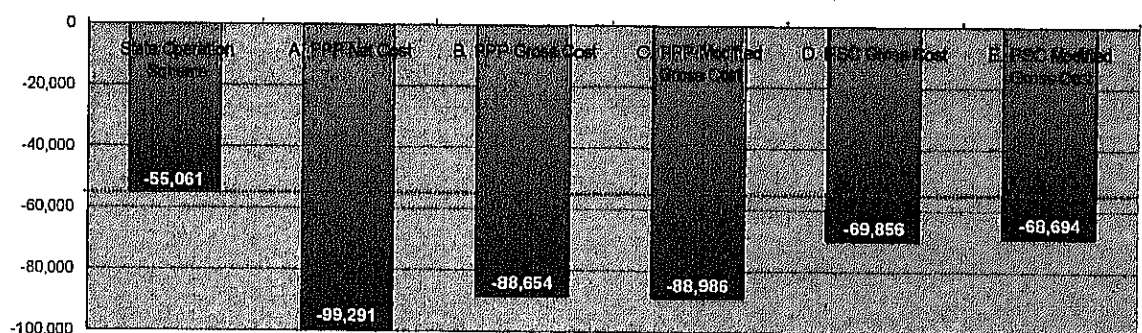
Source: JICA Study Team, Note: Unit= million Baht

Figure 4.2-1: Public Sector's NPV Gap Under 6 Patterns of Financial Framework (Purple Line)



Source: JICA Study Team, Note: Unit= million Baht

Figure 4.2-2: Public Sector's NPV Gap Under 6 Patterns of Financial Framework (Pink Line)



Source: JICA Study Team, Note: Unit= million Baht

Figure 4.2-3: Public Sector's NPV Gap Under 6 Patterns of Financial Framework (Orange Line)

As the above figure indicates, the public sector's NPVs under 6 patterns of financial framework are negative for all the analyzed projects, because, as the previous studies revealed, all the analyzed projects themselves are financially not profitable as a whole.

Financial burden of the public sector of each line is the smallest when adopting state operation scheme (the public sector's NPV= Purple Line: -38,974 million Baht, Pink Line: -30,021 million Baht, and Orange Line: -66,081 million Baht). This is because the public sector is able to access ODA loan with longer repayment period, and lower interest rate (3.75% for civil work, 4.05% for E&M and rolling stock, which is including swap rate<sup>25</sup>).

If no efficiency is achieved by the private sector, PPP Net cost concession impose heaviest burden on the public sector (public sector's NPV= Purple: -55,615 million Baht, Pink: -53,956 million Baht, and Orange: -99,291 million Baht). According to MAS, in the case of PPP net cost, the private sector required the highest ROE (13.5%) due to high ridership risk, and commercial banks request the highest interest rate to the private sector because of high project risk. In case of PPP net cost, the public sector needs to compensate the private sector's profitability through providing sizable amount of subsidy. Provision of such subsidy levied heavy burden on the public sector.

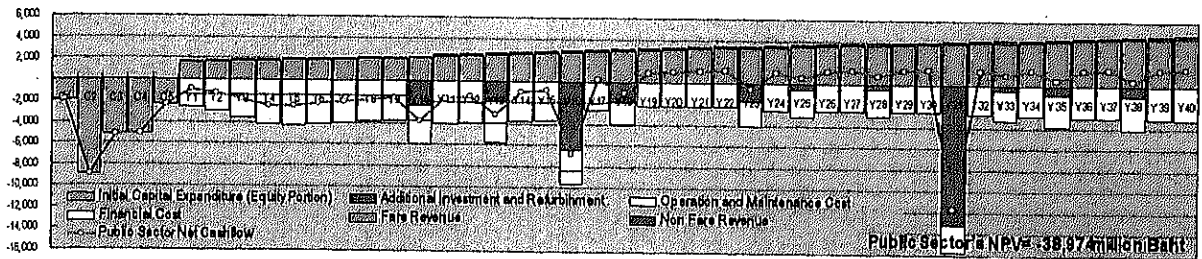
In case of PPP gross cost and PPP modified gross cost schemes, while the public sector finances less capital expenditure, the public sector also needs to bear subsidy payment to the private throughout the concession period. On the other hand, in case of PSC gross cost and PSC modified gross cost, while the public sector finances all infrastructures, the public sector can receive some revenue share and/or annuity from the private sector (otherwise their ROE exceeding predetermined percentage).

These analyses revealed that, if the private sector can not bring about operational efficiency and cost efficiency, project implementation thorough the private participation will increase the public sector's financial burden during whole project period.

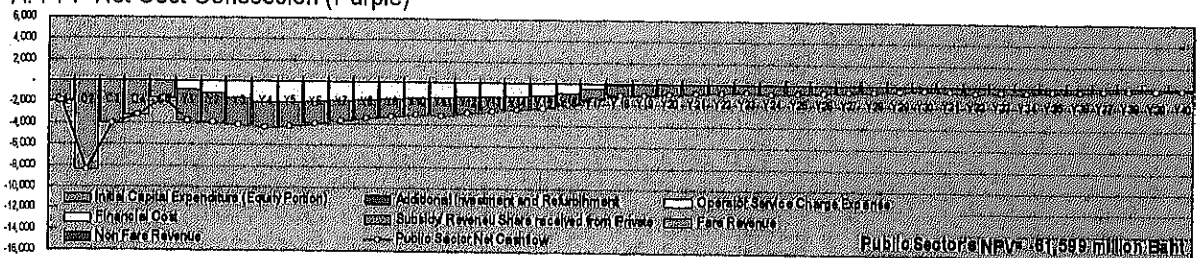
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<sup>25</sup> Following same assumption as used in the evaluation report of Purple Line, which was prepared based on the comments of the MRT Subcommittee and the MRTA Board.

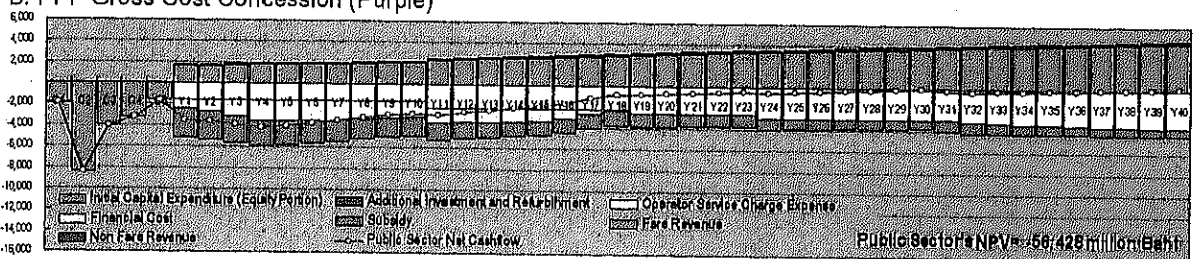
State Operation Scheme (Purple)



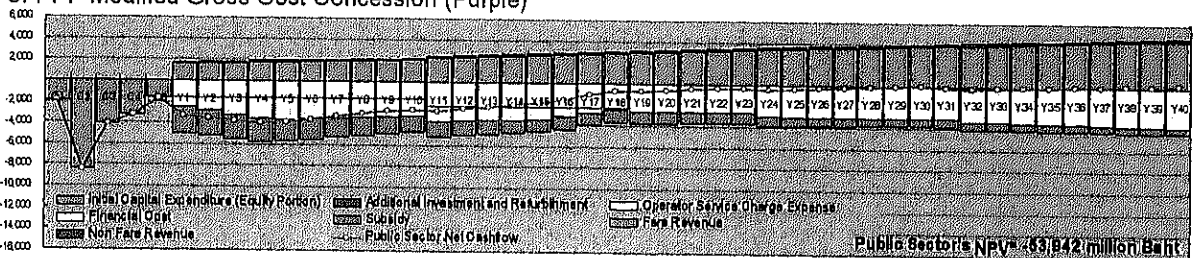
A. PPP Net Cost Concession (Purple)



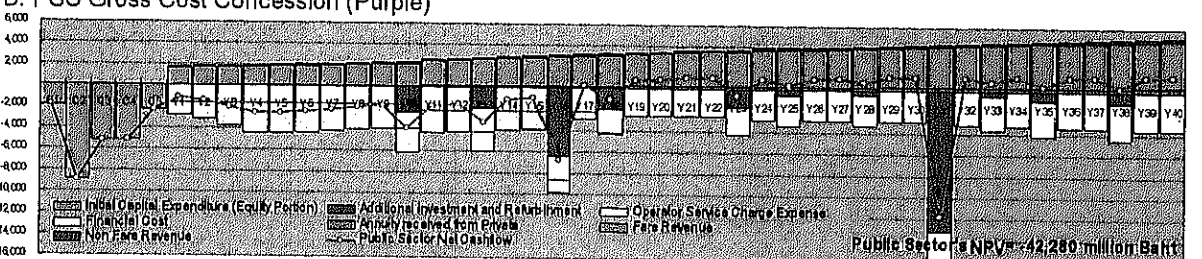
B. PPP Gross Cost Concession (Purple)



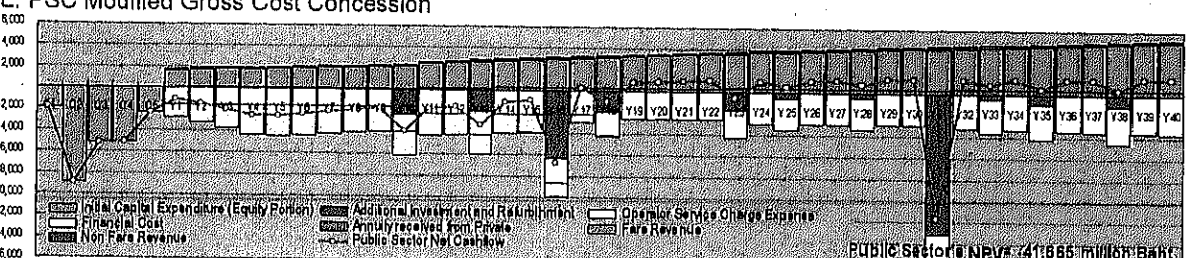
C. PPP Modified Gross Cost Concession (Purple)



D. PSC Gross Cost Concession (Purple)



E. PSC Modified Gross Cost Concession

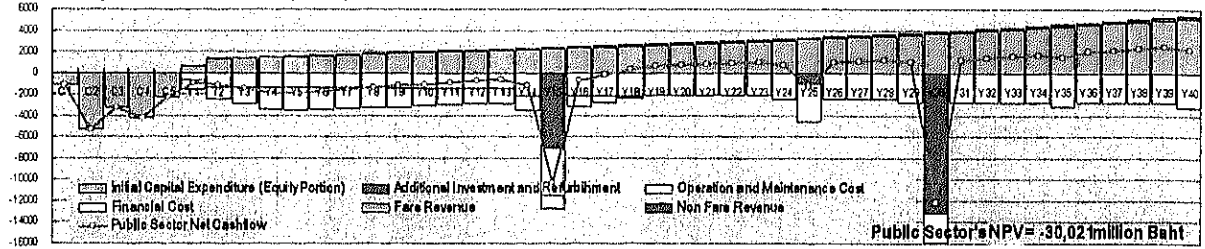


Source: JICA Study Team Note: 2007 Constant Price (unit: million Baht)

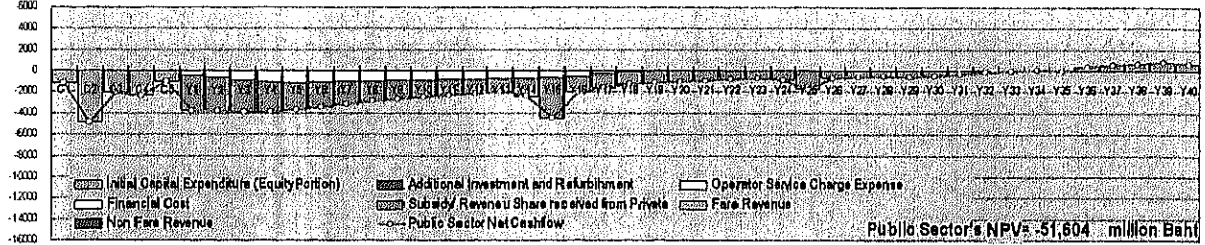
Figure 4.2-4: Public Sector's Cashflow under 6 Patterns of Financial Framework (Purple Line)



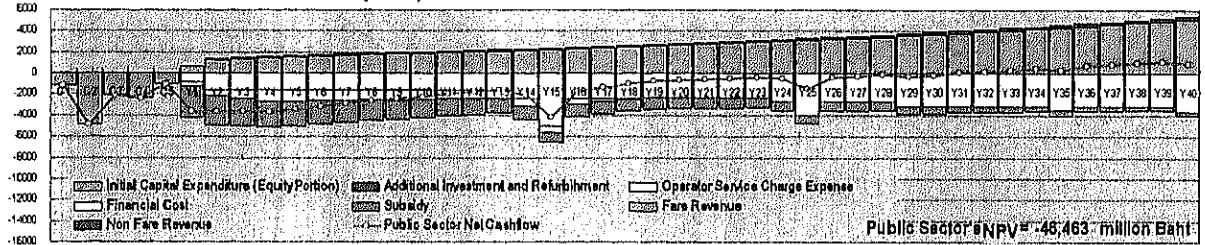
State Operation Scheme (Pink)



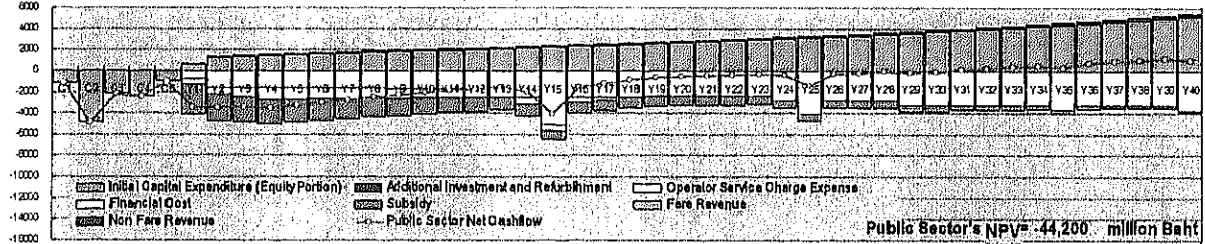
A. PPP Net Cost Concession (Pink)



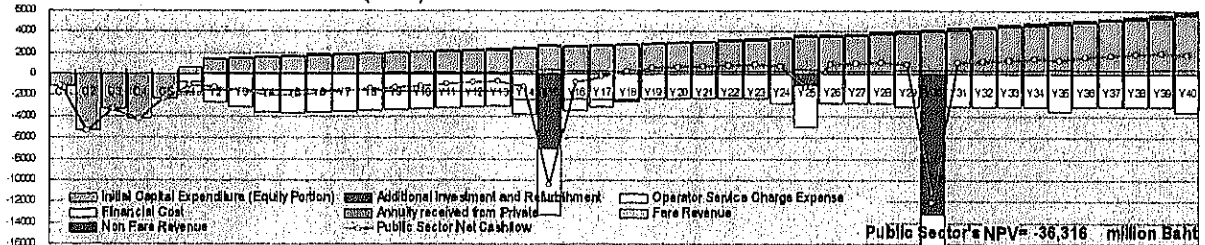
B. PPP Gross Cost Concession (Pink)



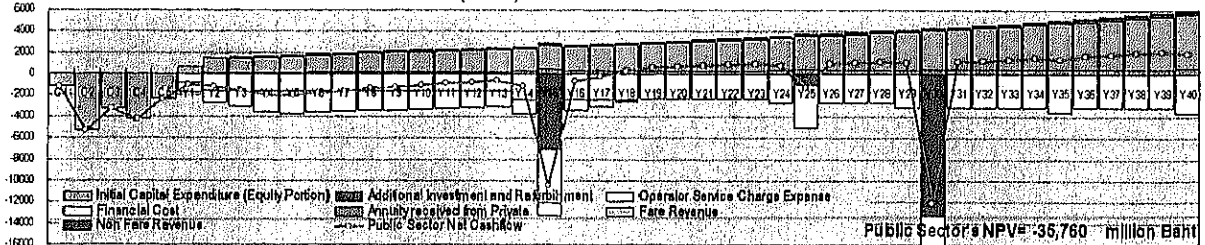
C. PPP Modified Gross Cost Concession (Pink)



D. PSC Gross Cost Concession (Pink)



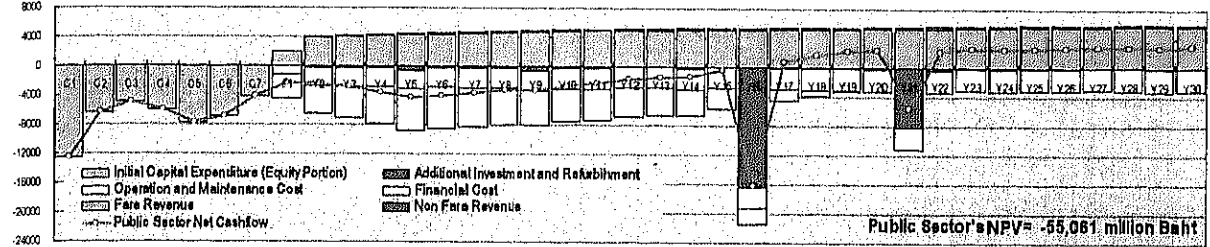
E. PSC Modified Gross Cost Concession (Pink)



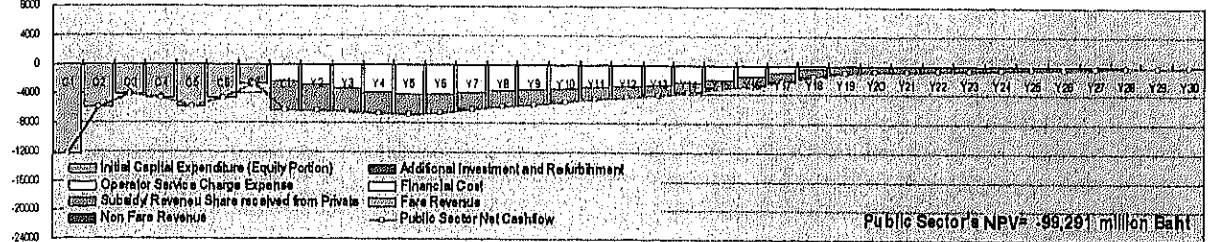
Source: JICA Study Team Note: 2008 Constant Price (unit: million Baht)

Figure 4.2-5: Public Sector's Cashflow under 6 Patterns of Financial Framework (Pink Line)

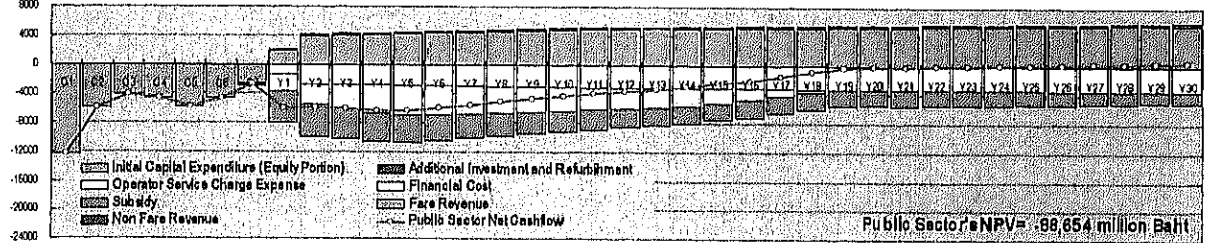
State Operation Scheme (Orange)



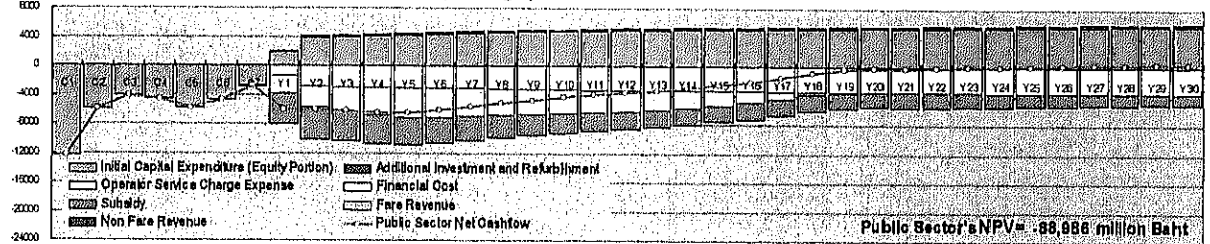
A. PPP Net Cost Concession (Orange)



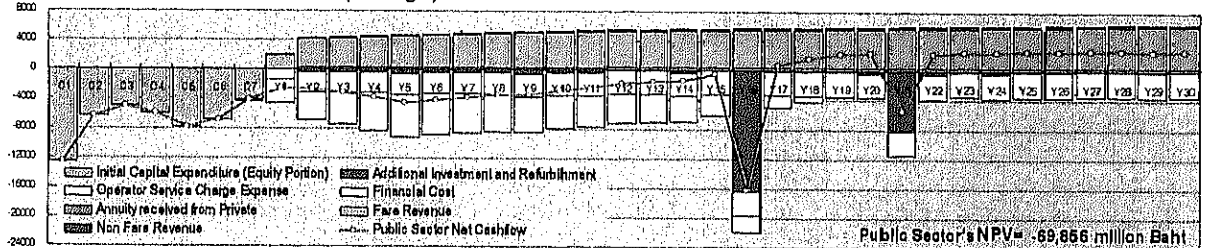
B. PPP Gross Cost Concession (Orange)



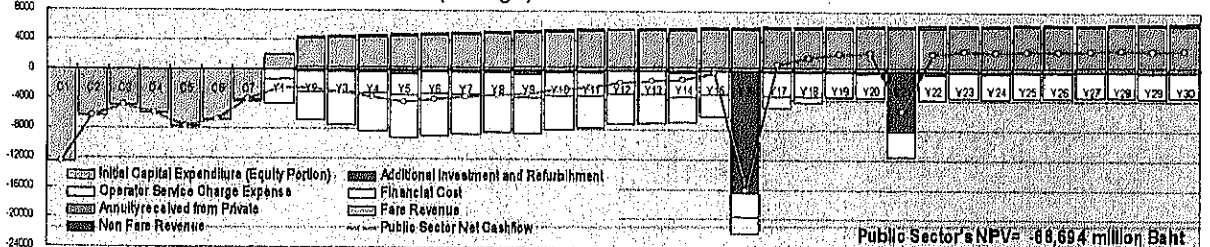
C. PPP Modified Gross Cost Concession (Orange)



D. PSC Gross Cost Concession (Orange)



E. PSC Modified Gross Cost Concession (Orange)



Source: JICA Study Team Note: 2005 constant price (unit: million Baht)

Figure 4.2-6: Public Sector's Cashflow under 6 Patterns of Financial Framework (Orange Line)

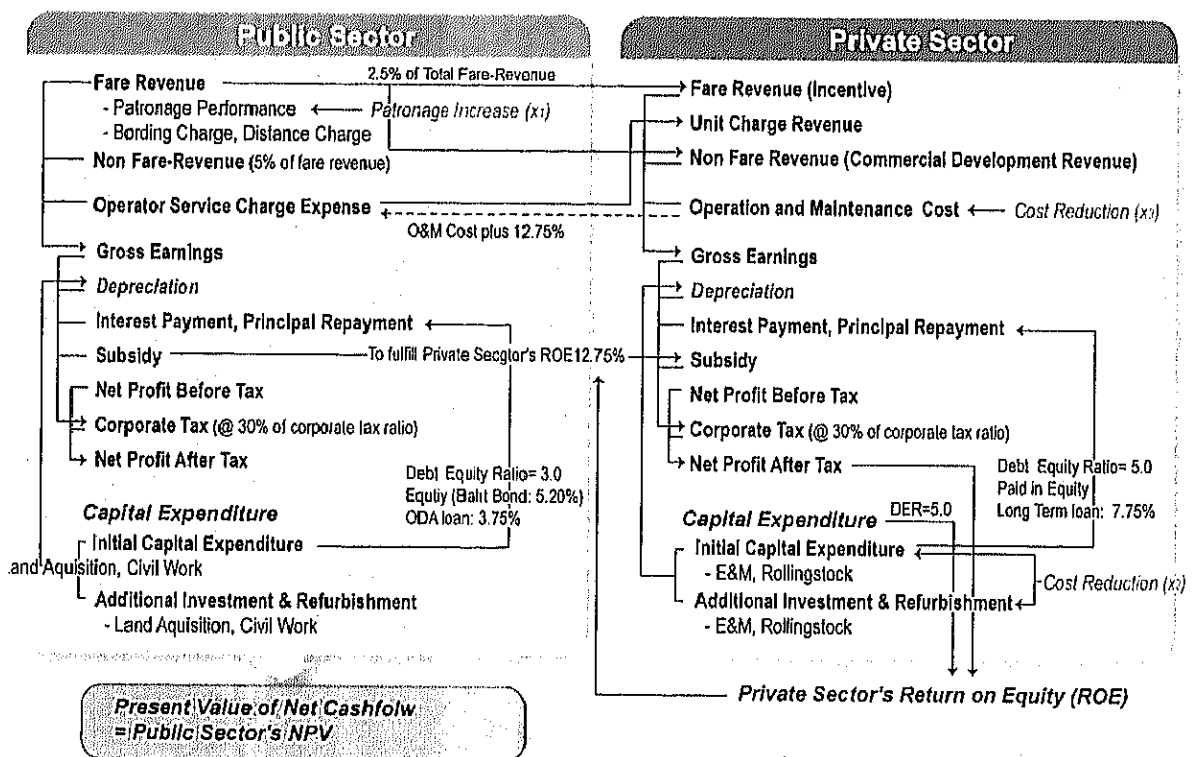
### 4.2.2 Analysis 2 (Sensitivity Analysis adopting Newton Raphson Method)

#### (1) Methodology of the Simulation

As the Analysis 1 (public sector’s NPV gap calculation) indicated, the private sector is required to achieve a certain degree of efficiency, in order to fill the gap between public sector’s NPV under state operation scheme and that under private participation schemes. If the private sector cannot bring about efficiency, it is better for the public sector to implement the project through a state operation scheme.

“Analysis 2” aims to examine the efficiency to be achieved by the private sector quantitatively to reduce the public sector’s financial burden in comparison with the state operation scenario. In analyzing the cashflow, i) ridership demand, ii) capital expenditure for E&M equipment and rolling stock, and iii) operation and maintenance cost are adopted as the variables.

Figure 4.2-7 illustrates schematic figure of financial model adopted for the simulation (shown only the case for PPP modified gross cost as a sample). Changes in the variables ( $x_1$ ,  $x_2$ , and  $x_3$ ) affect the profitability of the private sector as well as subsidy payment or revenue share between the public and the private sector, which eventually affects public sector’s NPV.



Source: JICA Study Team

Figure 4.2-7: Schematic Figure of the Financial Model (PPP Modified Gross Cost)



As same as Simulation 1, the public sector's NPV can be formulated as follows;

$$NPV_X = \sum_{t=5}^{40} \left\{ \frac{FR_{Xt} + NFR_{Xt} - OSC_{Xt} - OM_{Xt} - PP_{Xt} - IP_{Xt} - SB_{Xt} + RS_{Xt} - CI_{Xt} - AR_{Xt}}{(1 + \phi)^t} \right\} \dots (a)$$

Here:

- NPV<sub>X</sub>: Public sector's present value of net cashflow under financial framework "X"
- FR<sub>Xt</sub>: Public sector's fare revenue in year "t" under financial framework "X"
- NFR<sub>Xt</sub>: Public sector's non-fare revenue in year "t" under financial framework "X"
- OSC<sub>Xt</sub>: Operator's service charge paid by public sector to private sector in year "t" under financial framework "X"
- OM<sub>Xt</sub>: Public sector's operation and maintenance cost in year "t" under financial framework "X"
- PP<sub>Xt</sub>: Principal repayment in year "t" under financial framework "X"
- IP<sub>Xt</sub>: Interest payment in year "t" under financial framework "X"
- SB<sub>Xt</sub>: Subsidy from public sector to private sector in year "t" under financial framework "X"
- RS<sub>Xt</sub>: Revenue Share paid by private sector to public sector in year "t" under financial framework "X"
- CI<sub>Xt</sub>: Initial Capital Investment Cost (public sector's equity portion) in year "t" under financial framework "X"
- AR<sub>Xt</sub>: Additional Investment and Refurbishment cost levied by public sector in year "t" under financial framework "X"
- φ: discount rate (5.0%)

Among the above-mentioned indicators, some of them vary according to change in the three variables (=the performance of the private sector). For example, in the case of net cost concession, better ridership demand and smaller capital cost for E&M/rolling stock are resulted in smaller subsidy from the public sector. Also, smaller O&M cost of the private sector is resulted in smaller operator's service charge paid by the public sector. Financial model was formulated to always fulfill the private sector's required ROE defined under MAS, whenever 3 variables are moving.

$$NPV_X = f(X_{1t}, X_{2t}, X_{3t}) \dots (b)$$

Here:

- NPV<sub>X</sub>: Public sector's present value of net cashflow under financial framework "X"
- f(x<sub>1t</sub>, x<sub>2t</sub>, x<sub>3t</sub>): net cashflow of public sector in year "t" under financial framework "X" adopting assumptions of x<sub>1t</sub>, x<sub>2t</sub>, and x<sub>3t</sub>
- x<sub>1</sub>: difference of ridership demand between state operation and financial framework "X" in percentage
- x<sub>2</sub>: difference of capital investment cost for E&M and rolling stock between state operation and financial framework "X" in percentage
- x<sub>3</sub>: difference of O&M cost between state operation and financial framework "X" in percentage

This calculation aims to find the combination of the variables (x<sub>1</sub>, x<sub>2</sub>, and x<sub>3</sub>) which make break-even to fulfill following equation (c).

$$NPV_X - NPV_{SO} = 0 \dots (c)$$

Here:

- NPV<sub>SO</sub>: Public sector's present value of net cashflow under state operation scheme

As the first step to find a root of the above-mentioned equation, among 3 variables, 2 variables (increase in ridership demand, and reduction in capital investment cost for E&M/rolling stock) are fixed. The remaining variable, namely O&M cost reduction, to fulfill the above-mentioned equation is calculated with the Newton Raphson method. The Newton Raphson method uses the slope of the function to estimate the location of the root. Such calculations are repeatedly made for various cases; ridership demand increase (0% to 20% for

0.1% point interval), and reduction in capital investment cost for E&M equipment (-20% to 0% for 10% point interval).

## (2) Results of the Analysis

Figure 4.2-8 shows the sample result of the simulation based on the assumption of the private sector can reduce 10% capital investment cost for E&M and rolling stock. While the horizontal ( $x_1$ ) axis indicates ridership demand increase to be achieved by the private sector, the vertical axis ( $x_3$ ) indicates O&M cost reduction to be achieved by the private sector. The line in the figure indicates threshold whether the public can achieve VfM<sup>26</sup> (above the line) and it fails to achieve VfM (below the line).

For example, the left figure of Figure 1 shows that the public sector's VfM is achieved only when the private sector can reduce O&M cost by 25.1% and, at the same time, increase ridership demand by 20% compared with the public sector.

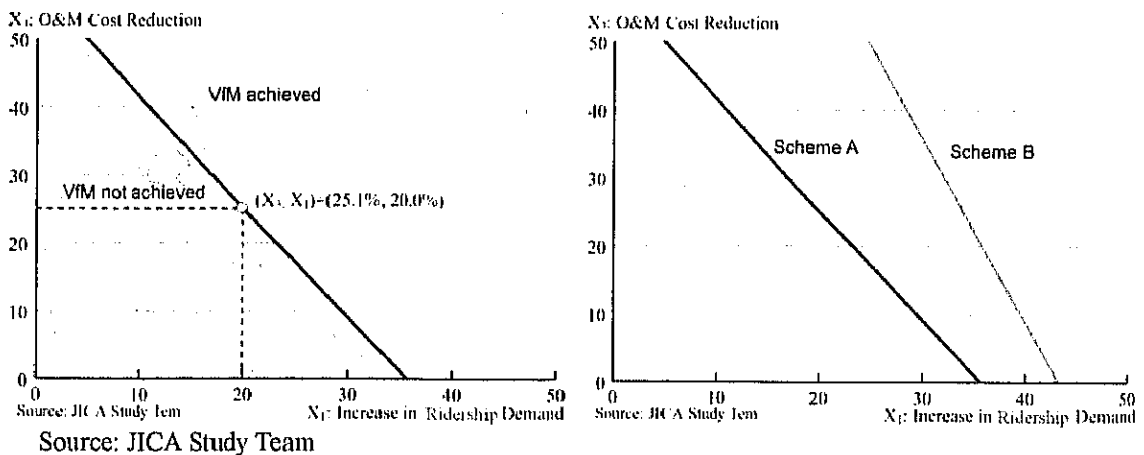


Figure 4.2-8: Example of the Result of Simulation

The graph also indicates that it becomes more difficult for the public sector to achieve VfM with increasing the distance of line from the position of the origin ( $x_1=0$ ,  $x_3=0$ ). For example, scheme B is more difficult for public sector to achieve VfM (please refer to right side of the above figure)

The figure 4.2-9 ~ 4.2.11 shows the results of the simulation for 5 project implementation schemes. In the case of the Orange line, required level of the private sector's performance is considerably higher than the others (threshold line is away from position of the origin).

<sup>26</sup> "Achieve VfM" indicates public sector's NPV under private participation scheme is bigger than the public sector's NPV under state operation scheme.

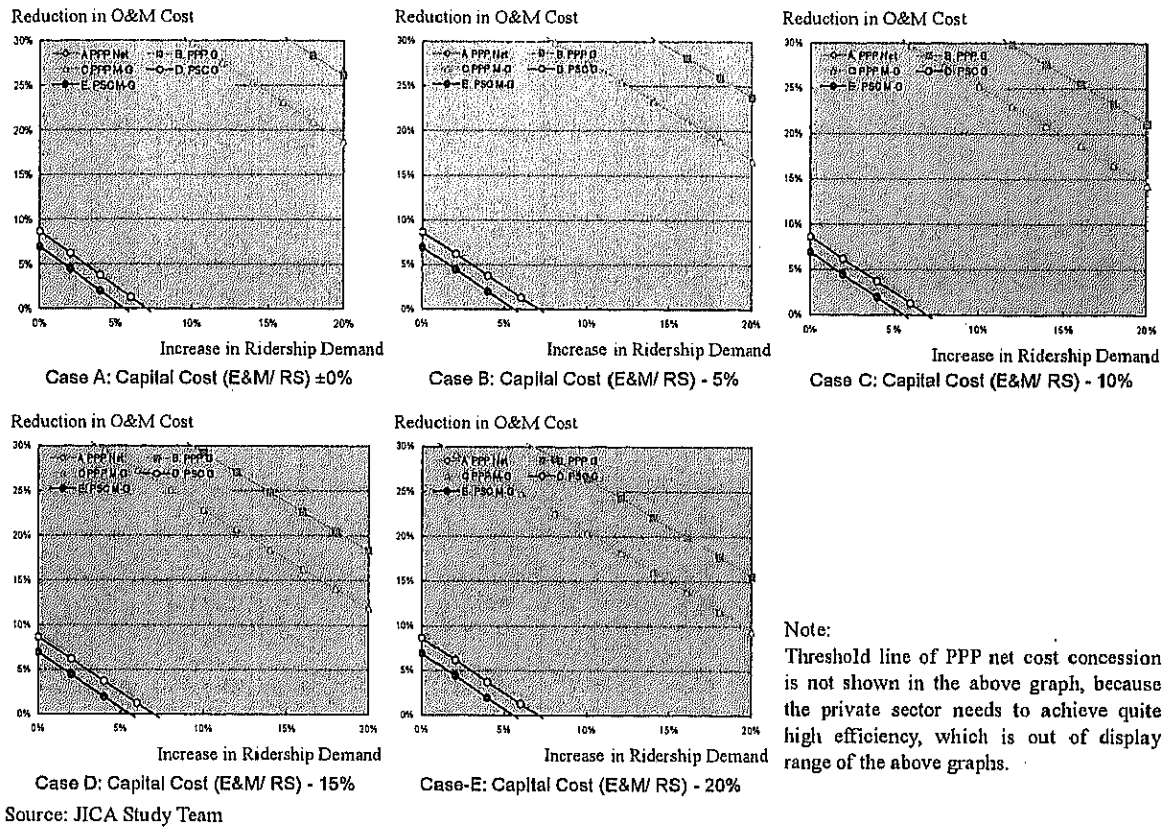


Figure 4.2-9: Results of the Simulation 2 for the Purple Line

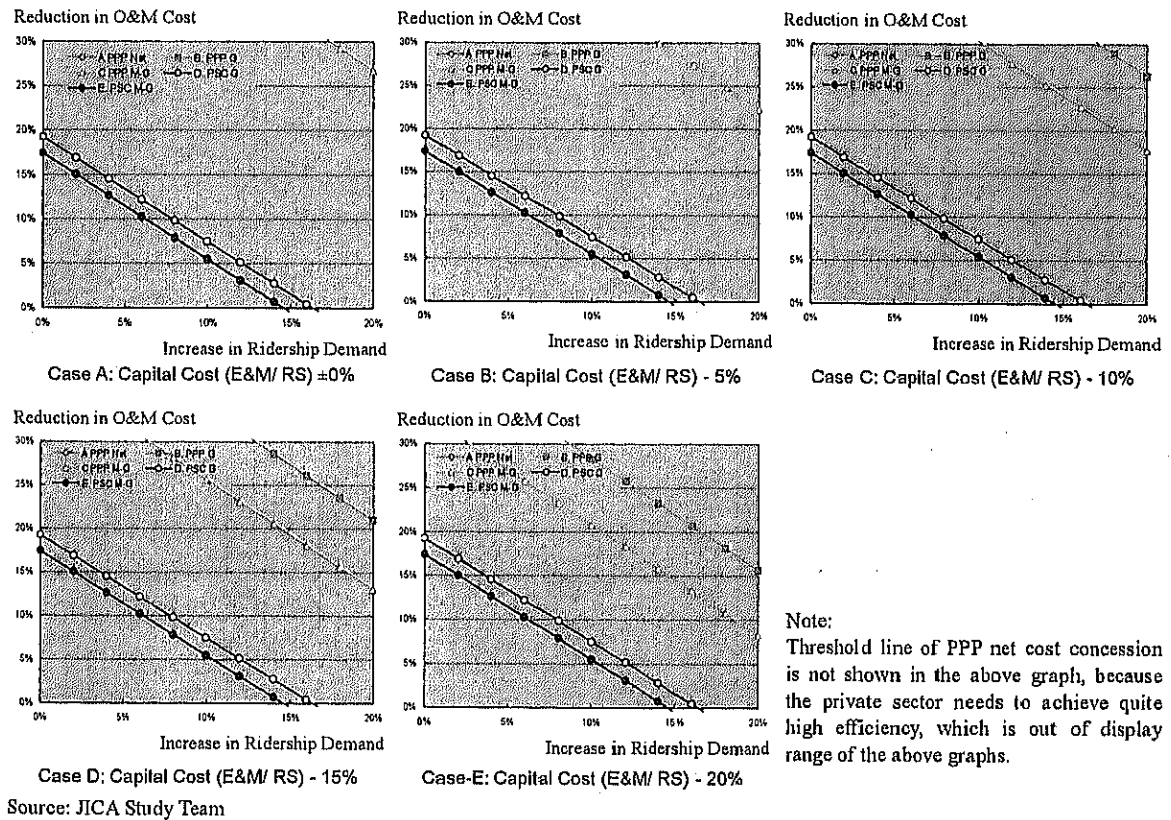


Figure 4.2-10: Results of the Simulation 2 for the Pink Line

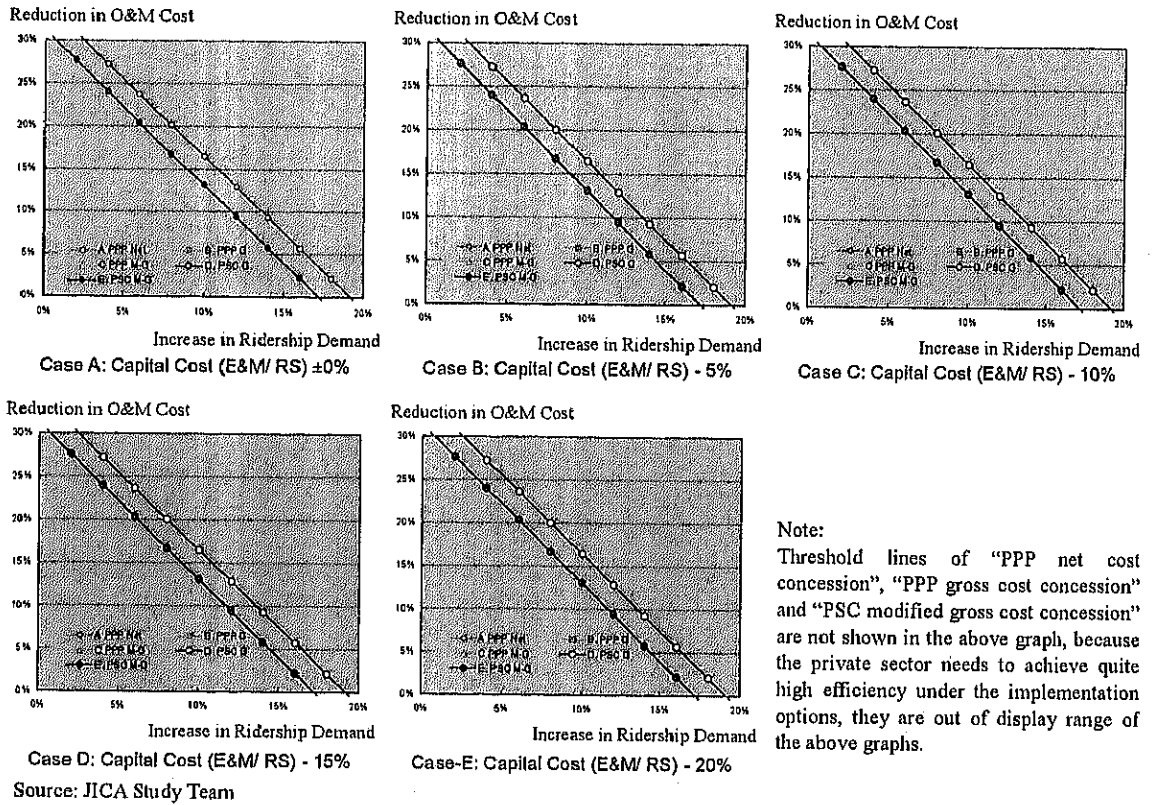
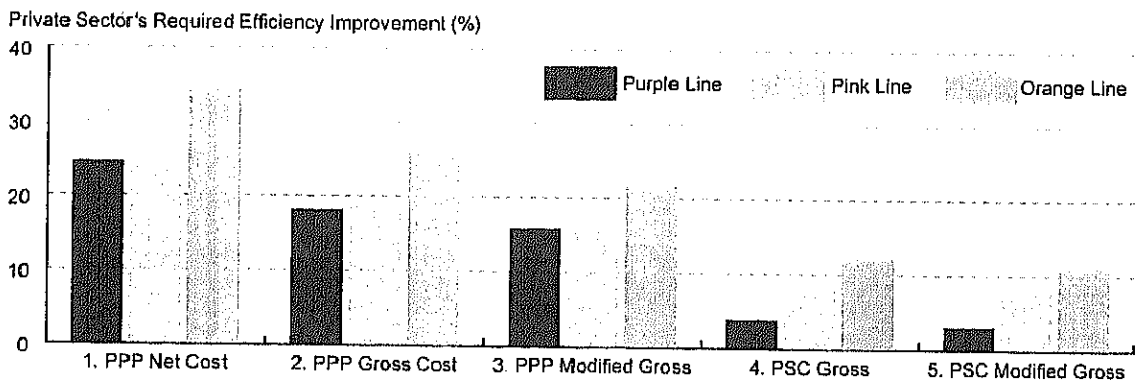


Figure 4.2-11: Results of the Simulation 2 for the Orange Line

Figure 4.2-12 illustrates the more simplified results of the Analysis 2. As shown in the figure, in case of the Orange line, required level of the private sector's performance is considerably higher than the others. When we focus on pattern of financial framework, the results indicate PPP schemes required private sector to achieve higher performance than PSC schemes. Particularly, in the case of PPP Net cost concession scheme, the private sector needs to achieve the highest level of performance among other schemes in order to achieve public sector's VfM. It would be very difficult for the public sector to achieve VfM particularly under PPP Net cost concession scheme.



Source: Study Team

Note: Private sector performance improvement indicate difference of in ridership demand increase, reduction in O&M Cost, and reduction in capital cost for E&M/ rolling stock in comparison to public sector's implementation

Figure 4.2-12: Required Level of Improvement Achieved by Private Sector

Among the analyzed three lines, the Purple line seems most suitable for adopting private participation schemes. On the other hand, in comparison with the Purple and the Pink, the Orange line is not suitable for the private participation scheme.

Required private sector's performances under various private participation schemes examined by "Analysis 2" are summarized as follows;

1) PSC Gross, PSC Modified Gross

PSC gross cost and PSC modified gross cost have a greater likelihood of achieving public sector's VfM than other 3 private participation schemes. In the case of the Purple line, public sector will achieve VfM, if private sector success to improve ridership demand and O&M cost efficiency by 3.1~3.9% each than public sector. Private sector will bring about public sector's VfM under the Pink line, when they successfully improve ridership demand and O&M cost efficiency by 7.9~8.9% each. Public sector's VfM will be more difficult to achieve under the Orange line project (private sector's necessary performance will be, for example, 11.1~12.3% improvement in 2 variables).

If the public sector successfully attracts enough skilled and experienced private concessionaire, and given reasonable incentive and penalty to them, public sector's VfM can be reasonably achievable under the Purple line project and the Pink line project. Although it is considered that achievement of public sector's VfM under the Orange line project will be more difficult than the Purple and the Pink lines, but there are still enough chances to achieve it.

2) PPP Gross, PPP Modified Gross

Under the Pink and Purple line projects, public sector will achieve VfM if the private sector successfully brings about 15.9% ~ 18.7% improvement of each variable. In the case of the Orange line project, public sector will be failed to achieve VfM even if the private sector brings about 20% improvement of each variable (at least 22.4~26.6% improvement is required).

Accordingly, it seems difficult for the public sector to achieve VfM under the Purple and Pink lines. Also, the achievement of VfM under the Orange line is considered to be extremely difficult.

3) PPP Net

When PPP net cost concession model is adopted for the analyzed three lines, the public sector will be fail to achieve VfM even if the private sector brings about 23.9% ~ 34.4% improvement of each variable than public sector. However, such drastic improvement cannot be expected even if private sector has enough experiences and skills. Therefore, the achievement of VfM under the PPP net cost concession is considered to be almost impossible.

#### 4.2.3 Summary of Results of the Financial Analysis and its Consideration

##### (1) Summary of Results of the Financial Simulations

The results of financial simulations for the three lines are concluded as follows:

1) Private Sector Needs to Achieve High Level of Performance to enable Public Sector to Realize

## VfM

In achieving the public sector's VfM, the private sector should achieve high level of performance (such as increase in ridership demand, decrease in capital cost and O&M cost) than the public sector. If the private sector fails to achieve such efficiency, the public sector's financial burden under the private participation will be larger than that under state operation scheme.

### 2) Public Sector's VfM can be hardly achievable under PPP net, PPP gross and PPP modified gross

It is quite difficult for public sector to achieve VfM, when they asking private sector to invest capital cost for E&M equipment/rolling stock. Because, higher financial cost for E&M equipment/rolling stock levied on private sector eventually impose heavy burden on public sector in the form of subsidy paid to public sector. Thus, under PPP schemes, private sector needs to achieve higher performance than public sector. Public sector's VfM is considered to be difficult to achieve under PPP gross cost concession, and PPP modified gross concession. And, it is no exaggeration to say that public sector's VfM cannot be achieved under PPP net cost concession scheme.

### 3) Public Sector has Chance to Achieve VfM under PSC Gross Cost and PSC Modified Gross Cost

On the other hand, PSC gross cost and PSC modified gross cost have a greater likelihood of achieving public sector's VfM than other 3 private participation schemes. In the case of the Purple line and the Pink line under PSC gross or PSC modified gross, public sector will achieve VfM, only if private sector success to increase ridership by 5~8%, and decrease O&M cost by 5~8% than public sector. If public sector successfully attracts enough skilled and experienced private concessionaire, and given reasonable incentive and penalty to them, public sector's VfM can be reasonably achievable.

## (2) Considerations for the Results of Financial Simulation

In understanding above mentioned results, attention should also be paid for the allocation of risk between public sector and private concessionaire. In this analysis, private sector's risk is partially incorporated. For example, according to MAS guideline, private sector's ROE and financial cost (interest rate) is higher when private sector takes higher ridership risk (net cost concession), and is lower when private sector doesn't take ridership risk (gross cost concession). On the other hand, public sector's risk is not quantified in MAS guideline, and is not incorporated in this financial simulation.

Table 4.2-4 shows allocation of risk factor between public sector and private sector under six patterns of financial framework. As shown in the table, public sector's risk is the highest when selecting state operation scheme, and lowest when selecting PPP net cost concession. If state operation scheme is selected as financial framework, all the risks need to be taken by the public sector.

Following table also indicate relation between public sector's risk and public sector's probable NPV. The higher the public sector's business risk, the higher the public sector's NPV, and vice versa. Therefore, if the public sector wishes to reduce their financial burden, the public