

CHAPTER 6 SUGGESTED SOLUTION DIRECTION AND ROADMAP

Thus far, the Study Team have reviewed the current urban railway situation in Thailand (chapter2), synthesized the issues of urban railway in Thailand (chapter3), analyzed the financial framework (chapter4), and extracted lessons from overseas cases (chapter5).

In this last chapter, the Study Team will bring all findings from this study and suggest recommendations on solution direction and describe the action roadmap on Thailand's path forward. Three-tiered structure will be used as a common framework.

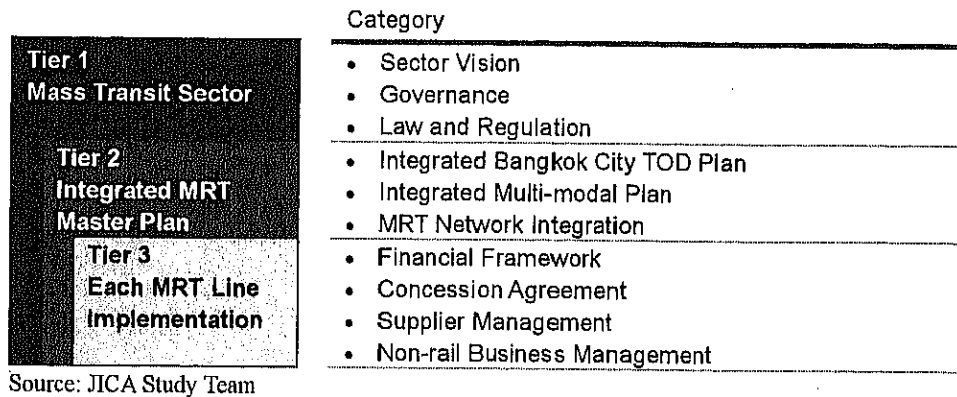


Figure 6.1-1: Three-tiered structure

6.1 Tier1: Issues, Solution Direction and Potential Support

Tier 1 is the fundamental basis for mass transit sector to prosper. Starting from sector vision, governance of the sector as well as law and regulations need to be refined and upgraded in Thailand.

6.1.1 Sector Vision (Tier1)

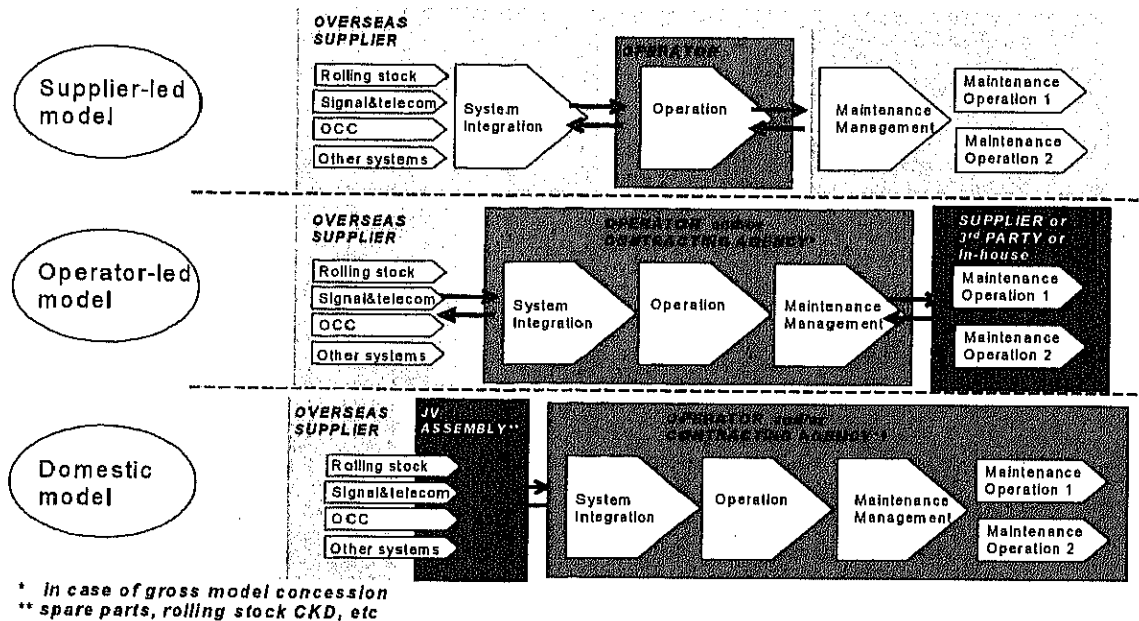
Issues: Lack of clear vision on future mass transit sector structure.

The sector value chain, in simple terms, consists of system components sourcing, system integration, system operation, maintenance management and maintenance operation. In the past, Thailand value chain has been shaped by suppliers (supplier-led model). This is natural in the early stages of network building. The key question is “what is the future vision?” This needs to be clarified going forward.

Solution Direction: Shift out from supplier-led model.

As indicated below (Figure 6.1.1), there are various options for value chain structure. The supplier-led model is perhaps not suitable for large cities like Bangkok, with plans for large network with many different lines. The operator (concessionaire) and contracting agency (e.g. MRTA) will need to build capacity to take more control of system integration and maintenance

management. This is because of the characteristics of urban railway network. For example, line extension needs to be managed in a way that has similar signal, telecommunication and rolling stock systems. Also, AFC system needs to be common across multiple lines. To achieve such network integration, supplier-led model is inflexible.



Source: JICA Study Team

Figure 6.1-2: Models of sector value chain

Necessary next steps:

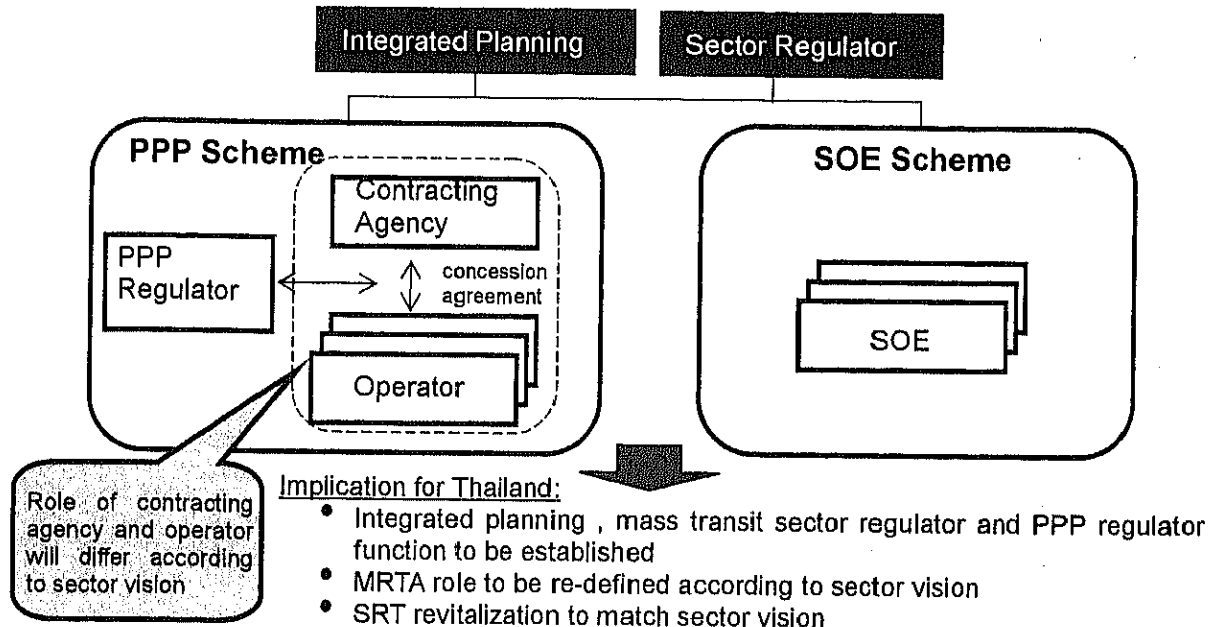
- **Research and Analysis: Overseas value chain study.** Research on different patterns of sector vision; 1) Study overseas mass transit value chain structure and synthesize merits/demerits for each model pattern, 2) Analyze cases of overseas industry players in the value chain, 3) Estimate economic size for each value chain component in Thailand and neighboring countries
- **Workshops: Sharing workshop of overseas value chain.** Share overseas research results and discuss sector vision options for Thailand.
- **Thailand Action Plan Development: Develop Thailand sector vision.** Assess options and develop recommendations for sector vision. Describe action programs to reach sector vision and derive implications for how tender preparation, concession agreement and supplier contract should be changed based on selection of vision.
- **Implement and Build Capacity: Decide and agree on implementation.** Reach broad stakeholder consensus on sector vision and commit to specific implementation activities.

6.1.2 Governance (Tier1)

Issues: Weak governance structure of mass transit sector. In the past, this sector has been

developed in a mode of trial and error. It is an opportune timing to shift gears and strengthen the governance structure of the sector.

Solution Direction: Establish sector regulator, PPP regulator and integrated planning function. Strengthen contracting agency (MRTA) function and revitalize SRT. Organizationally, below figure 6.1.3 describes the governance structure improvement points. Needless to say, organizational functions must be aligned with the selection of sector vision.



Source: JICA Study Team

Figure 6.1-3: Governance improvement view

Necessary next steps:

- **Research and Analysis: Overseas governance study.** Study detail cases of overseas regulator functions, contracting agency functions and SOE functions for urban mass transit
- **Workshops: Sharing workshop of overseas governance cases.** Hold discussions between stakeholders and decide on ideal governance structure to achieve sector vision
- **Thailand Action Plan Development: Develop Thailand governance organization plan.** Conduct detail design of sector regulator organization and clarify its roles and functions in Thailand context. Design revision of MRTA's function to achieve sector vision, especially with a view to operate under "gross model".
- **Implement and Build Capacity: Establish new organization and revise current organization.** Implement and monitor action programs to 1) establish new sector regulator/PPP regulator organization, 2) strengthen MRTA's function and 3) revitalize SRT organization division (or its subsidiary) that manages urban mass transit lines.

6.1.3 Law and Regulation (Tier1)

Issues: Sector specific law and regulation for urban mass transit does not exist. PPP Act and MRTA Act are existing laws that are critically important for the success of urban mass transit development. However, neither Act provides detail regulations on the actual implementation (i.e. design, construction, operation and maintenance). Also, PPP act does not provide sector specific guidelines on PPP scheme, including government support. In addition, MRTA Act may need to be refined based on how the sector vision will be shaped.

Solution Direction: Develop MRT Act, refine PPP Act and MRTA Act. Urban mass transit is different in characteristics from inter-city railway. It is centrally controlled at OCC (Operation Control Center) with minimum headway that could be 2-3min during peak hour. Hence, current SRT law does not apply to the urban mass transit construction and operations requirements (e.g. station and surrounding development, safety, security, environmental aspects). Development of MRT Act should be considered from this point of view.

In addition, the current PPP Act does not provide sufficient details specific to urban mass transit sector. As described before, PPP in mass transit has unique characteristics such as 1) the separation of civil and M&E, 2) the gross cost model with government taking ridership risks and 3) the importance of integration in Tier2. With these characteristics in mind, detail guidelines should be developed on how the government should think about areas such as risk allocation, control of tariff/non-rail business and subsidies.

Lastly, if sector vision and governance were to be changed and improved, then, the role of MRTA would also need to be refined. MRTA Act, which defines MRTA's role should be refined accordingly.

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

Source: JICA Study Team

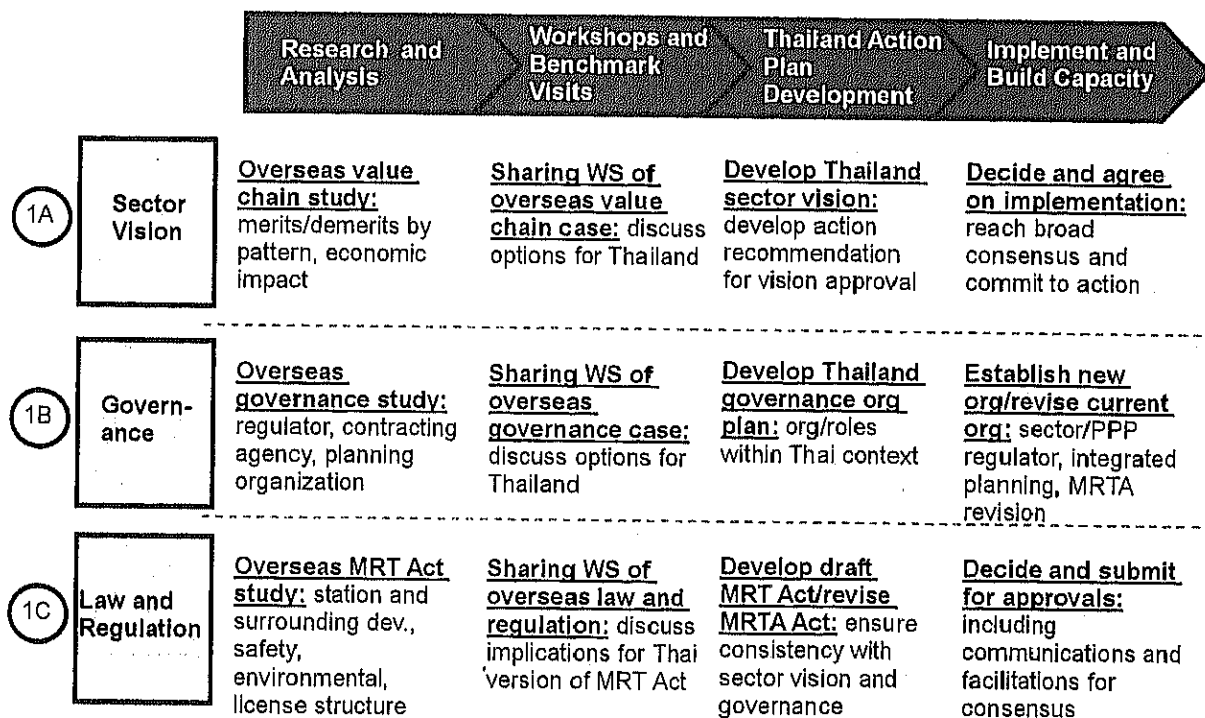
Figure 6.1-4: Key improvement points on law and regulation

Necessary next steps:

- **Research and Analysis: Overseas MRT Act study.** Study details of MRT Act in other countries, especially on station and surrounding development (e.g. joint development law in Japan), safety regulations, environmental regulations and implications for construction and operation licenses
- **Workshops: Sharing workshop of overseas law and regulation.** Discuss key points of MRT Act cases and derive implications on Thailand version of MRT Act.
- **Thailand Action Plan Development: Develop draft MRT Act, revise MRTA Act.** Refer to overseas case and develop draft of MRT Act and discuss between stakeholders. Monitor decisions on sector vision and governance improvements, especially on the future role of MRTA. Derive implications for refinements required for MRTA Act. Also, review latest version of PPP Act guideline. Take a sector-specific view and extract implications on further improvements, if any.
- **Implement and Build Capacity: Decide on changes and submit for approval.** Conduct necessary communications and facilitate consensus for approval.

For Tier1, in summary, there are three streams of necessary next steps.

A) Sector Vision, B) Governance, C) Law and Regulation. Figure 6.1-4 describes the next steps overview for Tier1.



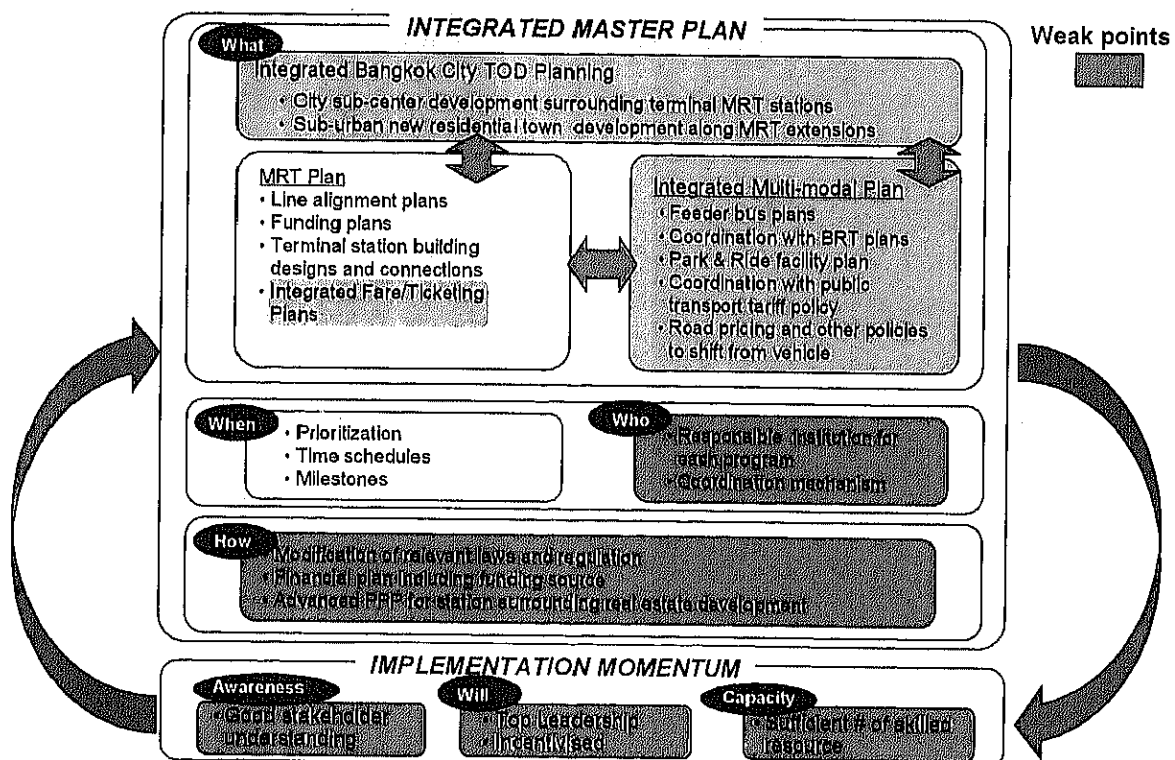
Source: JICA Study Team

Figure 6.1-5: Tier1 Next Steps

6.2 Tier 2: Integrated MRT Master Plan

Tier2 is all about integrated planning. It is not just about plans for each mass transit lines. It is about how mass transit lines integrate with each other, with other modes of transport and with city planning. The overall view of integrated MRT Master Plan is described in Figure 6.2. The blue shaded areas are where it is weak in the current situation. As you can see, most areas are weak on integration as well as on 'who', 'how' and 'implementation momentum'.

Thailand should take actions to ensure true integration of planning and implementation in order to reshape the capital city of Bangkok into the ideal next horizon. Solution directions will typically include elements of organization, financing and policy.



Source: JICA Study Team

Figure 6.2-1: Overall view of Integrated Master Plan

6.2.1 Integrated Bangkok City TOD Plan (Tier2)

Issues: Degree of integration is weak between MRT plan and city plan

Solution Direction:

- 1) Organization: Set up an oversight committee with neutral secretariat function to ensure integration between MRT plan and city plan
- 2) Financing: Establish a PPP scheme for station and surrounding city development

- 3) Policy: Special development zones around station allowing easier land consolidation (e.g. tax breaks)

Necessary next steps:

- **Research and Analysis:** Stock take past studies, overseas TOD case study. Conduct stock take of past studies and reports on city planning and MRT plan integration and make refinements. Study overseas cases of 1) Transit-Oriented Development (TOD) organization coordination mechanism, 2) PPP financing scheme for station and surrounding city development, 3) Policy framework for joint station and surrounding city development
- **Benchmark Visits:** TOD benchmark visits. Hold stakeholder discussions and organize benchmark visits to raise awareness and enlighten the need for Integrated Bangkok City TOD Plan
- **Thailand Action Plan Development:** Develop action plan on organization, finance and policy regarding TOD. Facilitate stakeholder discussions on set up of oversight committee and design its role with regards to Integrated Bangkok City TOD Plan. Decide on pilot project to develop financing scheme and supporting policy for PPP station and surrounding development.
- **Implement and Build Capacity:** Implementation of PPP station and surrounding development pilot. Initiate pilot implementation of joint station and surrounding development in Bangkok.

6.2.2 Integrated Multi-modal Plan (Tier2)

Issues: Degree of integration is weak between MRT plan and other modes of transport

Solution Direction:

- 1) Organization: Set up an oversight committee with neutral secretariat function to ensure integration between MRT plan and plans for other modes of transport
- 2) Financing: Establish cost sharing schemes government and transport operators for multi-modal access facilities such as pedestrian deck, park and ride facilities and bus bay
- 3) Policy: Strengthen policy guidelines for multi-modal accessibility and convenience requirements to avoid adhoc planning

Necessary next steps:

- **Research and Analysis:** Stock take past studies, overseas multi-modal studies. Conduct stock take of past study and reports on areas such as feeder bus routes, BRT plans, park and ride facility, station bus bay, road pricing and other demand management. Make necessary

refinements and upgrade integrated plan. Study overseas cases of 1) multi-modal planning organization, 2) cost sharing schemes for multi-modal access facilities, 3) multi-modal related policies

- **Benchmark Visits: Multi-modal terminal station benchmark visits.** Hold stakeholder discussions and benchmark visits on multi-modal terminal station design and its effects
- **Thailand Action Plan Development: Develop action plan on organization, finance and policy regarding multi-modal integration.** Facilitate stakeholder decisions on set up of oversight committee and its role with regards to Integrated Multi-modal Plan. Decide on pilot project to develop financing scheme and supporting policy for multi-modal terminal station development.
- **Implement and Build Capacity: Implementation of multi-modal terminal station development pilot.**

6.2.3 MRT Network Integration (Tier2)

Issues: Degree of integration is weak between different MRT lines

Solution Direction:

- 1) **Organization:** Set up an oversight committee with neutral secretariat function to ensure integration within different MRT lines (i.e. integration between SRT, MRTA, BMA). In the long-term, consider setting up joint equity holding company to manage common assets such as common ticketing system and smart card business
- 2) **Financing:** Establish cost sharing schemes between different lines on investment and management of common assets (e.g. depot, transit access facilities)
- 3) **Policy:** Strengthen policy guidelines for areas such as fare integration and technical performance specification of M&E systems

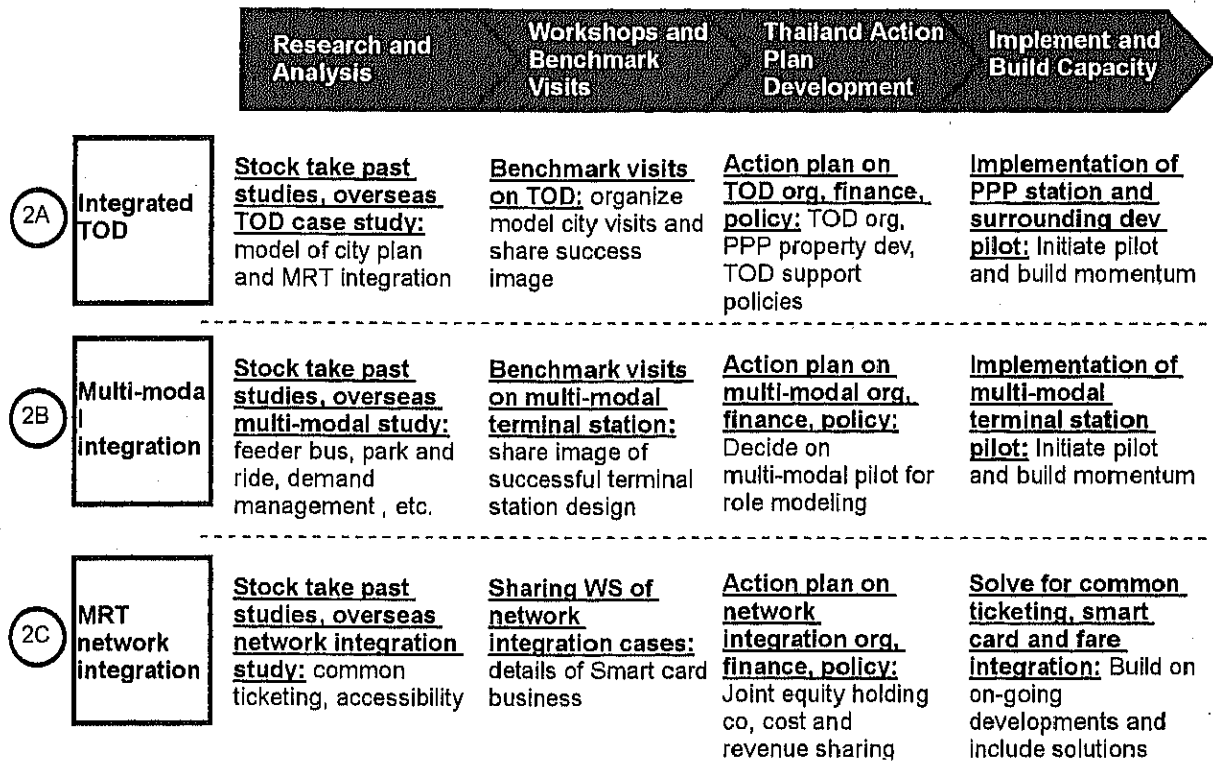
Necessary next steps:

- **Research and Analysis: Stock take past studies, overseas network integration studies.** There are already various studies and discussions regarding network integration for Bangkok MRT. It is important to update/upgrade the latest thinking into a network integration plan.
- **Workshops: Sharing workshop on overseas network integration cases.** Take specific themes such as common ticketing and smart card business.
- **Thailand Action Plan Development: Develop action plan on organization, finance and policy regarding network integration.** Recommend organization for common ticketing and smart card (e.g. joint equity holding co.). Develop cost and revenue sharing mechanisms.

- **Implement and Build Capacity:** Take actions for common ticketing, smart card and fare integration. Build on Purple Line /Red Line development activities and coordinate with existing Blue Line/Green Line.

For Tier2, in summary, there are three streams of necessary next steps.

A) Integrated TOD, B) Multi-modal integration, C) Network integration. Figure 6.2-2 describes the next steps overview for Tier2.

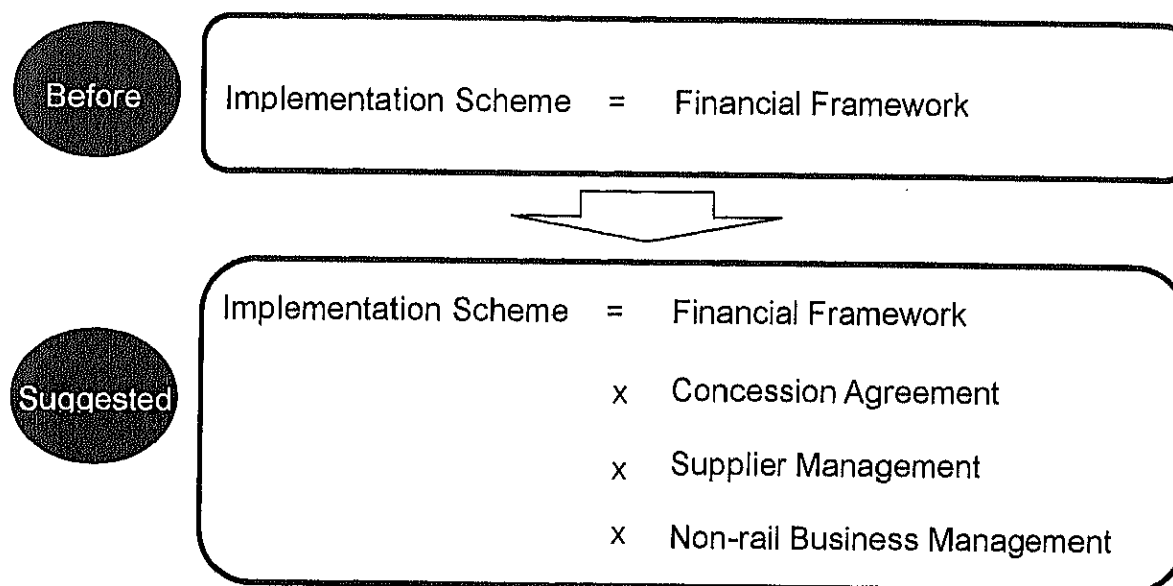


Source: JICA Study Team

Figure 6.2-2: Tier2 next steps

6.3 Tier3: Each MRT Line Implementation Scheme

Tier3 is about the implementation scheme of each MRT line, which consists of financial framework, concession agreement, supplier management and non-rail business management. These four elements are inter-related. For example, if 'gross cost model' is selected as financial framework, concession agreement/supplier management and non-rail businesses will need to be tailored to match the 'gross cost' characteristics. Thailand should build on the lessons from the past and improve on the packaged set of all four elements.



Source: JICA Study Team

Figure 6.3-1: Four elements of each MRT line implementation scheme

6.3.1 Financial Framework (Tier3)

Issues: There seems to be several “myth and realities” regarding PPP financial framework for urban railway in Thailand.

1) Myth: Best financial framework exists

Reality: There is no such thing as a best financial framework. Merits and demerits exist for each financial framework option. (refer to Chapter 4)

2) Myth: Selection of financial framework can solve many of the issues in the past

Reality: Financial framework alone cannot solve much. Financial framework selection needs to be packaged with concession agreement, supplier management and non-rail business management

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

Reality: For urban mass transit, there is no evidence that private can achieve better efficiency. The “Optimism Bias” used for current value for money calculation is not recommended.

Solution Direction: Refine the assessment guideline. Financial framework option comparison should be made more on government trade-offs between additional financing capacity/controllability versus additional business risks. It is not recommended to use value-for-money calculations based on current ‘optimism bias’ assumptions. Practically speaking, there is no such thing as the best answer. Each option has its merits and demerits. If government decides to adopt ‘gross cost’ model, it is a natural choice in the early stages of

network building because the ridership risk is too big for private investors and government can have more control for network integration purposes. However, under 'gross cost' model, government's capacity requirements are much higher and the other elements of Tier3 (i.e. concession agreement, supplier management, non-rail business) will need to be carefully implemented.

Necessary next steps:

- **Thailand Action Plan Development:** Refine the current assessment guideline. Provide detail descriptions of merits and demerits of each option.
- **Implement and Build Capacity:** Specify implications for next series of FS calculations. Especially for 'gross cost model', highlight the trade-offs and raise awareness on the importance of government's tighter management of concessionaire and suppliers. Ensure inputs into MRTA's capacity building activities on handling of financial calculations.

6.3.2 Concession Agreement including Tender Preparation (Tier3)

Issues: Tender preparation and concession agreement were not optimal in the past. Going forward, under 'gross cost' model, level of sophistication will further escalate.

Solution Direction: Develop a 'gross cost' model tender document and concession agreement template for M&E system installation, operation and maintenance. This template should take into account the following lessons from the past as well as 'gross cost' model specific considerations:

Lessons from the past:

- Conflict of interest should be avoided between shareholders and operating company
- Contract should specify 1) action commitments from both government and private, 2) conditions for capacity adjustment investments, 3) requirements for network integration such as common ticketing with other lines, 4) conditions to trigger revisions and concession extensions
- Contract should include incentives for sustainable operations, even towards end of concession period
- Contract should include guidelines on supplier management and contracts

'Gross cost' specific considerations:

- Annuity calculation method: specify method for each cost component (i.e. capital cost, system installation cost, operation cost, maintenance cost)
- Risk allocation: clarify who will take risks for annuity cost fluctuation factors such as FX, energy cost, re-financing interest rate, project delays, etc.

- KPI setting: Clarify KPI targets and how to measure indicators such as operational availability, reliability and customer satisfaction
- Incentives and penalty: Include incentives to improve operation and maintenance efficiency overtime (e.g. with local technical transfer) and penalties for not achieving KPI performance

Necessary next steps:

- **Thailand Action Plan Development: Develop template for tender document and concession agreement, which is tailored to 'gross cost' model.** Ensure lessons from past and 'gross cost' considerations are fully taken into account.
- **Implement and Build Capacity: Pilot implementation in Purple Line.** Invest enough resources on tender preparation as well as concession agreement negotiation. Ensure inputs into MRTA's capacity building activities on tender preparation, contract negotiation and performance management.

6.3.3 Supplier Management (Tier3)

Issues: Supplier management was not optimal in the past. Areas such as technical transfer, information disclosure and line extension conditions were not managed well.

Solution Direction: Develop a 'supplier management guideline' to be included in the concession agreement. This guideline should take into account the following lessons from the past.

- Technical and knowledge transfer should include KPI for both 'input' (e.g. amount of resource investment on training) and 'output' (e.g. #of qualified maintenance engineers developed within 5years)
- Information disclosure requirements of technical specifications regarding key systems (e.g. signal, telecommunications, rolling stock) should be included
- Fair price formula for line extension to be specified in advance
- Penalties for not achieving KPI performance as well as contract conditions to be included

Necessary next steps:

Thailand Action Plan Development: Develop template for supplier guideline. Ensure that lessons from past are fully taken into account.

Implement and Build Capacity: Pilot implementation in Purple Line. Invest enough resources in including supplier management guidelines into the tender document as well as concession agreement. Monitor actual supplier contract between concessionaire and supplier. Ensure inputs into MRTA and concessionaire's capacity building activities to take initiative on technical

specification, system integration and maintenance management.

6.3.4 Non-rail Business Management (Tier3)

Issues: Government has not exploited the full potential of non-rail business revenue sharing in the past

Solution Direction: Decide on roles and responsibilities of MRTA and concessionaire for each of the following business types. If MRTA were to be responsible, then, a new organization division with sufficient capacity should be formed. If concessionaire were to be responsible, then, a fair share of revenue should become an income to MRTA. This will be net-off to reduce the annuity payment. The decision needs to be reflected into the tender document and concession agreement.

Type 1: Business that comes together with railway infrastructure development (e.g. advertising, and space rental for retail)

Implication of Type 1:

Under the gross cost model, concessionaire or MRTA could lead business for advertising and retail space rental. Concessionaire would be in a better position to manage the interface with day-to-day operations. If rights were given to the concessionaire, however, tight negotiation on how to adjust the government's service fee payment will need to be managed.

Type 2: Business that requires investment on top of railway infrastructure development (e.g. telecom service business, smart card business, feeder bus business)

Implication of Type 2:

The value of business rights for this type of business is difficult to calculate. If rights were given to concessionaire, financial sharing mechanism will need to be thought through. Alternatively, MRTA could lead this business type and seek funding.

Type 3: Property development surrounding station and along alignment

Implication of Type 3:

Following actions will need to be considered:

- 1) To clarify the transfer of land from government ministries and agencies
- 2) To acquire a legal basis for property development and the responsibility and right to engage in property development.
- 3) To closely cooperate with central and/or local government bodies in charge of urban planning and development.
- 4) To initiate PPP concession scheme to involve private developers for station and surrounding

development.

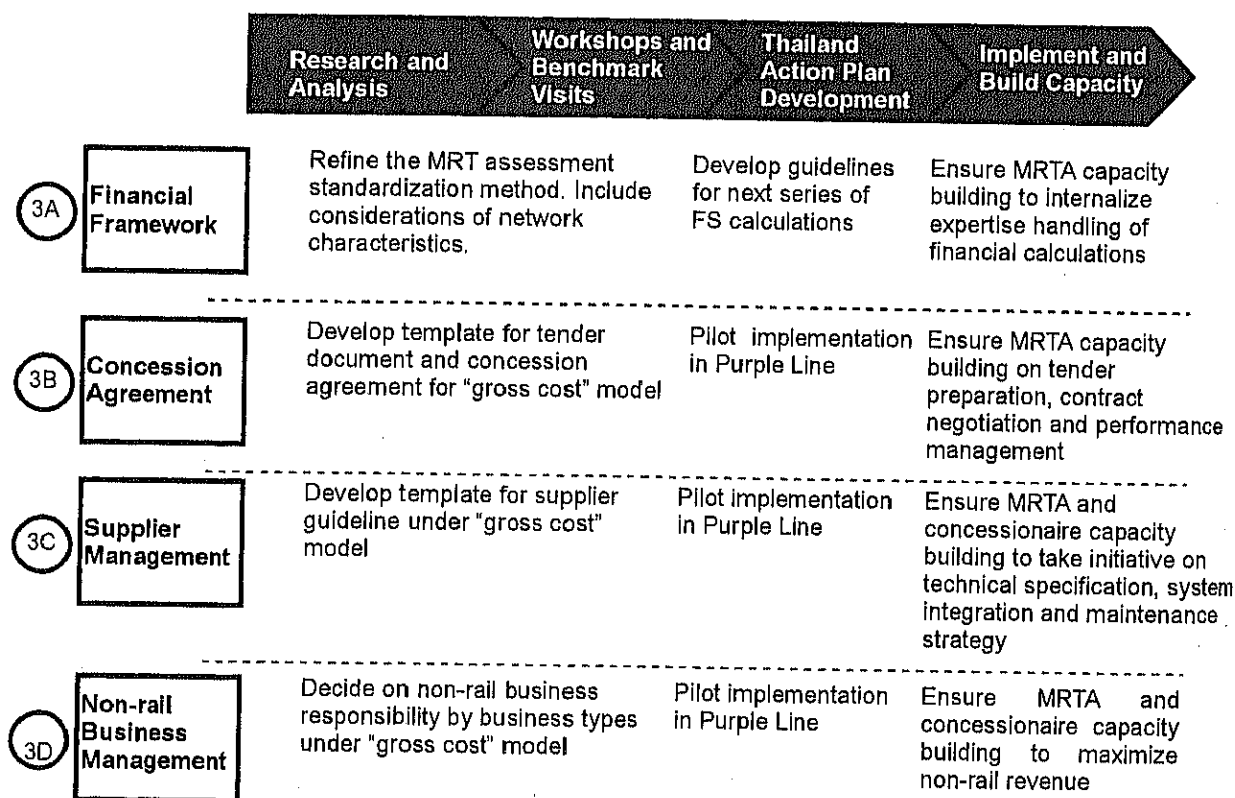
Necessary next steps:

Thailand Action Plan Development: Decide non-rail business responsibility by business types.
Develop non-rail business management guidelines for 'gross cost' model by business types.

Implement and Build Capacity: Pilot implementation in Purple Line. Include non-rail business management guidelines into the tender document as well as concession agreement. Invest enough resources for contract negotiation on non-rail business. Ensure inputs into MRTA and concessionaire's capacity building activities.

For Tier3, in summary, there are four streams of necessary next steps.

A) Financial framework, B) Concession agreement, C) Supplier management, D) Non-rail business management. Figure 6.3-2 describes the next steps overview for Tier3.



Source: JICA Study Team

Figure 6.3-2: Tier3 next steps

6.4 Suggested roadmap for Thailand

Thus far, we have explained the issues, solution direction and suggested next steps for each of the

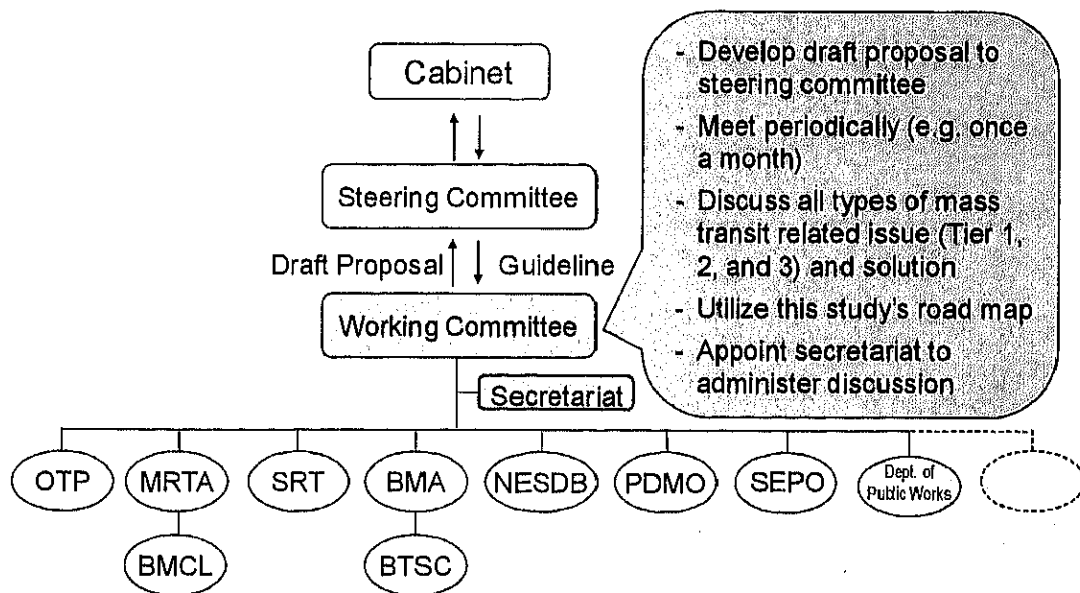
components within Tier1, Tier2 and Tier3. To put everything into perspective, we have developed a suggested roadmap for Thai stakeholders. It is in three steps:

STEP1: Establish a mass transit committee with neutral secretariat function

The committee should have a working committee and steering committee, supported by secretariat. It consists of all related stakeholders on urban mass transit development. This includes not just transportation but also city planning related stakeholders. The objective of this committee is to set-up, refine and maintain all elements related the successful implementation of mass urban transit infrastructure development. In the context of this report, it is about setting up and maintaining Tier1, Tier2 and Tier3.

The working committee should meet periodically (e.g. once a month) and discuss 1) prioritization of issues to be solved, 2) launch of action programs to solve issues, 3) progress of existing initiatives, 4) overseas cases and Thai implications. Also, the working committee should organize expert speaker sessions and benchmark visits, as appropriate. Key decision items will be proposed to the steering committee for guidance and decisions.

Activities of the working committee should be supported by a neutral secretariat function. This secretariat works with external experts and consultants to prepare materials for working committee discussions. It will administer all activities required to hold a periodic working committee.



Source: JICA Study Team

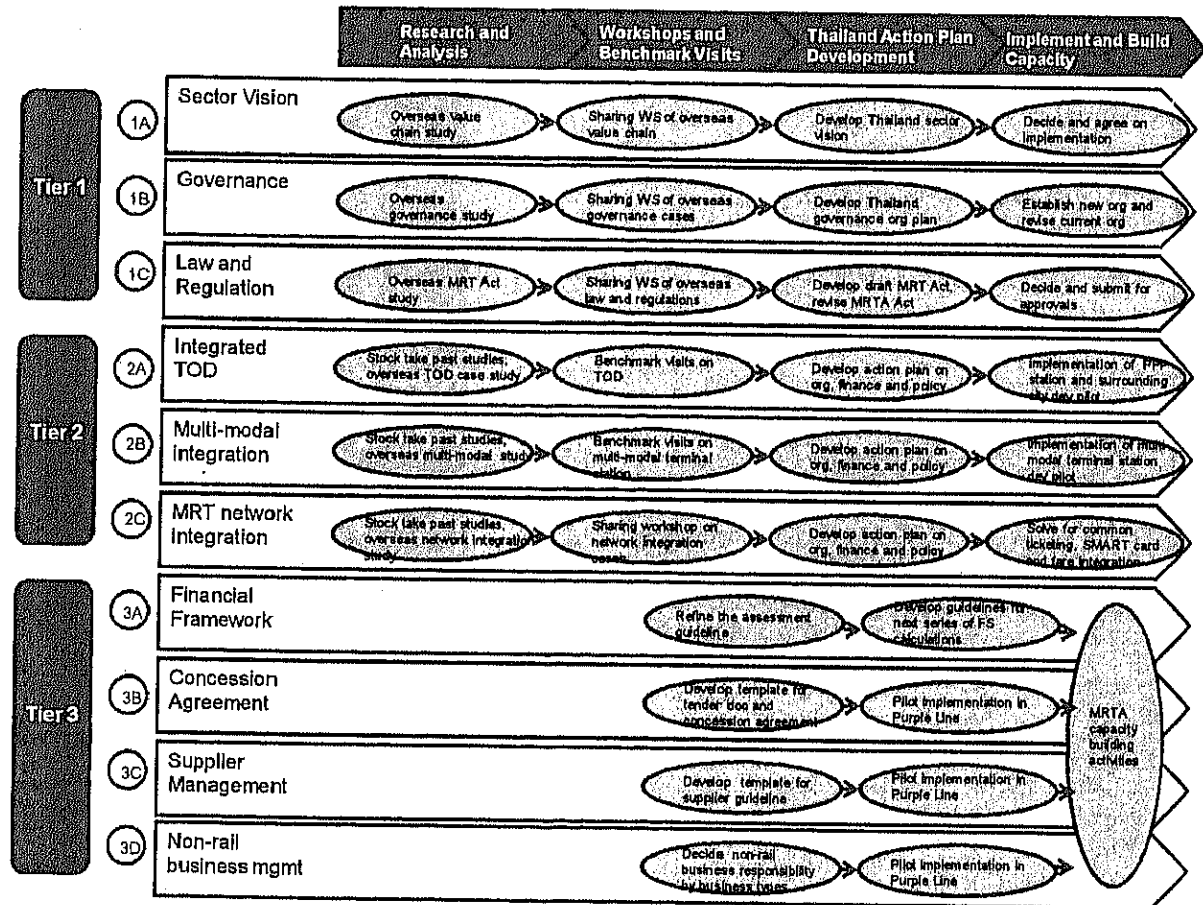
Figure 6.4-1: Image of mass transit committee

STEP2: Hold first working committee meeting and decide on priorities on the following 10 action streams along the three tiered structure.

As described above, each element of Tier1, Tier2 and Tier3 has clear next step action streams. In

total, there are 10 action streams (Figure 6.4-2).

The first role of the working committee will be to discuss the 10 action streams and decide on priorities and relations to all existing initiatives. Thereafter, the committee should develop an annual activity schedule to clarify annual objectives and set the pace.



Source: JICA Study Team

Figure 6.4-2: Ten action streams

STEP3: Launch series of action programs and monitor progress.

After the first working committee, the secretariat should prepare to launch series of action programs. Actions could be in various forms. For example,

- Pilot initiatives within committee member organizations
- Sub-committee discussions
- Research projects by consultants

Each action should have clear output, deadline and resource. Leader of each action program should be appointed from working committee members. Leader is responsible to the output quality and to report back to the working committee on progress and results.

APPENDIX 1

TERMS OF REFERENCE (TOR) OF THE STUDY

APPENDIX 1: TERMS OF REFERENCE (TOR)

Study in Japan

【J-1】 Review of financial framework of MRT including PPP

- (1) To review literature and cases on global experience in financial frameworks of urban railway system and summarize the following items:
 - (a) Type of financial frameworks
 - (b) Roles and responsibilities of stakeholders, i.e., operator and government
 - (c) Legal framework of PPP
 - (d) Risk allocation
 - (e) Service standard and revenue sharing
 - (f) Value for money (VfM) analysis
 - (g) Premise of financial analysis of project and content of financial analysis
- (2) To review literature and cases on operational efficiency and service level of urban railway system and summarize the following items:
 - (a) Customer satisfaction
 - (b) Operational efficiency (No. of service, peak-time operation, etc.)
 - (c) Financial efficiency
- (3) To formulate practical and recommendable project implementation schemes for MRT project by combining alternatives mentioned in (1) and (2) above. The number of schemes will be around 5.

To evaluate project efficiency of each scheme for such items as construction cost, operation cost, ridership, revenue, etc. based on literature.

【J-2】 Analysis on the possible financial framework with Japanese ODA Loan

- (1) To carry out financial analysis of the urban railway projects financed with Japanese ODA loan which are reviewed in **【J-1】** -(1).

To conduct short-term & long-term financial analysis (financial statements, future cash flow, and FIRR) for each project implementation scheme formulated in **【J-1】** -(3). At the analysis, weighted average capital cost (WACC) of implementing organization is considered. For standard units of construction cost, operating cost, and ridership demand, the results of evaluation of project efficiency in **【J-1】** - (3) are reflected.
- (2) To compare and evaluate project implementation schemes formulated in **【J-1】** - (3)

on the basis of the results of 【J-1】 - (2) and 【J-2】 - (1).

【J-3】 Other issues on PPP in MRT project

- (1) To conduct literature study and case studies of urban railway system in Japan and other countries on railway business strategy.

Case studies primarily cover the following items:

- (a) Linkage with urban planning and urban development
 - (b) Establishment of transportation network
 - (c) Approach to non-fare revenue increase
- (2) To analyze entry barriers and risks of private participants in railway network construction by more than one private operator by literature study and interview survey.

The analysis is primarily done from (a) the legal perspective (reciprocal extension contract, responsibility of development planning, etc.) and (b) the financial perspective (revenue sharing, development planning, etc.).

Field Study in Thailand

【T-1】 Collection of data & information on the current MRT projects in Thailand through interview survey and collection of literature, and summary of results

- (1) To collect supplemental data & information on the financial schemes of the current two MRT projects in Thailand, e.g. SkyTrain Project and Blue Line and analyze the following items:
 - (a) Project profile
 - (b) Type of the financial framework (including detailed information of adopted PPP scheme)
 - (c) Roles and responsibilities of stakeholders
 - (d) Legal framework of PPP in the railway sector in Thailand
 - (e) Risk allocation (e.g. construction risk, operation risk, ridership risk, political risk, country risk, exchange risk etc, force majeure risk)
 - (f) Service standard (i.e. minimum standards of operation such as min. no of service, peak-time operation, etc.) and revenue allocation
 - (g) Application method, premise, and results of VFM analysis
- (2) To analyze current service performance in comparison with original plan and identify problems of service performance according to the results of 【J - 1】 - (2).

- (3) To analyze the financial efficiency of the current MRT projects in Thailand focusing on such items as WACC of fund raising, short-term & long-term financial analysis (financial statements & future cash flow analysis) and FIRR of operating company and to identify problems in comparison with the results of 【J - 2】 - (1).
- (4) To identify the lessons to be learned from the projects from the results of the above (1) to (3) for the implementation of MRT projects in Thailand under both PPP scheme and operation-by-state scheme).

【T-2】 Collection of data & information on MRT master plan in Thailand and analysis of issues of MRT master plan (added in October, 2009)

- (1) To review the current situation of city plan centering on MRT projects and identify the situation and issues of collaboration between city plan and transportation plan;
- (2) To review the plans of other modes of transportation such as BRT and feeder bus and analyze the situation and issues of collaboration between MRT plan and plans of other transportation modes;
- (3) To review the contents of URMAPP3 (new MRT master plan) and to analyze issues, especially regarding a policy for network integration and a financial plan;
- (4) To review how URMAPP3 positions other related plans including whether the cabinet meeting has approved or not and to analyze the situation and issues of implementation framework of URMAPP3;
- (5) To analyze the situation and issues of organizational function which integrates related plans;
- (6) To design a framework of ideal integrated MRT master plan and identify a gap between the current situation and ideal framework; and
- (7) To formulate prospective assistance necessary for filling this gap.

【T-3】 Case studies

- (1) To carry out financial analysis of future MRT projects in Thailand assuming the use of Japanese ODA loan. The number of subject projects is around 3. Financial analysis is basically done for each project implementation scheme formulated in 【J - 1】 - (3). However, project implementation schemes may be modified according to a discussion between the Study Team and the Thai side.

【T-4】 Finalization of report and holding of debriefing session

- (1) To prepare a final report
A final report shall appropriately reflect the results of discussions between the Study Team and the Thai side.
- (2) To hold a debriefing session in Thailand to report the results of the Study to stakeholders in Thailand and JICA.

【T-5】 Review of tender documents for the Purple Line (added in January, 2010)

- (1) To review and analyze the contracts and tender documents for MRT system procurement including rolling stock and concession of operation including non-rail business, based on the results of [T-1], and make recommendations for the implementing agency; and
- (2) To draw up a report of review results and recommendations.

APPENDIX 2

MRT ASSESSMENT STANDARDIZATION

(reprinted from ADB document)

APPENDIX 2 Draft Standardization Directive

1. Harmonisation of the 1992 PPSU Act studies

Studies of individual MRT projects within the Five Lines network needed under the 1992 PPSU Act are being separately procured by separate government agencies using different consulting contracts. At the same time, the Sub-Committee for MRT Finance and Operations (the meeting of January 18, 2007) has specified for study a network and concessioning variation which involves combining the Blue Line extension and the Purple Line, which are to be otherwise examined through separate studies. In addition, the Sub-Committee meeting has specified that different types of concessions be studied (Net Cost, Gross Cost and Modified Gross Cost).

To enable comparison of the findings of the separately procured and managed studies and integration into a coherent and meaningful network-level plan, the Ministry requires that the studies observe a standardisation of assumptions, concepts and presentation of findings as set out below. This work is to be undertaken for each Project Option, which will include:

- Individual lines (ie Blue Line, Purple Line or Green Line as defined by the agencies);
- Project Variation(s) as relevant (ie as identified by Sub-Committee for MRT Finance and Operations at the meeting of January 18, 2007); and
- Other combinations of lines as may be determined.

1.1 Ridership and revenue forecasts

Studies shall be based on common and consistent assumptions regarding demography, forecast years, MRT fares and transport networks as shown in Tables 1 and 4. With regard to MRT fares, consideration is to be given to:

- Non-integrated fares, with each MRT boarding requiring payment of a fare that comprises a boarding charge plus a distance-related component; and
- Integrated fares, wherein passengers would not pay the boarding charge for second and subsequent boardings where they transfer directly between lines, eg a passenger transferring from the Purple to the Blue Line would pay a single boarding charge (for the first boarding) plus the distance-related component for their travel on each line.

1.2 Financial Modelling of PPP options

A key objective of the studies is to examine the potential options for private sector participation through investment in fixed Electrical and Mechanical (E&M) equipment and rollingstock for an MRT project, and operations and maintenance (O&M) of the constructed facility. Consideration is also to be given to alternative approaches to the financial structure of concession agreements.

Specifically, consideration is to be given for each Project Option to the following options with regard to private sector involvement:

- Investment and Operations:
 - A concessionaire undertakes only O&M, with the Government financing all infrastructure—this option will be the Public Sector Comparator – PSC; and

- A Public Private Partnership (PPP) in which a private sector concessionaire finances all E&M and rollingstock investment and undertakes O&M, with the Government financing other infrastructure investment.
- For each Investment and Operations option, three concessionaire Payment Options¹:
 - Net Cost (current method)
 - Gross Cost
 - Modified Gross Cost (with partial demand risk transfer)

Assessments of the technical, economic and financial feasibility of the projects shall assume that in all cases MRT operations and maintenance meet performance-based specifications.

Accordingly, six combinations of Investment and Operations option and Concession Payment option are possible for each Project Option. The analysis shall be based on common approaches and standards, including:

- a common duration for concessions, with evaluations to be undertaken for 25, 30, 35 and 40 year periods
- common factors as described in Table 1
- common factors with regard to depreciation and other accounting conventions
- a common risk analysis framework and basis for allocating and valuing risk in each option

The scope of the analysis for each combination of Project Option, Investment and Operations option, and Concession Payment option shall be in two parts:

Assessment of the financial performance of the Concessionaire

A financial feasibility analysis for each option that:

- Uses common factors as described in Table 1
- uses pro forma financial statements for the concessionaire (including income statement, cash flow and balance sheet for each year in the concession);

¹ The three concession options are:

- **Net Cost concession:** This is the form of agreement for the BTS and Blue Line subway. The concessionaire retains fare revenue and pays for O&M and pertinent asset costs. The government will need to make payments to the concessionaire if fare and other revenue is less than the costs incurred by the concessionaire, or the concessionaire will need to make payments to the government if the reverse should occur.
- **Gross Cost concession:** The government pays the concessionaire an amount equal to the costs the concessionaire incurs for the provision of agreed assets and services. Payments are subject to agreed standards being achieved. The government retains all fare revenue.
- **Gross Cost concession (with partial demand risk transfer):** A variant of the Gross Cost concession in which the concessionaire's remuneration incorporates a component that is related to patronage (ie the share of patronage over which the concessionaire has influence) or could be in the form of a bonus payment for achieving patronage targets.

- ensures that private sector concessionaires achieve an acceptable rate of return (either by making payments of excess revenue to the Government or receiving financial payments from the Government) with minimum cost to the Government;
- uses a funding plan based on limited recourse financing (ie the lenders cannot rely on any loan security beyond that provided in the project), indicating a Debt-to-Equity ratio, an interest rate and an internal rate of return on equity (ROE) which reflect the opportunity costs of the lenders and equity sponsors, taking into consideration the project risk of each option;
- presents the total cost of each option to the government; and
- presents summary indicators that show the performance of each option, including the financial internal rate of return (FIRR) on investment and the Enterprise Value (EV) of the project (defined as the Net Present Value of the cash flow available for debt service and other funds providers) and indicators of loan performance risk such as the Debt Service Coverage ratio series.

Value for Money (VfM) assessment

Overview

The objective of the Value-for-Money (VfM) analysis is to determine the procurement option that is likely, when account is taken of all risks and uncertainty, result in the lowest cost to the government over the life of the concession. As indicated elsewhere, six procurement options are to be considered covering investment and payment options. The VfM analysis should be prepared for the recommended concession period. The VfM analysis is also to be undertaken in a quantitative manner as far as possible. A qualitative assessment should be made where a quantitative analysis is not possible.

The VfM analysis will be based on forecast cash flows in nominal values. The results of the VfM analysis should be expressed as an expected present value of the cost to the government of ensuring the delivery of the MRT line over the duration of the concession, including the value of risk in each option that is retained by the government.

Costs to be taken into account will include:

- The best estimate of the cost of the project to the government and of forecast patronage demand, as estimated in the current studies.
- The potential for costs and revenue to differ from these best estimates, which will be largely related to optimism bias.

Best Estimate of Project Costs and Revenue:

The best estimate of the cost of the project and likely revenue will be prepared under other project activities. Issues to be considered are:

- In the case of a Net Cost concession there could be either a payment from the concessionaire to the government or the reverse depending on the financial viability of the project.
- In the case of a Gross Cost concession, separate account needs to be taken of payments to concessionaires and fare revenue that would be handled outside the concession.

- The cost of civil infrastructure need not be addressed because it is the same for each procurement options.
- Account should be taken of the effects of the three forms of concession on:
 - Funding costs incurred by concessionaires, including the effect on debt-equity ratio and the cost of equity and debt capital
 - The incentive for the concessionaire to maximise patronage on their system

Optimism Bias and Other Uncertainty:

International studies of project development in land transport have established sound statistical evidence for a phenomenon now known as 'optimism bias'. This is the tendency for actual costs to be higher and actual passenger demand to be lower than the best estimate at the time the decision is made to proceed with the project. Specific detailed data on the extent of optimism bias in Thailand is not available, though its presence is evident in cost escalation for past public sector projects and the lower than expected demand for the current MRT lines in Bangkok.

Costs and revenue may differ from the best estimate due to:

- Optimism bias. In the current analysis:
 - Parameters for the extent of optimism bias are reported in Table 2.
 - For construction cost, the statistical data for optimism bias is drawn largely from projects constructed by the public sector. Optimism bias in this case is consistent with the public sector approach to decision-making and project management incentives, which is not well suited to achieving project assets that satisfy well-considered use, quality and cost objectives. By contrast, common experience is that the private sector is able to better use skills, knowledge and inventiveness in various disciplines including risk analysis to achieve the ends. The lack of analysis of past expected and actual project costs in Thailand and non-disclosure of private sector costs necessitates some judgement of the appropriate extent of optimism bias to use in the current studies. Data reported in Table 2 are based on international experience (specifically capital costs and patronage) and understandings of general experience.
 - The potential for capital costs to be higher than expected will be less with concessionaire procurement because of better contract management
 - A concessionaire is likely to add a premium into a contract in a net cost concession to protect themselves against exposure to patronage risks that are beyond their control. This will not occur with a gross cost concession because the maximum patronage risk that a concessionaire bears is within their control.
 - In a gross cost concession where no patronage risk is transferred to the concessionaire, the concessionaire will not strive to maximise patronage. In the other concession options, the concessionaire has the incentive to maximise patronage to the extent that it is within their control.
- General uncertainty such as changes in law, taxes, force majeure and government policy. These should be addressed in a qualitative assessment that identifies any key differences between the six procurement options.

1.3 Submission of financial models with the study reports

Submission of the study reports should be accompanied by a fully-functioning, fully-auditable copy of the financial model or models used in the study, housed in an electronic file capable of being operated by a standard spreadsheet programme (such as Excel).

1.4 Economic Analysis

Key parameters for use in economic evaluations are shown in Table 3.

1.5 Studies inception conference

An inception conference for the studies will be organised, with attendees to include OTP, the MRT agencies (namely MRTA and BMA) and their study consultants, to discuss and ensure the required harmonisation as described above.

2. Open Technologies and Systems

The studies technical feasibility assessment and project cost estimation shall consider the efficiency and cost effectiveness of open technologies and systems for MRT. In particular the studies shall:

- *identify all potential barriers to efficient and safe inter-operability of trains including signalling, rollingstock, ticketing, passenger information, communication and power, processes (managerial, legal and human) and proprietary technologies (in technology systems and sub-systems);*
- *identify the options to address these impediments, for existing (ie legacy) systems as well as future procurements; and*
- *for each option prepare an economic or cost-benefit analysis of removing these impediments and estimate an associated phasing schedule for implementation.*

3. Passenger benefits: integrated MRT network

The traveling public benefits where the planning and management of an MRT network allow through-operation across any concession boundary, under an integrated fare tariff. Where through-operation is restricted due to poor planning or fragmented concessioning, passengers maybe be forced to transfer from one line to another and suffer an inconvenience which should be avoided or reduced if possible. Where fare is not integrated across concessions, passengers suffer a financial rather than a physical inconvenience under forced transfer.

The Net Cost, Gross Cost and Modified Gross Cost concessions being considered impose different demand risk burdens on revenue and, ultimately, the project cash flow available to service private sector debt and pay dividends. As is the case with the two existing Bangkok MRT concessions, where concessionaires bear significant demand risk they are likely to insist on exclusivity of line access to protect their fare revenue and cash flow.

Studies shall consider how these different demand risk burdens restrict or promote the potential passenger benefit of through-operation and fare integration, taking into account the phased development of the Bangkok MRT network.

Table 1: Standard Assumptions for Financial Analyses

Item	Quantity	Units	Notes
Price Units			
Base year prices	early 2007		
General rate of inflation		(% p.a.)	applied to all cost items—NESDB to provide
Duration of Analyses			
Concession duration	25, 30, 35, 40	years	(after construction period)
Evaluation period - financial analysis (FIRR)	25, 30, 35 & 40	years	(after construction period)
Discount Rates			
	5.0%	% p.a.	Approximates the risk-free rate. Used to find NPV of cash flows where risk is treated using explicit percentage overrun/underperformance factors (see Table 3).
Annualization factors			
Passenger demand	330	days/year	relative to average demand per working weekday
Supply of services	350	days/year	relative to average supply of services per working weekday
Revenue			
Fare structure			
Boarding charge	10	Baht	2001 prices
Distance charge	1.8	Baht/ km	2001 prices
Fare escalation (nominal)	3.0%	% p.a.	assuming fare increase every year at inflation rate
Non-fare revenue	7.0%	%	as % of fare revenue
Asset Life			
Civil Works			
Tunnels	100		
Structures, incl. stations & depots	50		
Buildings	30	years	

Item	Quantity	Units	Notes
E&M equipment			
Power supply	30	years	
Mechanical, signalling, train control & ICT	15	years	
Rollingstock	30	(years)	
Land acquisition	nil		
Mid-life Refurbishment (in addition to O&M cost)			
Rollingstock			
Refurbishment of rollingstock occurs after	15	years of service	
Cost of refurbishment	33%	of initial price	cost of refurbishment, as a % of the initial cost of a railcar
Exchange rate	35	(Baht/US\$)	
Private Sector Financing			
Debt-to-Equity ratio			
Net cost concession	2.0	times	1.5 for BMCL at present
Gross cost concession	6.0	times	No demand risk. IPPs at 3-4 times.
Modified gross cost concession	5.0	times	Benchmarked on UK LRT projects (some demand risk)
Loans			Average for all loans
Grace period	2	years of service	Principal repayment begins after this period
Terms of loan (including grace period)	15	years	
Interest rate (%)			Average over the loan term
Net cost concession	8.5%		
Gross cost concession	7.5%		
Modified gross cost concession	7.75%		
Return on Equity			

Item	Quantity	Units	Notes
Net cost concession	13.50%		Risk premium (on risk free rate) of 8.5% is similar to BMCL contract
Gross cost concession	12.50%		IPP equity returns are 12-13%
Modified gross cost concession	12.75%		
Financial Statements			
Corporate tax	30%	of profit before tax	
Accounts receivable	16.67%	of non-fare revenue	Equal to 2 months waiting time for non-fare revenue collection
Inventory	0.25%	of gross fixed assets	
Accounts payable and current liabilities	8.33%	of O&M cost	Equal to 1 month of outstanding obligations

Table 2: Allowances for Optimism Bias (% difference from the Best Estimate)

	Government procurement			Concessionaire procurement		
	Net Cost concession	Gross Cost concession	Modified Gross Cost concession	Net Cost concession	Gross Cost concession	Modified Gross Cost concession
Costs						
Capital Cost – E&M	+45%	+45%	+45%	+15%	+15%	+15%
O&M Costs	+20%	+10%	+10%	+20%	+10%	+10%
Patronage						
Operating Year 1	-50%	-55%	-50%	-50%	-55%	-50%
Operating Year 3 & after	-30%	-33%	-30%	-30%	-33%	-30%

Source: Based on International studies for implementation of rail projects.

Table 3: Standard Assumptions for Economic Analyses

Item	Quantity	Units	Notes
Price Units	early 2007		
Duration of Analyses	30	years	(after construction period)
Discount Rates	12.0%	% p.a.	Sensitivity test at 8%
Annualization factors			
Passenger demand	330	days/year	relative to average demand per working weekday
Supply of services	350	days/year	relative to average supply of services per working weekday
Revenue			
Fare structure			
Boarding charge	10	Baht	2001 prices
Distance charge	1.8	Baht/km	2001 prices
Real change in fare	0.0%	% p.a.	assuming fare increase every year - assumed equal to inflation
Non-fare revenue	7.0%	%	as % of fare revenue
Asset Life			
Civil Works			
Tunnels	100		
Structures, incl. stations & depots	50		
Buildings	30	years	
E&M equipment			
Power supply	30	years	
Mechanical, signalling, train control & ICT	15	years	
Rollingstock	30	(years)	
Land acquisition	nil		

Item	Quantity	Units	Notes
Mid-life Refurbishment (in addition to O&M cost)			
Rollingstock			
Refurbishment of rollingstock occurs after	15	years of service	
Cost of refurbishment	33%	of initial price	cost of refurbishment, as a % of the initial cost of a railcar
Exchange rate	35	(Baht/US\$)	
Economic values for estimating benefits			
Value of travel time			Use parameters in Tables 4a-4d to calculate these economic values.
Vehicle operating cost			
Environmental cost			

Table 4. Assumptions for passenger demand forecast

Item	Required standard	Notes
Demography	Thailand Official Census 2000.	Source: National Statistical Office
Forecast years	2006 (base), 2011, 2016	
Transport networks	As in OTP's Extended Bangkok Urban Model (eBUM)	Use of eBUM is mandatory
Patronage growth from 2021	2% per annum	In line with population growth

Table 4a. Vehicle kilometres and hours travelled, with the project implemented and without

	Without the project			With the project		
	Vehicle km (million)	Vehicle hours (million)	Speed (kph)	Vehicle km (million)	Vehicle hours (million)	Speed (kph)
Year 2006	194.94	7.94	24.55	194.94	7.94	24.55
Year 2011	226.98	10.07	22.54	224.73	9.84	22.84
Year 2016	268.45	12.47	21.53	263.02	11.80	22.29

Source: OTP

Table 4b. Average vehicle operating cost of representative vehicle

Unit: Baht /vehicle km, 2003 constant prices

Speed(kph)	10	20	30	40	50	60	70	80	90	100
Baht/vehicle km	8.86	6.02	5.12	4.68	4.42	4.27	4.20	4.17	4.19	4.25

Source: OTP. Representative vehicle taken to be medium-sized passenger car.

Table 4c. Average value of time

Unit: Baht /person-hour, 2000 constant prices

2006	2011	2021	Notes
71.4	88	126.2	Based on Urban Rail Transport Master Plan data for High Comfort Public Transport Category.

Source: OTP

Table 4d. Average environmental cost per representative vehicle km

Unit: Baht /vehicle-km, 2003 constant prices

	Notes
5.0	Average of the costs for light-duty vehicles using gasoline and diesel in McCubin & Delucchi, 1999.

Source: OTP

APPENDIX 3

CASHFLOW OF THE ANALYSIS 1

MADE OF PRINCIPLES: 100%
Total: 100%

Table with columns for various financial categories and years (2009-2013). Rows include: Public Safety, Police, Fire, Public Works, etc.

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Appendix 3-10: Cashflow and Income Statement of the PPP Modified Gross LTP (Risk Unit) (Use the Annual Section)

Account Name	Year											
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue
Expenses
Net Income
Capital Expenditures
Debt Service
Other Income
Net Cash Flow
Balance Sheet
Income Statement
Summary

Notes to the Cashflow and Income Statement of the PPP Modified Gross LTP (Risk Unit) (Use the Annual Section)

Appendix 3-14: Cashflow and Income Statement of the PPP Net

Category	2019												2020												2021												2022											
	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD													
Revenue	114	114	114	114	456	114	114	114	114	456	114	114	114	114	456	114	114	114	114	456	114	114	114	114	456	114	114	114	114	456	114	114	114	114	456													
Expenses	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Net Income	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Summary of Cashflow and Income Statement of the PPP Net. This table provides a detailed breakdown of quarterly and annual cash flows and income for the years 2019 through 2022. The categories include Revenue, Expenses, and Net Income, with values presented in thousands of dollars. The data is organized into columns for each quarter and year, allowing for a comprehensive analysis of the project's financial performance over time.

