

The Kingdom of Thailand

Office of Transport and Traffic Policy and Planning (OTP)

State Railway of Thailand (SRT)

**The Study on
Development of Smart City Concept
for The Bang Sue Area
in
The Kingdom of Thailand**

FINAL REPORT

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List of Acronyms

AMC	Asset Management Company
ASCN	ASEAN Smart City Network
ASEAN	Association of South-East Asian Nations
BCP	Business Continuity Plan
BMA	Bangkok Metropolitan Administration
BMR	Bangkok Metropolitan Region
BOI	Board of Investment
BOT	Build-Own-Transfer
BRT	Bus Rapid Transit
CCTV	Closed Circuit Television
CGS	Cogeneration system
DEPA	Digital Economy Promotion Agency
EEC	Eastern Economic Corridor
EGAT	Electricity Generating Authority of Thailand
EIA	Environmental Impact Assessment
EIU	Economist Intelligence Unit
ERC	Energy Regulatory Commission
ETDA	Electronics Transactions Development Agency
EV	Electric Vehicle
EXAT	Expressway Authority of Thailand
FDI	Foreign Direct Investment
HEMS	Home Energy Management System
ICR	Inception Report
ICT	Information and Communication
IoT	Internet of Things
IRR	Internal Rate of Return
ITR	Interim Report
J-CODE	Japan Conference on Overseas Development of Eco-Cities
JICA	Japan International Cooperation Agency
JOIN	Japan Overseas Infrastructure Investment Corporation for Transport and Urban Development
JV	Joint Venture
KPI	Key Performance Indicator
MaaS	Mobility as a Service
MDES	Ministry of Digital Economy and Society
MEA	Metropolitan Electricity Authority
MEMS	Mansion Energy Management System
MICE	Meeting, Incentive tour, Convention, Conference, Exhibition
MLIT	Ministry of Land Infrastructure Transport and Tourism
MOE	Ministry of Energy
MOI	Ministry of Interior
MONRE	Ministry of Natural Resources and Environment
MOT	Ministry of Transport
MOTS	Ministry of Tourism and Sports
MOU	Memorandum of Understanding
MRTA	Mass Rapid Transit Authority of Thailand
MWA	Metropolitan Waterworks Authority
NACTO	National Association of City Transportation Officials

NBTC	National Broadcasting and Telecommunications Commission
NDI	National Digital Identity
NESDC	National Economic and Social Development Council
OECD	Organization for Economic Cooperation and Development
OSSC	One Stop Service Center
OTP	Office of Transport and Traffic Policy Planning
PMO	Project Management Office
PPP	Public-Private Partnership
PRT	Personal Rapid Transit
PV	Photovoltaics
R&D	Research and Development
SEMC	Smart Energy Management Center
SEPO	State Enterprise Policy Office
SPV	Special Purpose Vehicle
SRT	State Railway of Thailand
SSC	Smart City Company
SWOT	Strength-Weakness-Opportunity-Threat
TCC	Thai Charoen Corporation
TFF	Thailand Future Fund
TOD	Transit Oriented Development
UR	Urban Renaissance Agency

Summary



Background and Objectives

1.1 Background of study

(1) Context for Bang Sue Smart City development

The Bang Sue area – the target area of this study – will accommodate 6 intersecting lines, including a high-speed rail and airport link line with the Bang Sue Grand Station and its adjacent stations as a traffic hub. The plan is to develop the area as a new urban core for Bangkok incorporating urban business functions by applying a Transit Oriented Development (TOD) approach. The area is thus envisaged to become a Gateway for Bangkok through which a variety of people and businesses come and gather.

The Bang Sue area is also conceived as a pilot city to promote Smart City development under the ASEAN Smart City Network (ASCN) framework. Thailand has vigorously promoted Smart City development policies by leveraging the “Thailand 4.0” national development strategy to accelerate economic development through enhancing added value and creating new industries. The government formed a “Smart City Steering Committee” chaired by the Deputy Minister of Transport that established the seven Smart City components of Smart Economy, Smart Mobility, Smart Energy, Smart Environment, Smart Governance, Smart Living and Smart People. A working group was set up for each seven smart component and relevant ministries assigned as secretariat to elaborate detailed criteria for becoming a Smart City.

In this context, the study supports realization of a Smart City in the Bang Sue area in an integrated manner covering more than 300 ha of land – most of which owned by the State Railway of Thailand (SRT).

(2) Previous studies on Bang Sue area development

The development plan for the area as an urban hub for integrated business functions was proposed in the

2007 JICA study “Data Collection Survey on Urban Redevelopment in Bang Sue Area” (“the previous study”). Specifically, a spatial plan, land use plan and phased development scheme were devised along with a development vision proposal and draft concept paper. Most importantly, integrated development was conceived as a basic policy permeating the entire plan.



Source: Previous JICA study

Figure 1. Stepwise Development Plan

1.2 Objectives of study

The objective of this study is to propose a Smart City Concept together with development plan, implementation structure, business plan and roadmap to realize the Smart City based on the basic roadmap for integrated development suggested in the FY2017 JICA study.

This study builds upon general policy such as integrated development and plans such as spatial and land use plans set forth in the FY2017 JICA study.



2.1 Capturing the Bang Sue area development context

To devise the Bang Sue area Smart City concept, development project attributes and potentials were recaptured from several aspects outlined below.

(1) ASEAN regional context

- ❖ **Area-based approach:** The project designates a specific Smart City development site in the Bang Sue Area.
- ❖ **Multi-sectoral approach:** The Smart City development project targets solving various urban issues by urban and spatial planning.

(2) Bangkok urban context

- ❖ **Transit Oriented Development approach:** Various roads and railways intersect while the existing bus terminal connects suburban and regional areas. Huge potential exists to become a highly convenient transit hub.
- ❖ **New urban core development:** The area is far from the traditional urban core and business center, representing a great possibility to become a new Central Business District in Bangkok.
- ❖ **New urban form:** Away from the busy and densely built traditional urban area, Bang Sue could present a new urban form for Bangkok.

(3) Bang Sue district context

- ❖ **Existence of prominent Thailand companies:** Located in the area are PTT offices, the Energy Complex office space, SCG offices, as well as a plan to establish the State Railway of Thailand (SRT) head office. Collecting these prominent Thailand companies forms a new potential business district.
- ❖ **Large green area:** Chatuchak Park is known as one

of the largest city parks and a place for rest.

- ❖ **Unique infrastructures:** Gas pipelines as well as transport related infrastructures such as a train station, bus terminal, and highways constitute a unique infrastructure setting.
- ❖ **Traditional urban lifestyle:** Chatuchak Weekend Market and residential areas are representative of traditional Bangkok urban lifestyle.

(4) People and user context

- ❖ **Diversity of people:** A wide range of people with various ages, incomes, purposes, residences and nationalities are expected to come to the area.

2.2 Implications of other Smart City / urban development

Implications for Bang Sue Smart City were drawn from case studies of other Smart City or urban development projects in Japan and other Asian cities.

- ❖ **Integrated development (Kashiwa-no-ha, Umekita, Japan):** Coordination of development under the overall plan and overarching concept contribute to creating a harmonized urban atmosphere and branding of the area.
- ❖ **Urban management utilizing city information (Kashiwa-no-ha, Chinese cities):** Using various kinds of urban data compiled on urban data platform achieves efficient urban management.
- ❖ **Walkable urban environment (Umekita, Seoul, Korea):** Developing a walkable urban environment around traffic hubs such as stations create a vibrant urban atmosphere.

2.3 Mission for Bang Sue area development

Following the attributes and potentials for Bang Sue area development, the Smart City development mission is outlined as follows.

- * To create a new urban core which would be a hub for business, living and recreation.
- * To fulfil potential as the “Largest station in South East Asia” through TOD approach.
- * To propose a new urban lifestyle by merging traditional and modern global trends.
- * To serve as a show case model for ASEAN cities by embodying a problem-solving approach.

2.4 Bang Sue Development Vision

“Global Gateway Bang Sue” is the proposed development vision. According to the vision, the area is seen as becoming a city where new business, industry, education, lifestyle and culture come together, merge and takeoff.



Figure 2. Development Vision:
“Global Gateway Bang Sue”



Figure 3. Spatial Planning Concept for Bang Sue

Seven gateway components function to support this development vision: “Business”, “Urban Lifestyle”, “Education”, “International Culture”, “Traditional Culture”, “Rest and Recreation” and “Innovation”.

The zoning of the area is redefined to embody this vision, as indicated in Figure 3. Zones are reorganized as larger mass units. Distinct functions are assigned to each mass so that activities inside the zone are promoted and enhanced, while effectively interlinking with each other to catalyze a “chemical reaction” which further vitalizes activity and injects new elements to the area.

2.5 Bang Sue Smart City Concept – “Platform for Innovation”

The “Platform for Innovation” Smart City function weaves together each of the seven gateway functions that catalyze connection and interaction to support the continuously evolving city. Connection and interaction among people, businesses, social needs, technologies and culture are activated on this “Platform for Innovation”. Bang Sue becomes a place where people get inspired. Innovative ideas are generated and thus

implemented and demonstrated in the area to enhance living comfort or to solve urban issues.

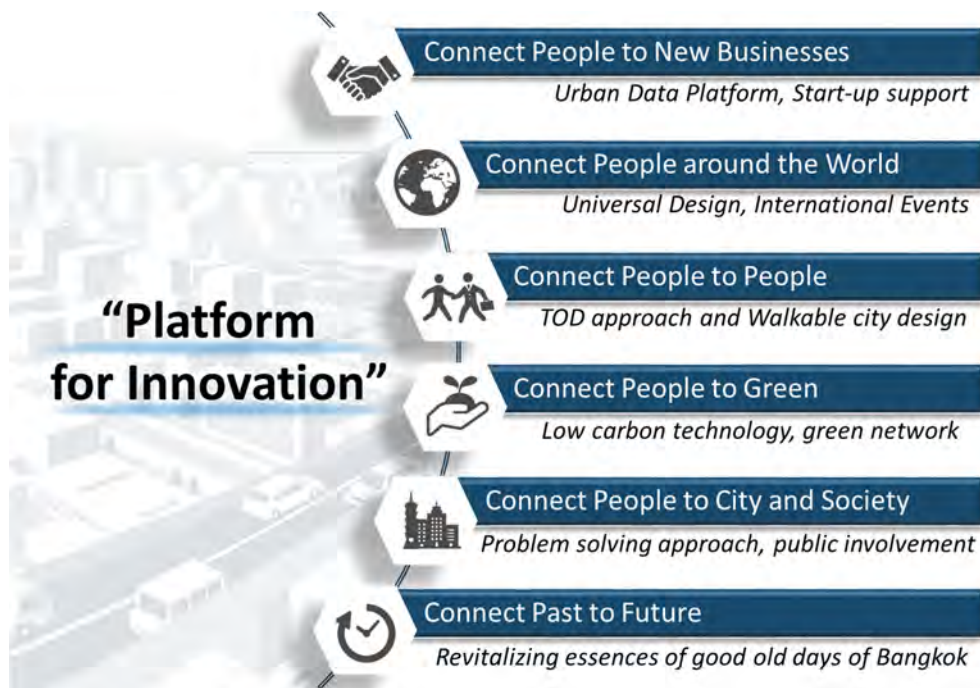


Figure 4. Bang Sue Smart City Concept

This study focusses on three Smart City Components identified following consultation with the Thailand Government and stakeholders: Smart Mobility, Smart Energy, and Smart Environment. These project concepts are described in the following sections.

3.1 Smart Mobility

(1) Overview

‘Smart Mobility’ is a comprehensive concept in the Bang Sue area: sustainable mobility balanced socially, environmentally and economically to provide solutions for urban transport challenges using remarkably advanced technologies.

(2) Key Concepts of Smart Mobility

Key concepts are determined towards the following city:

- ❖ A city where people can walk around comfortably and safely; a Walkable City.
- ❖ A city where people can move comfortably, easily, and friendly to the environment.
- ❖ A city where people can enjoy abundant space with proper management of multimodal transportation systems.

Key concepts of smart mobility are formulated as follows in order to realize the urban vision:

- ❖ The Sky deck network will be developed to connect Bang Sue Grand station, development zones and transport bases.
- ❖ Public transport services using small, environmentally friendly Personal Rapid Transit (PRT) electric vehicles would be established on the Sky Deck using IoT. Automated driving systems could be introduced in the future.
- ❖ Visitors from outside the area will park their private cars in parking lots positioned at the outer edge of the development area and be able to move inside the Bang Sue area by foot or PRT.
- ❖ Road congestion in the zones will be alleviated by suppressing automobile inflow and promoting public transportation use.



Figure 5. Smart Mobility Conceptual Image

(3) Smart Mobility Development Plan

- ❖ **Sky Deck Network:** The plan proposes an elevated sky deck network connecting Bang Sue Grand station, main facilities and fringe parking lots. Sky deck transport modes could be limited to pedestrians, bicycles and small transport. As part of the ‘Walkable City’, sky deck will segregate automobiles and pedestrians vertically to realize smooth inter and intra zone trips. Considering Thailand’s climate, a rain or sun proof roof structure should be installed in harmony with city block building development.

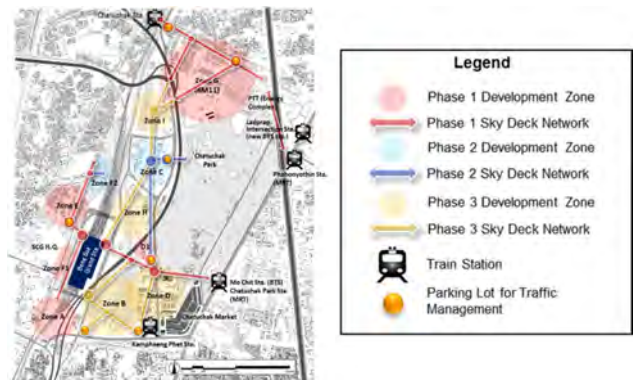


Figure 6. Sky Deck Network Conceptual Design



Figure 7. Sky Deck Network and PRT Image

❖ **Smart Public Transport:** An eco-friendly compact electric vehicle Personal Rapid Transit (PRT) system is proposed for the sky deck network. PRT can be introduced according to step-wise development phases, and achieve high transport capacity by high frequency operation. Introduction cost is lower than other urban traffic systems. Provided traffic service can respond flexibly to various traffic demands depending on development situation or time period.

❖ **Limiting Vehicle Inflow to Development Zones and Developing Fringe Parking Lots:** Automobile inflow to development zones is limited to alleviate traffic congestion and create attractive urban spaces. Moreover, fringe parking lots will be positioned at outer edges of the development area to receive automobile traffic and switch to other transport modes.



Figure 8. Traffic Control Section and Fringe Parking



Figure 9. Fringe Parking Conceptual Image

❖ **Street Design:** By restricting automobile inflow, space for road traffic in the Bang Sue area could be reallocated and redesigned from traffic oriented roads into urban public places to connect people to people, society and the green environment.

❖ **Other Smart Mobility Related Measures:** In addition to the previous concepts, the study highlights importance of developing transport information management systems, bicycle and personal mobility lanes, and car and ride sharing.

(4) Smart Mobility Policy Impact Evaluation

To verify impacts of smart mobility policies quantitatively, traffic simulation was used to analyze the following three scenarios .

- Case 1: Without smart mobility measures in 2032
- Case 2: Sky Deck and PRT system installed in 2032
- Case 3: Sky Deck Network and PRT system, vehicle flow restrictions into development zones and fringe parking installed in 2032

As a result, average traffic speeds in Case 2 and 3 were higher than in Case 1. Introducing smart mobility policies could improve traffic conditions in addition to ensuring attractive urban spaces and a Walkable City. Although the study's target area is limited to the Bang Sue area, it is important to consider transport activity covering surrounding areas in the future.

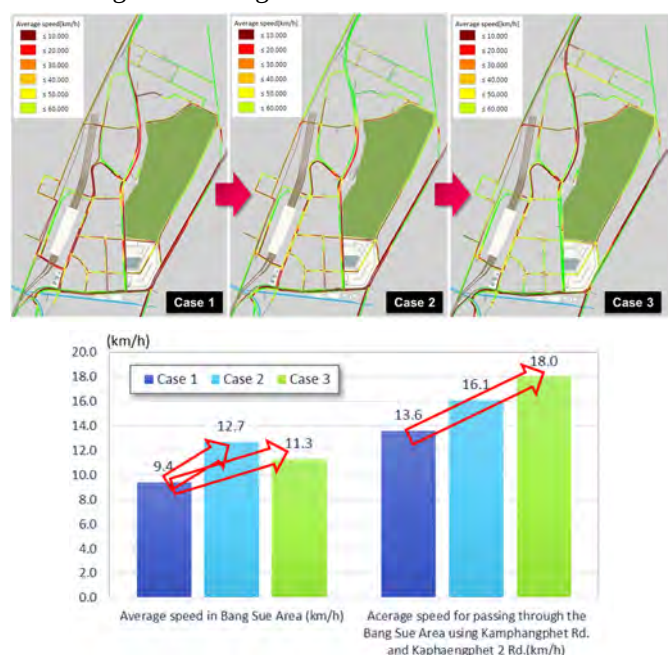


Figure 10. Average Traffic Speed Comparison

3.2 Smart Energy

(1) Overview

The “Smart Energy” project for Bang Sue has been considered and suggested toward reducing CO₂ emissions as much as possible, facilitate local energy production for local consumption and to supply the area with highly reliable, sustainable energy as a comprehensive concept.

In addition, it is proposed that the PTT-owned gas pipeline installed close to SRT’s existing train line be used as an energy source and a distributed energy supply system should be established.

(2) Basic Concept and Development Policy

- ❖ **Smart Energy Concept/Development Policy:** The energy supply system suitable for the Smart City in Bang Sue is considered based on the following concepts and development policies.



Figure 11. Smart Energy Concept

- ❖ **Basic Smart Energy Network Concept:** In Bang Sue the regional cooling network, composed mainly of high-efficiency cold source equipment, is combined with a microgrid system consisting mainly of Customer Grid Supply (CGS) and solar power generation in order to achieve sophisticated management with ICT technology and build a highly efficient, reliable smart energy network with less environmental burdens. In this smart energy network each energy center is installed in

respective zones to serve as an energy supply hub for each zone and achieve energy-saving operational control and sophisticated management through unified management in the smart energy management center (SEMC).

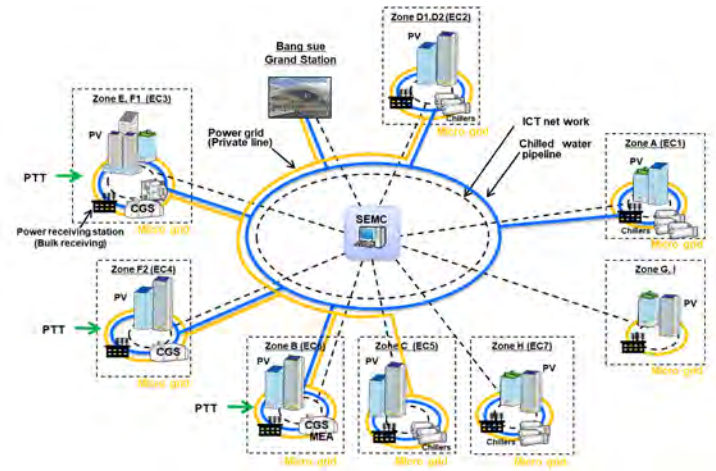


Figure 12. Smart Energy Network Concept

- ❖ **Area Energy Management System (AEMS):** The SEMC introduces AEMS to consolidate management of distributed energy systems like energy centers installed in respective zones and optimize intraregional energy supply and demand systems by an AI system.

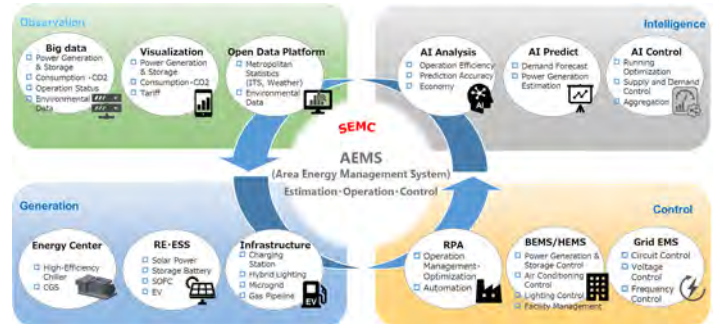


Figure 13. AEMS Concept

- ❖ **Ecosystem Establishment:** The smart energy system collaborates with the smart mobility system to supply power including intraregional renewable energy for PRT’s power sources to establish an intraregional public transportation system with less environmental load. Furthermore, the storage cell mounted on PRTs is highlighted for adoption as a multipurpose energy supply and demand

coordination resource, achieving an ecosystem under the smart energy plus smart mobility system.



Figure 14. Collaboration between Smart Energy System and Smart Mobility System

- ❖ **Energy supply model:** The Bang Sue energy supply system builds a platform combined with energy supply and value-added energy service to construct a pioneering business model in ASEAN.

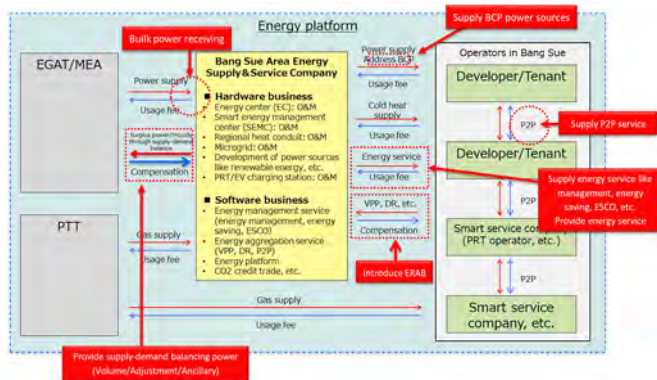


Figure 15. Energy supply model

(3) Smart Energy Development Plan

- ❖ **Regional cooling network:** Each energy center installed in Zones A, B, C, D1, D2, E, F2 and H adopts the following two systems respectfully: a regional cooling system to build a network for cooling water pipes between zones (Zones A, B, D1, D2, E, and F2) and a city block cooling system exclusive for each zone (Zones C, D1 and H).
- ❖ **Microgrid:** To achieve energy management under each EMS, a microgrid system shall be built via a self-supporting line within each zone where power is supplied collectively and a solar power generation system is installed on roofs of all facilities.

❖ Business continuity planning (BCP) measures:

To contribute to the urban energy security system, an energy center, introducing CGS in Zones B, E and F2, supplies emergency power sources to key facilities like Bang Sue Grand Station, the medical complex (Zone D1) and the Meeting, Incentives, Conferences and Exhibition (MICE) center (Zone C).

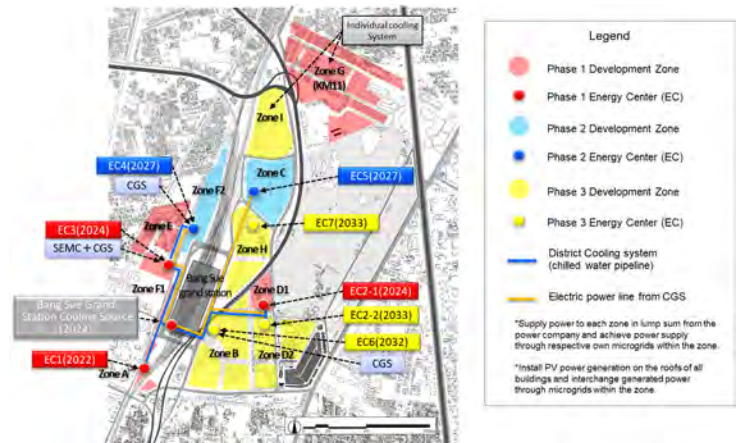


Figure 16. Development Layout

(4) Smart Energy Network Advantage

- ❖ **CO₂ Emission Reduction Impact:** The Bang Sue area smart energy network is expected to reduce CO₂ emission by approximately 28% compared with a traditional individual ventilation system.
- ❖ **Life Cycle Cost:** The Bang Sue smart energy network slashes life cycle costs by approximately 21% compared with a traditional individual ventilation system.

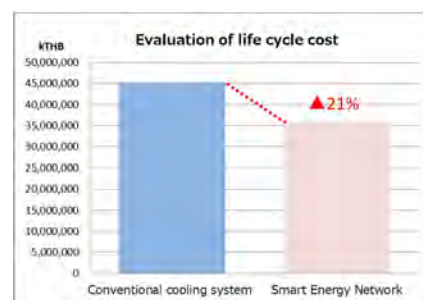


Figure 17. Life Cycle Cost Comparison

3.3 Smart Environment

(1) Overview

Smart Environment is a compulsory. Smart Component to be included in Smart City projects in Thailand. Several Smart Environment contents are proposed, taking into account Bang Sue Area attributes.

(2) Basic Policy and Concept for Development

Some of the key contents and approaches proposed for Smart Environment are shown as below.



Figure 18. Proposed contents for Smart Environment

- ❖ **Green Network:** A Green Network will be developed around Chatuchak Park to form a comfortable and walkable nature environment that will be defined in the development plan. The City Development Guideline will specify management.
- ❖ **Environment monitoring system:** The following approaches will be suggested to embody an environmentally conscious city: (1) information collection and disclosure on the environment such as an air pollution index; and (2) introduction of an

environmental management system such as a complaint management system.

- ❖ **Waste and water management:** Waste management will be implemented in coordination with BMA. Promotion of recycling and reuse will reduce solid waste disposal. As well, waste separation systems utilizing ICT will improve waste treatment efficiency.

For water supply and sewage services, water recycling will be promoted and quality management enhanced in coordination with MWA.

- ❖ **Environmentally friendly transportation:** Environmentally friendly transportation will be promoted such as electric powered vehicle public transport and a bicycle sharing system, as well as introduction of pedestrian priority zones and sky decks, together with Transit Oriented Development (TOD).

Landscaping and control of noise and vibration:

The City Development Guideline will manage landscaping. Noise and vibration will be controlled by introducing noise-control technologies which have delivered performance results in the Japanese road facilities such as noise barriers, sound-absorbing concrete finishing and sound-absorbing road joints.

- ❖ **City Development Guideline and Area Management Body:** The production of a City Development Guideline is proposed as a key tool to facilitate integrated development. The guideline will stipulate environmental regulations and landscaping and disaster prevention rules to be followed by zone developers and individual operators. An Area Management Body will be set up to enforce the Guideline and coordinate with relevant stakeholders.

3.4 Open Data Platform and Smart City Center

(1) Open Data Platform Concept

An Open Data Platform using 5G networks and IoT technology is proposed to support innovation-incubating businesses and services. All kinds of data will be collected and integrated on the data platform for multiple purposes such as urban management, research and planning for business promotion as well as providing information.

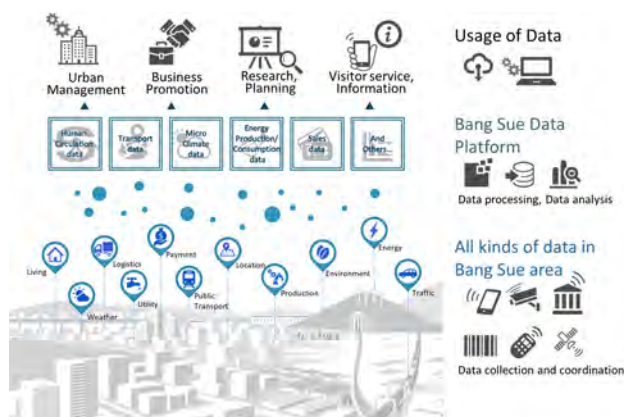


Figure 19. Open Data Platform Concept

Open Data Platform could contribute to creating various new services and businesses for private companies, especially start-ups. These systems and social infrastructures will create an innovation-incubating environment to open up business opportunities and enhance area value. The following activities are proposed to realize the Open Data Platform.

- **Establishing a Smart City Center**
- **Collecting and disclosing Open Data:** Developing a service to collect open data (e.g. 3D modeling data, traffic data, energy data) and disclosing data collected for launching creative and innovative businesses.
- **Installing fiber optics:** Installing fiber optics to maintain 5G quality (i.e. eMBB, eMTC and URLLC) in the Bang Sue area.

- **Installing Surveillance Cameras:** Installing CCTV and application software for traffic congestion surveillance and marketing analysis in commercial areas.

(2) Establishing a Smart City Center

A Smart City Center is proposed in Zone E. The Smart City Center is a facility complex to manage smart services and deploy a Data Center. It will also include other Smart Services such as a long-life learning center, a cultural exchange space and an administrative customer service. Cooperation with related organizations like Bangkok Metropolitan Admin. (BMA) and Digital Economy Promotion Agency (DEPA) is essential to establish the Smart City Center.

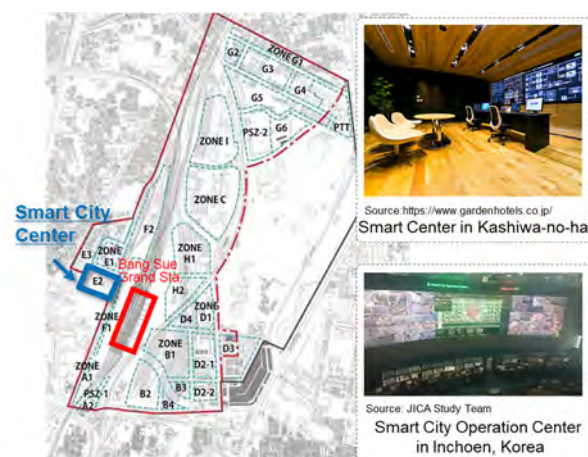


Figure 20. Proposed Smart City Center location and Image

Table 1. Proposed Facility Plan and Functions

Facility Plan	Functions	Cooperate with:
Monitoring Room	Space (control rooms) to display CCTV and collected data on large monitors	BMA, RTP
Data Center	Server room to store software and data needed to implement the smart service business	CAT/ DEPA
Exhibition Room	Exhibition room to introduce Smart City service	CAT/ DEPA
Work/ Conference Space	Work/Conference space to address staff and visitors	CAT/ DEPA
Energy Plant	Facilities to install cogeneration and cooling systems	MEA EGAT
Community Space	Space for lifelong learning center or administrative consultation service	BMA
PRT Parking Lot	PRT parking lot, inspection, and recharging space	BMA

4.1 Preconditions for development structure

The overall structure to implement Bang Sue Area development was devised underlining the integrated development concept and private participation for Smart City development. The overall structure also reflects the following three key factors identified in discussion with Thailand counterparts and upon considering current Thailand administrative conditions:

- ❖ **High level decision making and coordination:** To implement the large scale long term development project, an organization needs to be set up in government to oversee, manage and coordinate with relevant stakeholders.

- ❖ **Setting up SRT Asset Management Company:** SRT is in the process establishing the Asset Management Company (AMC). The AMC is tasked with managing SRT assets, and so considered suitable to manage Bang Sue area development.
- ❖ **Filling technical and financial gaps:** SRT and the AMC do not have experience in Smart City development and as well face limited funding sources. Filling these gaps needs to be arranged.

4.2 Overall development structure

Given these preconditions, the overall development structure proposed is shown in Figure 21. Roles of each organization are described as follows.

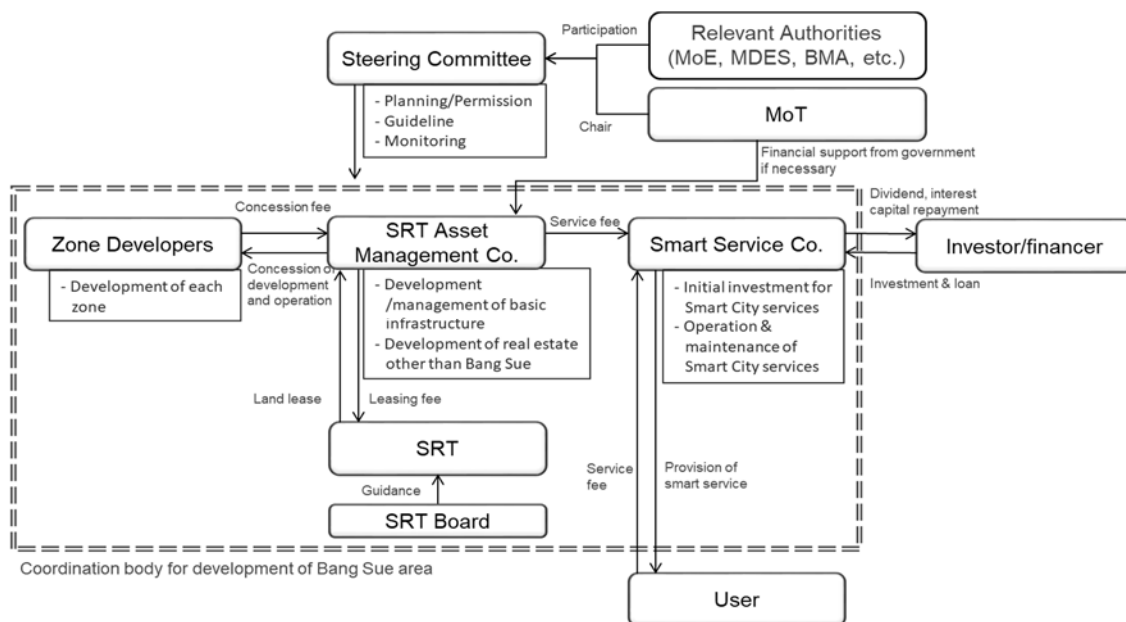


Figure 21. Proposed overall structure for Bang Sue area development

(1) Steering Committee

The Steering Committee will be chaired by the Permanent Secretary of the Ministry of Transport (MoT), with Co-secretariat role by MoT Office of Transport and Traffic Policy and Planning (OTP) and SRT. The committee takes charge of quick decision

making for policies, development plans, and town management policies.

The committee secures agreement on basic policy among stakeholders, promotes projects, and monitors Bang Sue development progress. The committee will also have authority to authorize the Master Plan and Development Guideline.

Working groups may be set up for respective smart services under the Steering Committee, considering various coordination and deregulation of smart services and commercialization measures, and so forth.

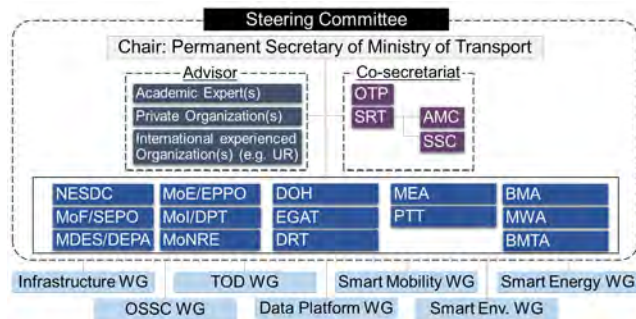


Figure 22. Steering Committee Organization

(2) Asset Management Company (AMC)

The AMC serves as the entity responsible for Bang Sue Development and coordinates stakeholders engaged in Bang Sue development. The AMC will lease land from SRT and develop land or sub-leasing of areas to developers. The company will manage leasing contracts, service agreements and so forth between the AMC and zone developers and between the AMC and the Smart Service Company (SSC).



Figure 23. SRT AMC Organization

The AMC will also coordinate with BMA, MWA, MEA and so forth to develop basic road, drainage, water, sewerage and waste management infrastructure in the Bang Sue area.

The AMC will also pay a “Service Fee” to the SSC from concession fees paid by developers, covering costs of non-profitable smart services provided by the SSC.

AMC shall continuously consider providing innovative smart services together with SSC.

It will be noted that in the case of delay or failure to set up the AMC, SRT will take on all responsibilities specified for the AMC.

(3) Smart Service Company

The Smart Service Company (SSC) will develop, operate, manage and maintain infrastructure for smart city services, offering smart services to zone developers and users or visitors to the Bang Sue area, and introduce new technologies. SSC shall continuously consider providing innovative smart services together with AMC.

The SSC could be established in the form of a Special Purpose Vehicle (SPV), in which the government would decide the shareholders. Establishment of the SSC as an SPV will be approved by the cabinet. An alternative is for the SSC to be set up with investments from SRT and other entities (e.g. state-owned enterprises) as a Joint Venture (JV) company. In the future public institutions and/or private companies from overseas could join the SSC.

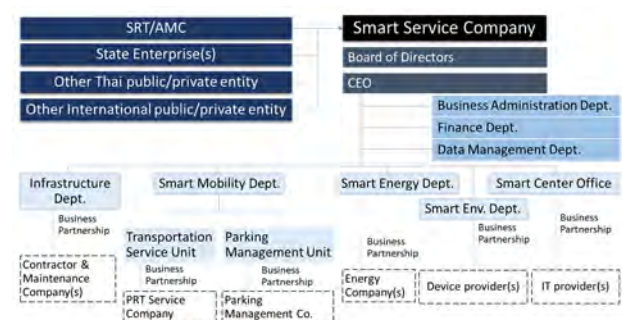


Figure 24. Smart Service Company Organization

(4) Zone developer

Bidding sessions select Zone Developers for Zones A to I respectively. Developers conclude a contract with the AMC to develop and operate zones stipulated in the contract. In the process they also earn revenues and pay concession fees in line with their contract with the AMC.



Proposed Business Model

5.1 Investment sharing and cost estimate

(1) Investment sharing structure

Investment funds for this development project will be covered by combining government budgets, state-owned enterprise investment, private developer investment and smart service company investment. The financing structure to develop facilities and introduce Smart services is classified into four layers depending on project features and responsibilities of the entities.

Layer 1 – Basic Infrastructure will be developed by government budget or funds provided by SRT as the landowner.

Layer 2 – Smart City Infrastructure will be partially covered by private companies.

Layer3 – Smart Service businesses will be covered mainly by SSC and other private companies.

Layer 4 – In-zone development will in principle be implemented by respective zone developers as private investment projects.

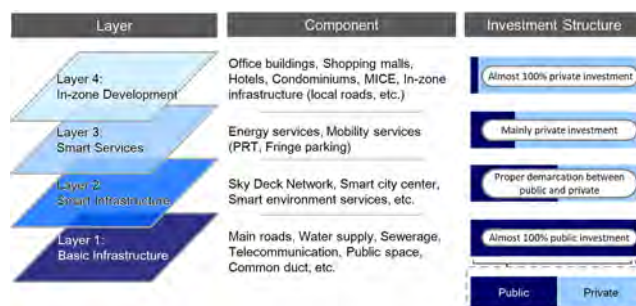


Figure 25. Investment Layer System

(2) Investment cost estimate

The estimated total investment cost is calculated based on the proposed Smart City Components and general unit costs. Table 2 summarizes the investment cost estimate.

Table 2. Investment cost estimate by Layer and Phase

Category			Approximate cost (Million THB)			
			Total	Phase 1	Phase 2	Phase 3
Layer 1	Basic Infrastructure	Major Road	134	24	19	91
		Zone Boundary Road	277	111	21	145
		Others (Water, etc.)	4,817	2,884	832	1,101
	Disaster Prevention		32	13	6	13
	Green Network		37	13	6	18
Layer 2	Sky Deck (Outside the Zones)		2,318	1,534	457	327
	Smart Environment		19	18	1	0
	Smart City Platform		745	377	171	198
Layer 3	Smart Mobility		3,376	1,398	1,062	916
	Smart Energy		11,140	3,905	2,795	4,440
TOTAL (Layer 1~3)			22,895	10,277	5,370	7,249
Layer 4	Buildings	Office	42,089	20,222	5,691	16,177
		Commercial facility	34,767	9,226	10,706	14,835
		Residence	172,568	65,532	39,439	67,597
		Hotel	17,343	5,852	4,282	7,208
		Cultural facility	8,723	4,758	3,965	0
		Public office	4,758	4,758	0	0
	Inter-zone Infrastructure		1,147	643	93	411
	Sky Deck (Inside the Zones)		3,932	1,606	620	1,705
TOTAL (Layer 4)			285,327	112,597	64,796	107,933
TOTAL			308,222	122,874	70,165	115,183

5.2 Proposed business model

(1) Proposed Smart City business model (Base case)

Considering the Bang Sue area, since the land of the Bang Sue area (approx. 370 ha as a whole) belongs to SRT, all the development activities including infrastructure development shall be primarily managed by SRT. SRT/AMC, however, would not have enough capacity from both financial and technical aspects, thus the establishment of Smart Service Company with sufficient capacity to raise funds and to manage Smart City development is proposed in this study



Figure 26. Money flow Conceptual Image

Under the proposed Base Case business structure, the SSC will cover initial investments for smart infrastructure and services (Layer 1 to 3). Once the AMC secures revenue (land lease fees) from zone developers, the AMC will share revenue as a service fee to the SSC to cover initial investment. Smart energy and mobility services could be feasible without the service fee from the AMC.

(3) Business Components

Smart City business to be undertaken by the SSC comprise the following components:

- **Smart Mobility:** Operate PRT system and provide and manage fringe parking service.
- **Smart Energy:** Provide energy services including cogeneration, district cooling and area energy management.
- **Smart Environment:** Manage green and open spaces.

- **Smart City Center:** Operate and manage Smart City Center.
- **Smart Infrastructure:** Operate and manage smart infrastructures such as the Sky Deck Network.

Smart Mobility and Smart Energy services business components generate direct revenue from users, while service fees paid by SRT and the AMC sustain Smart Environment, Smart City Center, and Smart Infrastructure services.

5.3 Financial feasibility analysis

Infrastructure development in Bang Sue shall basically be undertaken by SRT since the land of the Bang Sue area belongs to SRT. However, there would be some options for the demarcation of infrastructure development. More involvement from public sector would be encouraged, as the area is too huge to be covered by one entity for infrastructure development, and that the Bang Sue Smart City development should be recognized as a national project since the project is one of the Flagship projects of Smart City to be developed as a new gateway for ASEAN.

Financial feasibility analysis for overall business of the SSC is conducted for the following four cases as shown in Table 3:

- **Case 1:** SRT will secure initial investment cost before getting revenue from zone developers;
- **Case 2:** Public agencies and public companies will cover infrastructure investment cost (incl. sky deck);
- **Case 3 (Base case):** All basic infrastructure and Sky Deck (Outside the Zones) are implemented by SSC;
- **Case 4:** SSC and the public agencies will coordinate to share infrastructure investment.

The service fee was instituted based on the percentage at which Case 3 – the Base Case – would

be financially viable. Analysis results indicate that the proposed business model could be financially viable as private businesses at the specified service fee level, while this could also contribute to reducing SRT's deficit.

It must be noted, however, that financial analysis results are highly volatile and depend strongly on

demand. A detailed follow up study will be necessary, therefore, once a concrete business plan is established. In addition, a risk mitigation scheme and flexible arrangements would be essential to ensure viability and business sustainability.

Table 3. Result of financial feasibility analysis

Category			Case1	Case2	Case3 (Base Case)	Case4
Demarcation						
Layer 1	Basic Infrastructure	Major Road	AMC/SRT	Public	SSC(w/ SF)	Public
		Zone Boundary Road	AMC/SRT	Public	SSC(w/ SF)	SSC(w/ SF)
		Other (Water, telecom, etc.)	AMC/SRT	Public	SSC(w/ SF)	Public
	Disaster Prevention		AMC/SRT	Public	SSC(w/ SF)	Public
	Green Network		AMC/SRT	Public	SSC(w/ SF)	Public
Layer 2	Sky Deck (Outside the Zones)		AMC/SRT	Public	SSC(w/ SF)	SSC(w/ SF)
	Smart Environment		SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)
	Smart City Platform		SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)
Layer 3	Smart Mobility		SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)
	Smart Energy		SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)
Layer 4	Inter-zone Development		Private	Private	Private	Private
Criteria						
Coordination in infrastructure development			★★★	★	★★★★	★★
Financial burden on SRT (especially for initial cost)			★	★★★★	★★	★★★
Financial burden on Public			★★★	★	★★★	★★
Execution capability of the agency			★	★★★★	★★	★★★
Risk distribution(too much risk on one agency)			★	★★	★	★★★
Public sector involvement			★	★★★★	★	★★★
Private sector involvement and future prospect			★	★	★★★	★★★
Smart Service Co.	Project IRR (2020-61)		39.4% (36.2%)	39.4% (36.2%)	8.7% (14.9 %)	20.8 % (26.1 %)
	Average of ROE (2034-61)		22.6 % (25.8%)	22.6 % (25.8%)	5.8% (15.1%)	14.7% (21.9%)
AMC (SRT)	Accumulated NCF (2034) (Million THB)		17,719 (17,267)	28,514 (28,062)	27,753 (27,240)	28,254 (27,802)
	Accumulated NCF (2061) (Million THB)		112,185 (111.733)	131,316 (130.863)	130,554 (139.942)	131,056 (130.604)

SSC (w/ SF): SSC investment with Service Fee, SSC investment without Service Fee

* Service fee from AMC (SRT) to the SCC set as 33% (2022-2033) and 14% (2034-2061) of SRT's revenue from developers (Land Lease Fee) respectively.

** Figures in () include Smart Mobility Services. Since financial feasibility of smart mobility service is highly volatile according to demand (depending on demand fluctuation), revenue of the smart mobility service is excluded to evaluate the feasibility of SRT and the SSC. If the SSC can earn enough revenue from the smart mobility service, the service fee from the AMC to SRT could be considered to change.



6.1 Actions to be taken

(1) Challenges

As outlined previously, the Bang Sue Smart City development project presents the opportunity to unlock undoubted potential that could bring vast benefit to the society of Thailand by showcasing new urban development while accelerating the economic transformation set forth in the “Thailand 4.0” policy.

It must be noted, however, that a myriad challenges need to be tackled, given the scale and timeframe of development. Prompt actions need to be taken, especially as first phase development needs to synchronize with the Bang Sue Grand Station and Red Line Mass Transit System construction projects.

Among various issues, the study team has identified three key areas in which actions need to be taken imminently:

	Challenge 1: High level decision making and coordination • Implement necessary deregulation measures • Approve and authorize plans and actions
	Challenge 2: Fill financial and technical capability gaps • Finance for initial investment • Technical capability to lead Smart City project
	Challenge 3: Integrated Development Mechanisms • Phased infrastructure development • Coordinating interface among stakeholders • Incorporating private sector skills and expertise

(2) Proposed measures and key points to consider

Proposed measures and key points to consider regarding these identified challenges are as follows.

Measures for Challenge 1

Establishing Steering Committee

- ❖ Establish clear roles and responsibility among related organizations
- ❖ Allow flexible arrangement, set up Working Groups for specific issues

Measures for Challenge 2

Establishing the AMC and SSC

- ❖ Ensure transparent governance structure and independence
- ❖ Address demand risk mitigation and arrange incentive schemes
- ❖ Recruitment and capacity building

Measures for Challenge 3

Formulation of Integrated Infrastructure Development Plan, Smart City Development Plan, and City Development Guideline

- ❖ Establish guidelines and incentive scheme to coordinate development
- ❖ Ensure coordination of plans at various levels – Integrated Infrastructure Design, Master Plan, District Plan, Zone Plan, Smart Service F/S

6.2 Action Plan

The Action Plan for Bang Sue Smart City development is devised with the focus on the year leading up to 2021, which is to be a key milestone year when Grand station and the Red line are both planned to start operation. The recommended timeline by year is summarized as follows.

- **By early 2020:** The Smart City concept approved and authorized by the MoT and SRT; Steering Committee set up by initiative of the MoT; and the AMC and SSC preparatory offices set up by initiative of SRT.
- **By end of 2020:** Development plan and activities authorized by the Steering Committee, managed and coordinated by the MoT; Integrated Infrastructure Development Plan, Smart City Development Plan, and City Development Guidelines devised by the AMC (or its preparatory office); and Feasibility Study for Smart Services conducted by the SSC (or its preparatory office).

- **By end of 2021:** Fully functionality of proposed Steering Committee, AMC and SSC promoting vehicles together with institutional framework comprising plans and guideline.

As mentioned, the swift establishment of the overall development structure, including the establishment of the Steering Committee, AMC, and

preparation for the establishment of SSC, is highly recommended. It is also expected that further concrete Smart City development plan be developed following this study and that Smart City development be realized under quick decision making by the Steering Committee.

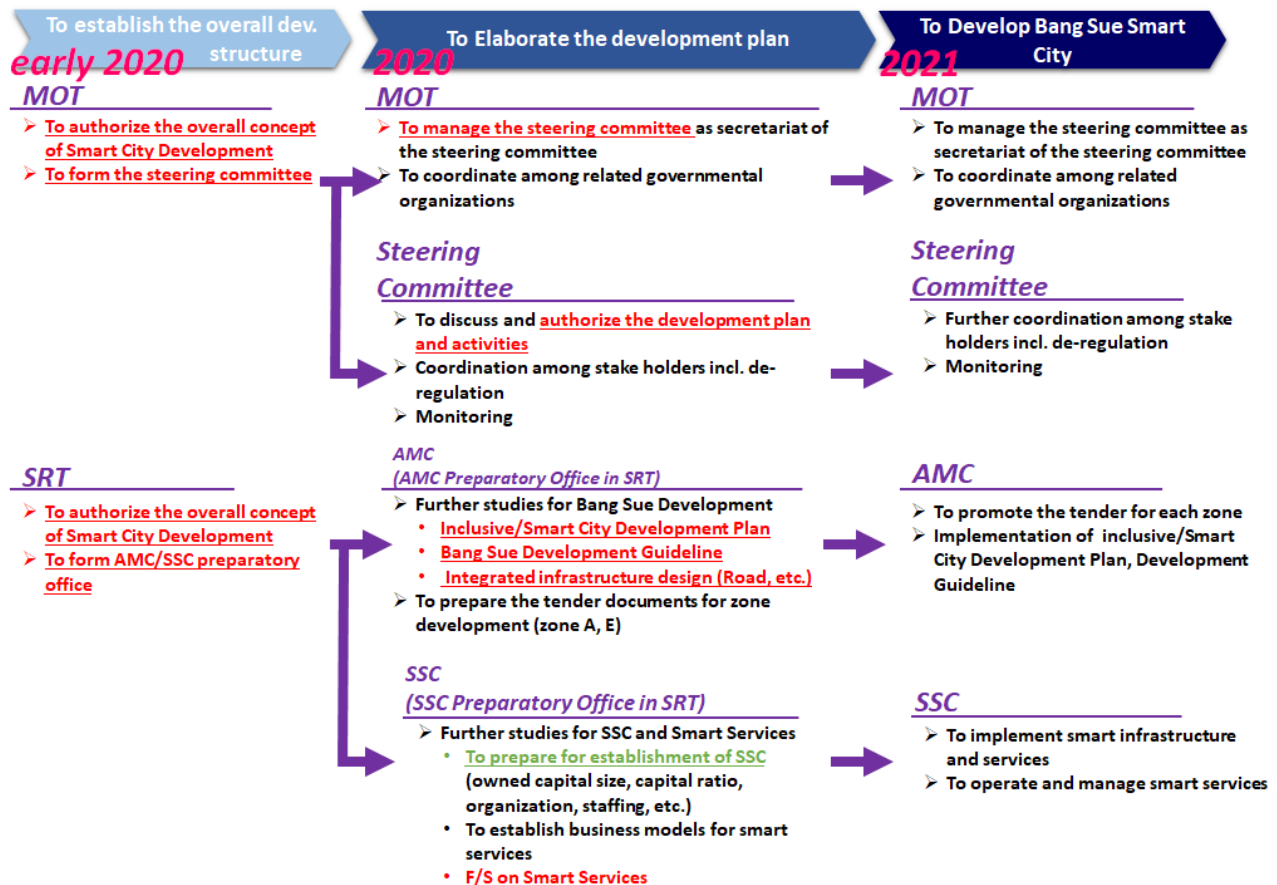


Figure 27. Action Plan to 2021

6.3 Conclusion: Towards realizing Bang Sue Smart City

Smart City development in the Bang Sue Area is expected to be shared among all related organizations in Thailand and subsequently taken forward under the initiative of implementation agencies such as the MoT Office of Transport and Traffic Policy and Planning (OTP) and the State Railway of Thailand (SRT). It is also expected that proposals set forth in this study be

implemented at an early stage, while at the same time, flexibly accommodating rapidly evolving technology. Commitment from the Thailand Government and associated organizations will be a key factor in developing the Bang Sue Area as a cutting-edge Smart City which will be a model not only for Thailand, but also for the ASEAN region.



1.1 ภูมิหลังในการศึกษา

(1) บริบทในการพัฒนาบางซื่อสมาร์ทซิตี้

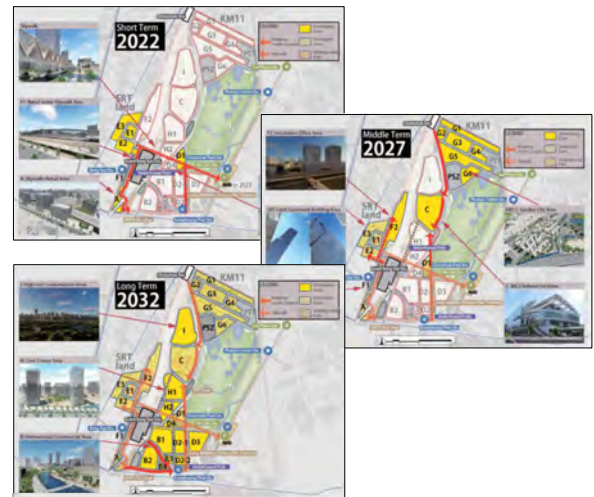
พื้นที่บริเวณบางซื่อซึ่งเป็นพื้นที่เป้าหมายในการศึกษาครั้งนี้ ในอนาคตจะเป็นพื้นที่เชื่อมต่อเส้นทางรถไฟ 6 สาย ซึ่งรวมถึงรถไฟความเร็วสูง รถไฟแอร์พอร์ตลิงค์ เป็นศูนย์กลางการคมนาคมในบริเวณสถานีกลางบางซื่อและสถานีใกล้เคียง พื้นที่นี้ได้รับการวางแผนพัฒนาให้เป็นศูนย์กลางเมืองใหม่ของกรุงเทพฯ ผนวกธุรกิจหลากหลายประเภทเข้าไว้ด้วยกัน ผ่านแนวคิดการพัฒนาพื้นที่รอบสถานีขนส่งมวลชน (Transit Oriented Development: TOD) คาดหวังว่าพื้นที่ดังกล่าวจะเป็นประตูสู่กรุงเทพฯ ซึ่งผู้คนหลากหลายจะเข้ามาพบปะและทำกิจกรรมร่วมกัน

พื้นที่บริเวณบางซื่อถือเป็นหนึ่งในพื้นที่นำร่องในการส่งเสริมการพัฒนาเมืองอัจฉริยะภายใต้กรอบ ASEAN Smart City Network (ASCN) ประเทศไทยภายใต้นโยบาย “ไทยแลนด์ 4.0” ซึ่งมุ่งเน้นในการขับเคลื่อนอุตสาหกรรมด้วยเทคโนโลยีทันสมัยเพื่อสร้างมูลค่าเพิ่ม จึงมีการส่งเสริมการพัฒนาเมืองอัจฉริยะอย่างเต็มที่ ได้มีการจัดตั้งคณะกรรมการขับเคลื่อนเมืองอัจฉริยะ (Smart City Steering Committee) ขึ้นเพื่อประสานงานกับหน่วยงานภาครัฐและภาคส่วนที่เกี่ยวข้อง อีกทั้งยังมีคณะทำงานซึ่งประกอบด้วยแต่ละหน่วยงานผู้รับผิดชอบทำหน้าที่ส่งเสริมและประเมินโครงการตามองค์ประกอบของเมืองอัจฉริยะทั้ง 7 ด้าน คือ ด้านการคมนาคมขนส่ง ด้านพลังงาน ด้านสิ่งแวดล้อม ด้านเศรษฐกิจ ด้านธรรมาภิบาล ด้านความเป็นอยู่ ด้านประชาชน

ภายใต้บริบทดังกล่าว การศึกษาในครั้งนี้มุ่งเน้นในการสนับสนุนให้เกิดการพัฒนาเมืองอัจฉริยะในพื้นที่บริเวณบางซื่อ ซึ่งมีพื้นที่มากกว่า 300 เฮกเตอร์ และพื้นที่ส่วนใหญ่เป็นกรรมสิทธิ์ของการรถไฟแห่งประเทศไทย

(2) การศึกษาครั้งก่อนเกี่ยวกับการพัฒนาพื้นที่บางซื่อ

ในการสำรวจครั้งก่อนเรื่อง “การรวบรวมและยืนยันข้อมูลเกี่ยวกับการพัฒนาพื้นที่บริเวณบางซื่อของไทย” โดย JICA ในปี 2560 ได้มีการพิจารณาและเสนอแผนการจัดการพื้นที่ แผนการใช้ที่ดิน และแผนการพัฒนาตามลำดับขั้น โดยมุ่งเน้นสร้างพื้นที่บริเวณบางซื่อให้เป็นศูนย์กลางใหม่ของกรุงเทพฯ พร้อมด้วยความสามารถในการรองรับธุรกิจระหว่างประเทศ โดยใช้แผนและนโยบายการพัฒนาแบบบูรณาการเป็นแนวคิดพื้นฐาน



ที่มา: การศึกษา JICA ในครั้งก่อน

ภาพที่ 1 แผนการพัฒนาตามลำดับขั้น

1.2 วัตถุประสงค์การศึกษา

วัตถุประสงค์ในการศึกษาครั้งนี้ คือ การพิจารณาและนำเสนอแนวความคิดเรื่องเมืองอัจฉริยะ พร้อมทั้งแผนการพัฒนา โครงสร้างการดำเนินงาน แผนธุรกิจ แผนการดำเนินงาน เพื่อขับเคลื่อนให้เกิดเมืองอัจฉริยะขึ้น โดยตั้งอยู่บนพื้นฐานของ roadmap พื้นฐานในการประสานการพัฒนาให้เป็นไปในทิศทางเดียวกัน ซึ่งได้มีการเสนอแนะไว้ในการศึกษาครั้งก่อนของ JICA เมื่อปี 2560

การศึกษาในครั้งนี้จะดำเนินการตามแผนงานด้านต่างๆ เช่น หลักการพื้นฐาน แผนการจัดการพื้นที่ แผนการใช้ที่ดิน แผนการพัฒนาตามลำดับขั้น ซึ่งได้ระบุไว้ในการศึกษาครั้งก่อนเมื่อปี 2560



องค์ประกอบของเมืองอัจฉริยะที่น่าเสนอ

2.1 ความหมายและบริบทในการพัฒนาพื้นที่บริเวณบางซื่อ

ในการพัฒนาแนวความคิดเมืองอัจฉริยะสำหรับพื้นที่บริเวณบางซื่อได้มีการรวบรวมลักษณะเฉพาะและศักยภาพของโครงการพัฒนาดังกล่าวจากหลายมุมมอง ดังนี้

(1) ระดับภูมิภาคอาเซียน

- ❖ **แนวคิดแบบเน้นพื้นที่ (Area-based approach):** พื้นที่บริเวณบางซื่อได้รับการกำหนดให้เป็นพื้นที่เป้าหมายในการพัฒนาเมืองอัจฉริยะตาม ASCN
- ❖ **แนวคิดเน้นการบูรณาการระหว่างภาคส่วน (Multi-sectoral approach):** การพัฒนาบางซื่อสามารถชี้แจงให้ช่วยแก้ปัญหาของเมืองซึ่งเป็นประเด็นปัญหาที่เกิดขึ้นในเมืองต่างๆของอาเซียน ผสานระหว่างผังเมืองและแผนการจัดการพื้นที่

(2) ระดับกรุงเทพ

- ❖ **แนวคิด TOD:** เนื่องจากพื้นที่ดังกล่าวมีถนนและทางรถไฟที่สำคัญพาดผ่าน อีกทั้งยังมีสถานีขนส่งขนาดใหญ่อยู่ภายในบริเวณ เป็นจุดเชื่อมต่อการคมนาคมขนส่งหลากหลายประเภท จึงมีศักยภาพสูงในการพัฒนาตามแนวคิด TOD
- ❖ **การพัฒนาเป็นศูนย์กลางเมืองแห่งใหม่:** พื้นที่บริเวณบางซื่อมีศักยภาพในการพัฒนาไปเป็นศูนย์กลางใหม่ของเมือง ช่วยเติมเต็มพื้นที่เขตเมืองเดิมของกรุงเทพ
- ❖ **รูปแบบใหม่ของเมือง:** บางซื่อจะแตกต่างจากเมืองเก่าที่ประสบปัญหาด้านเศรษฐกิจอันเกิดจากความหนาแน่นของประชากร บางซื่อมีศักยภาพในการเป็นเมืองในรูปแบบใหม่สำหรับกรุงเทพ

(3) ระดับพื้นที่บริเวณบางซื่อ

- ❖ **ศูนย์รวมของบริษัทขนาดใหญ่ของไทย:** พื้นที่บริเวณบางซื่อนอกจากจะมีสำนักงานใหญ่ของบริษัท ปตท. จำกัด และบริษัท ปูนซิเมนต์ไทย จำกัดแล้ว การรถไฟแห่งประเทศไทยยังมีการดำเนินการย้ายสำนักงานใหญ่

มายังบริเวณดังกล่าวอีกด้วย ดังนั้นเมื่อการพัฒนาดำเนินไป บางซื่อก็จะสามารถกลายเป็นศูนย์กลางใหม่ของเมืองได้

- ❖ **พื้นที่สีเขียวขนาดใหญ่:** สวนสาธารณะจุดจักรเป็นที่ยึดมั่นในฐานะสวนสาธารณะที่ใหญ่ที่สุดแห่งหนึ่งในกรุงเทพ และเป็นสถานที่พักผ่อนที่ประชาชนชื่นชอบ
- ❖ **โครงสร้างพื้นฐานที่เป็นเอกลักษณ์:** พื้นที่บริเวณบางซื่อมีโครงสร้างพื้นฐานที่เป็นเอกลักษณ์ มีทั้งเส้นทางรถไฟฟ้า ทางรถไฟ สถานีขนส่ง รวมทั้งยังมีทางด่วนตัดผ่าน
- ❖ **แหล่งวัฒนธรรมดั้งเดิมของเมือง:** ตลาดนัดจุดจักรในช่วงสุดสัปดาห์เป็นสถานที่ท่องเที่ยวเชิงวัฒนธรรมที่เป็นที่นิยมของทั้งประชาชนในท้องถิ่นและนักท่องเที่ยวชาวต่างชาติ

(4) ระดับประชาชนผู้อยู่อาศัยและผู้ใช้งาน

- ❖ **ความหลากหลายของผู้คน:** คาดว่าจะมีผู้ใช้บริการหลากหลายกลุ่มอายุ ระดับรายได้ จากสถานที่ต่างๆ รวมทั้งบุคคลหลากหลายเชื้อชาติเดินทางมายังพื้นที่บริเวณดังกล่าวด้วยวัตถุประสงค์ที่ต่างกันออกไป

2.2 บทเรียนจากการพัฒนาเมืองอัจฉริยะอื่น

คณะผู้ศึกษาได้ศึกษาตัวอย่างจากการพัฒนาเมืองอัจฉริยะและเมืองอื่นๆ ในญี่ปุ่นและเมืองต่างๆ ในภูมิภาคอาเซียน

- ❖ **การพัฒนาแบบบูรณาการ (Kashiwa-no-ha, Ume Kita):** การประสานงานในการพัฒนาภายใต้แผนและแนวคิดโดยรวมควรก่อให้เกิดบรรยากาศและแบรนด์ของเมืองที่สอดคล้องเป็นแบบแผนเดียวกัน
- ❖ **การจัดการเมืองโดยใช้ข้อมูล (Kashiwa-no-ha, Chinese cities):** สามารถผลักดันให้เกิดการจัดการเมืองให้มีประสิทธิภาพได้ด้วยการใช้ข้อมูลที่หลากหลายซึ่งรวบรวมจากแพลตฟอร์มข้อมูลของเมือง

- ❖ บรรยากาศของเมืองที่สามารถเดินภายในเมืองได้ (Umekita, Seoul): สามารถสร้างให้เกิดบรรยากาศที่มีชีวิตชีวาภายในเมือง ได้จากการจัดให้มีบริเวณทางเดินรอบจุดสำคัญ เช่น บริเวณสถานี เป็นต้น

2.3 พันธกิจในการพัฒนาพื้นที่บริเวณบางซื่อ

จากลักษณะเฉพาะและศักยภาพในการพัฒนาพื้นที่บริเวณบางซื่อดังกล่าวข้างต้น จึงได้กำหนดพันธกิจที่จำเป็นในการพัฒนาพื้นที่บริเวณบางซื่อ ดังนี้

- * เพื่อสร้างศูนย์กลางเมืองในรูปแบบใหม่ ตอบโจทย์ทั้งทางด้านธุรกิจ การดำรงชีวิต และการพักผ่อนหย่อนใจ
- * เพื่อดึงศักยภาพเพื่อการเป็นสถานที่ใหญ่ที่สุดในเอเชียตะวันออกเฉียงใต้โดยการดำเนินการตามแนวคิด TOD
- * เพื่อนำเสนอรูปแบบการใช้ชีวิตในเมืองแบบใหม่ที่เป็นการนำกระแสวัฒนธรรมต่างประเทศที่ทันสมัยมาผสมผสานกับวัฒนธรรมและวิถีชีวิตดั้งเดิม
- * เพื่อเป็นกรณีตัวอย่างสำหรับเมืองต่างๆ ในอาเซียน โดยใช้วิธีการแก้ไขประเด็นปัญหาต่างๆ

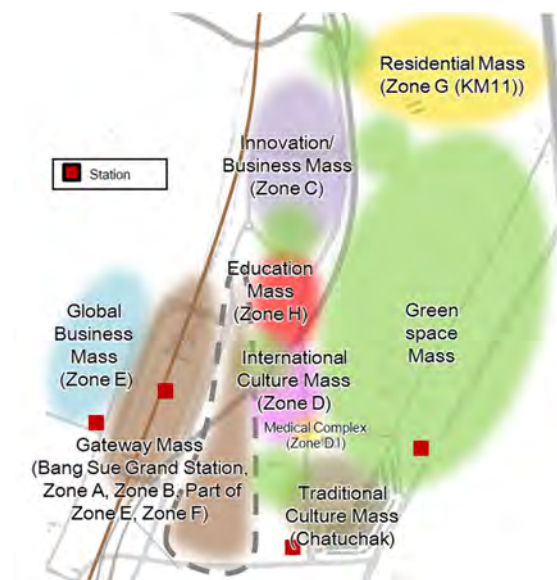
2.4 วิสัยทัศน์ในการพัฒนาพื้นที่บริเวณบางซื่อ

วิสัยทัศน์ในการพัฒนาที่น่าสนใจ คือ “Global Gateway Bang Sue” ภายใต้วิสัยทัศน์ดังกล่าว คาดหวังว่าบางซื่อจะกลายเป็นเมืองที่มีการพัฒนาโดยผสมผสานภาคธุรกิจ อุตสาหกรรมใหม่ วิถีชีวิต และวัฒนธรรมเข้าไว้ด้วยกัน

“Global Gateway Bang Sue”



ภาพที่ 2 วิสัยทัศน์การพัฒนา : “Global Gateway Bang Sue”



ภาพที่ 3 แนวคิดการจัดการพื้นที่ภายใน

วิสัยทัศน์ในการพัฒนาเป็นหน้าที่ในการเป็นจุดเชื่อมต่อ (gateway) ทั้ง 7 ด้าน ประกอบด้วยด้านธุรกิจ วิถีชีวิตเมือง การศึกษา วัฒนธรรมสากล วัฒนธรรมดั้งเดิม การพักผ่อนและสันทนาการ และนวัตกรรม

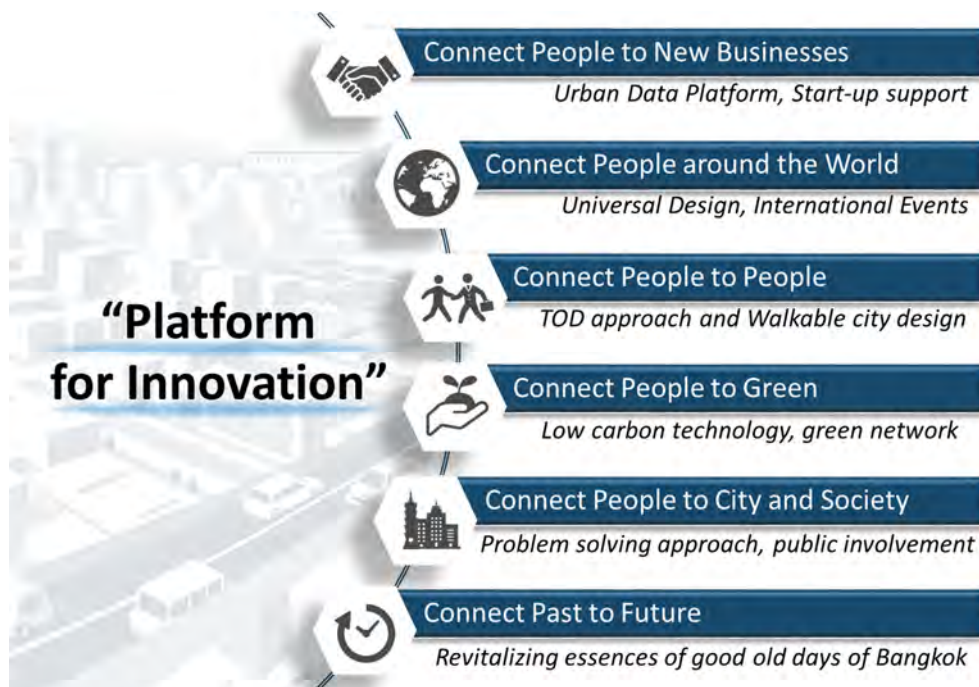
ภาพที่ 3 เป็นการจัดวางแผนโซนใหม่ตามวิสัยทัศน์ในการพัฒนา โดยแต่ละโซนมีจัดพื้นที่ในรูปแบบ mass ซึ่งในแต่ละ mass มีบทบาทหน้าที่ของตนเอง ทั้งนี้ คาดว่าหากมีการสนับสนุนให้แต่ละ mass ดำเนินการตามบทบาทหน้าที่ของตนเอง ในอีกทางหนึ่งก็เชื่อมโยงให้เกิดเป็นปฏิสัมพันธ์ระหว่าง

กัน เกิดความมีชีวิตชีวาในพื้นที่บริเวณโดยรวมและเป็นแรงดึงดูดผู้คนให้เข้ามาภายในบริเวณ

2.5 แนวคิดบางข้อสมาร์ทซิตี้ – “Platform for Innovation”

สำหรับแนวคิดเมืองอัจฉริยะสำหรับพื้นที่บริเวณบางข้อจะใช้แนวคิด “Platform for Innovation” ภายใต้อาณาเขตนี้

บทบาทหน้าที่ของสมาร์ทซิตี้ในบริเวณพื้นที่บางข้อ กล่าวคือหน้าที่ในการเป็นจุดเชื่อมต่อในแต่ละด้านทั้ง 7 ด้านจะต้องสอดคล้องกัน ทำให้พื้นที่ดังกล่าวมีการเติบโตอย่างยั่งยืน เทคโนโลยีและบริการอัจฉริยะที่จะถูกนำไปใช้ในพื้นที่จะช่วยสนับสนุนการเชื่อมโยง การมีปฏิสัมพันธ์ของผู้คน ภาครัฐกิจความต้องการ เทคโนโลยี การแลกเปลี่ยนวัฒนธรรม ทำให้เกิดแนวคิดและนวัตกรรมใหม่ เป็นพื้นฐาน (แพลตฟอร์ม) ในการเติบโตของพื้นที่ ตามแนวความคิดนี้ คาดว่าบางข้อจะเป็นพื้นที่ที่สร้างแรงบันดาลใจให้กับผู้ที่มาเยือน อีกทั้งเป็นพื้นที่ที่มีการใช้เทคโนโลยีและนวัตกรรมใหม่ในการแก้ไขปัญหาประเด็นปัญหาของสังคม



ภาพที่ 4 แนวคิดบางข้อสมาร์ทซิตี้

ในการศึกษาครั้งนี้จะเน้น 3 องค์ประกอบของเมืองอัจฉริยะ คือ Smart Mobility Smart Energy และ Smart Environment ซึ่งเป็น 3 องค์ประกอบสำคัญที่ทางคณะผู้ศึกษาได้รับการยืนยันหลังจากการหารือกับภาครัฐของไทยและหน่วยงานที่เกี่ยวข้อง การออกแบบโครงสร้างการดำเนินงานใน 3 ด้านที่สำคัญมีดังต่อไปนี้

3.1 Smart Mobility

(1) ภาพรวม

แนวความคิด Smart mobility ภายในพื้นที่บริเวณบางซื่อเป็นแนวความคิดแบบบูรณาการ มีการประยุกต์ใช้เทคโนโลยีสมัยใหม่ มีการพิจารณาทั้งในด้านสังคม สิ่งแวดล้อม และเศรษฐกิจ จึงขอเสนอแนวความคิด Smart mobility ที่จะป็นทางแก้ไขต่อประเด็นปัญหาภายในบริเวณบางซื่ออย่างยั่งยืน

(2) แนวคิดพื้นฐานของ Smart Mobility

คาดหวังให้รูปแบบของเมืองออกมาในลักษณะ ดังต่อไปนี้:

- ❖ เป็นเมืองที่ผู้คนสามารถเดินในบริเวณพื้นที่ได้อย่างสบายและปลอดภัย (Walkable City)
- ❖ เมืองที่ผู้คนสามารถเคลื่อนที่ไปยังจุดต่างๆ ได้อย่างสบายง่าย และเป็นมิตรต่อสิ่งแวดล้อม
- ❖ เมืองที่ผู้คนสามารถใช้ประโยชน์จากพื้นที่ที่กว้างขวาง โดยมีการจัดการระบบการจราจรภายในพื้นที่อย่างเหมาะสม

เพื่อผลักดันภาพของเมืองในอนาคตให้เกิดขึ้นจริง คณะผู้ศึกษาขอเสนอแนวคิดพื้นฐานเกี่ยวกับ smart mobility ดังนี้

- ❖ สร้างเครือข่ายทางเดินลอยฟ้า (Sky deck) เชื่อมระหว่างสถานีกลางบางซื่อ โซนที่มีการพัฒนา และสถานีขนส่ง
- ❖ คาดว่าจะมีการนำรถ EV ที่เรียกว่า PRT (Personal Rapid transit) มาใช้ วิ่งบนทางเดินลอยฟ้า มีการใช้เทคโนโลยี IoT มาใช้ ทั้งนี้ สามารถนำระบบเคลื่อนที่อัตโนมัติเข้ามาใช้ในอนาคต และ
- ❖ สถานที่จอดรถจะอยู่ในบริเวณรอบนอกของพื้นที่ที่ทำการพัฒนา ผู้มาเยือนจากภายนอกจะต้องจอดรถยนต์ไว้ภายนอก แล้วเดินหรือใช้บริการ PRT เพื่อเคลื่อนย้ายภายในบริเวณ
- ❖ สำหรับถนนในแต่ละโซน เพื่อควบคุมปริมาณการเข้าออก

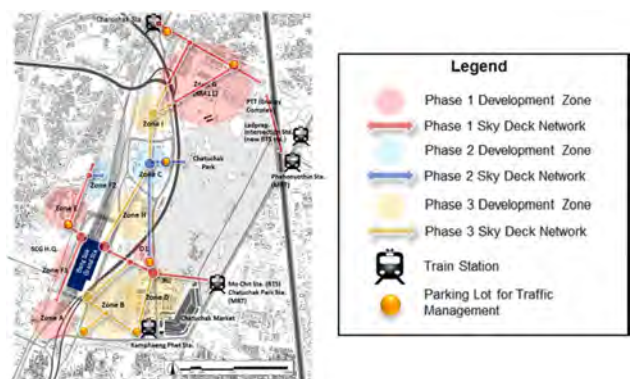
ของรถยนต์ภายในบริเวณ จะสนับสนุนการใช้ระบบขนส่งสาธารณะ เพื่อลดความแออัดของการจราจร



ภาพที่ 4 ภาพแนวคิด Smart Mobility

(3) แผนการพัฒนา Smart Mobility

- ❖ **เครือข่ายทางเดินลอยฟ้า:** เสนอให้มีการสร้างทางเดินลอยฟ้ายกระดับ เชื่อมต่อระหว่างแต่ละโซนกับสถานีกลางบางซื่อ ให้ทางเดินลอยฟ้าเป็นพื้นที่ที่มีแค่ผู้เดินเท้าและรถ PRT เท่านั้นที่จะสามารถเคลื่อนที่บนทางเดินดังกล่าวได้ อีกทั้งการแบ่งแยกทางของรถบ้านและผู้เดินเท้าด้วยความสูงที่ต่างระดับกัน ทำให้การสัญจรทั้งภายในโซนและระหว่างโซนเป็นไปอย่างราบรื่นสมกับเป็นเมืองที่สามารถเดินภายในบริเวณได้ (Walkable City) เพื่อให้เหมาะสมกับสภาพอากาศของไทย จึงควรพิจารณาจัดสร้างหลังคาบังแดด สอดประสานกับการพัฒนาพื้นที่อาคาร



ภาพที่ 5 แนวคิดการออกแบบเครือข่ายทางเดินลอยฟ้า



ภาพที่ 6 แนวคิดเครือข่ายทางเดินลอยฟ้า และ PRT

- ❖ ระบบขนส่งสาธารณะอัจฉริยะ: เสนอให้นำรถ PRT ซึ่งเป็นรถ EV ขนาดเล็กที่เป็นมิตรกับสิ่งแวดล้อมมาใช้วิ่งบนทางเดินลอยฟ้า ในการนำเทคโนโลยี PRT มาใช้นั้นสามารถแบ่งการประยุกต์ใช้เป็นระยะๆ ได้ โดยสามารถรองรับผู้โดยสารได้เป็นจำนวนมากในกรณีที่มีความถี่ในการเดินรถสูง ค่าใช้จ่ายในการนำมาใช้ต่ำกว่าระบบคมนาคมขนส่งอื่นๆ สามารถให้บริการด้านคมนาคมขนส่งที่ตอบสนองความต้องการ ซึ่งแตกต่างกันไปในแต่ละระดับการพัฒนาของพื้นที่และในแต่ละช่วงเวลาได้อย่างยืดหยุ่น
- ❖ การจำกัดปริมาณจราจรที่จะเข้าสู่บริเวณพื้นที่ที่ทำการพัฒนาและการสร้างที่จอดรถรอบนอก: เสนอให้มีการจำกัดปริมาณการจราจรที่จะเข้าสู่บริเวณพื้นที่ที่ทำการพัฒนา เพื่อบรรเทาความหนาแน่นของการจราจรและเกิดเป็นพื้นที่เมืองที่น่าดึงดูดใจ ทั้งนี้ ควรสร้างที่จอดรถรอบนอกบริเวณที่ทำการพัฒนาเช่นบริเวณใกล้เคียงถนนสายสำคัญ เพื่อเป็นที่รองรับรถยนต์จากผู้มาเยือนจากภายนอกและเปลี่ยนมาใช้ระบบขนส่งอื่นแทน



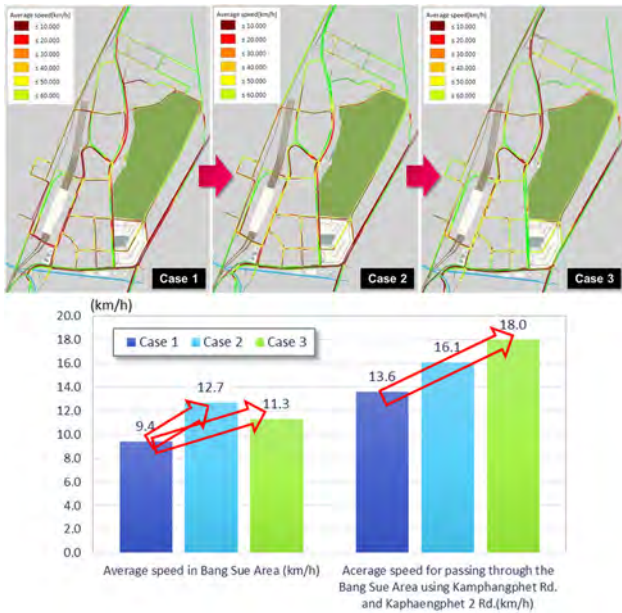
ภาพที่ 7 บริเวณที่มีการควบคุมการจราจรและสถานที่จอดรถรอบนอก



ภาพที่ 8 แนวคิดการออกแบบสถานที่จอดรถรอบนอก

- ❖ การวางผังถนน: เพื่อให้สอดคล้องกับมาตรการจำกัดปริมาณจราจรเข้าสู่ภายในบริเวณ เสนอให้มีการจัดสรรออกแบบพื้นที่ที่เป็นถนนใหม่ เปลี่ยนจากถนนที่เน้นให้ความสำคัญกับการเดินรถของรถยนต์ส่วนบุคคล มาเป็นพื้นที่สาธารณะของเมืองที่เชื่อมโยงระหว่างผู้คน สังคม และธรรมชาติ
 - ❖ มาตรการอื่นๆ ที่เกี่ยวข้องกับ Smart Mobility: นอกเหนือจากแนวความคิดในการดำเนินงานข้างต้น การส่งเสริมให้มีระบบจัดการข้อมูลจราจร ช่องทางเดินรถสำหรับรถยนต์และช่องทางสำหรับผู้เดินเท้า การทำ car sharing และระบบ ride sharing ก็เป็นประเด็นที่สำคัญ
- (4) การประเมินผลกระทบของนโยบาย Smart Mobility
- การจำลองสภาพจราจรจะทำการทดสอบโดยแบ่งออกเป็น 3 กรณี เพื่อทดสอบประสิทธิภาพของนโยบาย
- กรณีที่ 1: สภาพการจราจรในปี 2575 ที่ไม่มีการใช้มาตรการ smart mobility
 - กรณีที่ 2: สภาพการจราจรในปี 2575 ในกรณีที่มีการนำระบบทางเดินลอยฟ้าและรถ PRT ไปใช้
 - กรณีที่ 3: สภาพการจราจรในปี 2575 ในกรณีที่มีการนำระบบเครือข่ายทางเดินลอยฟ้าและรถ PRT ไปใช้ มีการจำกัดปริมาณรถยนต์ที่เข้าสู่บริเวณพื้นที่ภายในและจัดให้มีที่จอดรถรอบนอก

จากผลการวิเคราะห์พบว่า ความเร็วเฉลี่ยในการเคลื่อนตัวของการจราจรบนถนนในพื้นที่บริเวณบางซื่อในกรณีที่ 2 จะเร็วกว่ากรณีที่ 1 ในการนำมาตรการ smart mobility ไปใช้เป็นการสร้างพื้นที่ภายในบริเวณให้เป็นเมืองที่ผู้คนสามารถเดินเท้าได้ (Walkable City) ส่งผลให้การจราจรบนถนนภายในบริเวณได้รับการปรับปรุงให้ดีขึ้น ถึงแม้ว่าขอบเขตการศึกษาในครั้งนี้จะจำกัดเฉพาะภายในพื้นที่บริเวณบางซื่อ แต่การพิจารณาถึงสภาพการจราจรในบริเวณรอบข้างในอนาคตก็เป็นสิ่งสำคัญเช่นเดียวกัน



ภาพที่ 9 การเปรียบเทียบความเร็วเฉลี่ยในการจราจรแต่ละกรณี

3.2 Smart Energy

(1) ภาพรวม

“Smart Energy” สำหรับพื้นที่บริเวณบางซื่อเป็นแนวคิดแบบบูรณาการ ซึ่งมีวัตถุประสงค์มุ่งเน้นให้เกิดการลดการปล่อยก๊าซคาร์บอนไดออกไซด์ สนับสนุนให้ผลิตไฟฟ้าเองและนำไปใช้ภายในบริเวณ อีกทั้งเป็นพื้นที่มีแหล่งไฟฟ้าที่มีความเสถียรและน่าเชื่อถือ สามารถส่งไฟฟ้าได้แม้ในยามเกิดภัยพิบัติ

นอกจากนี้ ในบริเวณใกล้เคียงทางรถไฟเดิมของการรถไฟมีเส้นท่อก๊าซของปตท.อยู่ จึงเสนอนำมาใช้เป็นแหล่งพลังงานอีกแหล่งหนึ่ง โดยสร้างระบบจ่ายกระแสไฟฟ้าแบบ distributed energy system

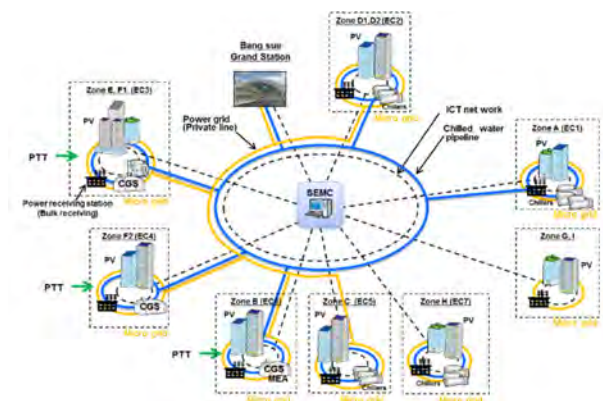
(2) แนวคิดและหลักการพื้นฐานในการพัฒนา

- ❖ แนวคิดและหลักการพัฒนาด้าน Smart Energy: ระบบพลังงานที่เหมาะสมกับเมืองอัจฉริยะที่มุ่งหวังจะเกิดขึ้นในบริเวณพื้นที่บางซื่อนั้นจะพิจารณาตามแนวคิดและหลักการพัฒนา ดังต่อไปนี้



ภาพที่ 10 แนวความคิด Smart Energy

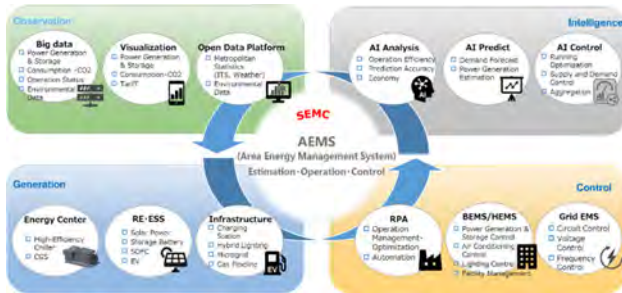
- ❖ แนวคิดพื้นฐานเกี่ยวกับเครือข่าย Smart Energy: ระบบ regional cooling network ซึ่งประกอบด้วยอุปกรณ์แหล่งกำเนิดความเย็นประสิทธิภาพสูงในพื้นที่บริเวณบางซื่อจะรวมกับระบบ microgrid ซึ่งประกอบด้วย CGS และระบบผลิตพลังงานแสงอาทิตย์ เพื่อจัดการกับระบบพลังงานที่มีความซับซ้อนจะมีการใช้เทคโนโลยี ICT มาใช้เพื่อให้เกิดเป็นเครือข่าย Smart energy ที่มีประสิทธิภาพสูงเป็นแหล่งพลังงานที่ไว้วางใจได้ และสร้างภาระต่อสิ่งแวดล้อมน้อยลง สำหรับเครือข่าย smart energy นี้จะมีการจัดตั้งศูนย์พลังงานในแต่ละโซน ซึ่งจะเป็นแหล่งพลังงานไฟฟ้าภายในแต่ละโซน ในขณะเดียวกันการรวมการบริหารศูนย์พลังงานไว้ที่ศูนย์จัดการพลังงาน (SEMC) จะช่วยลดการใช้พลังงานในการควบคุมการปฏิบัติงานของระบบและทำให้การควบคุมระบบที่ซับซ้อนได้ดียิ่งขึ้น



ภาพที่ 11 แนวความคิดเรื่องเครือข่าย Smart Energy

- ❖ ระบบควบคุมพลังงานในรายพื้นที่ (Area Energy Management System: AEMS): SEMC จะนำระบบ AEMS มาใช้เป็นตัวประสานระบบพลังงานที่แยกออกไป

ในแต่ละศูนย์พลังงานที่กระจายอยู่ในแต่ละโซน นำระบบ AI มาใช้เพื่อให้เกิดการจัดการอุปสงค์และอุปทานของพลังงานไฟฟ้าภายในบริเวณอย่างเหมาะสม



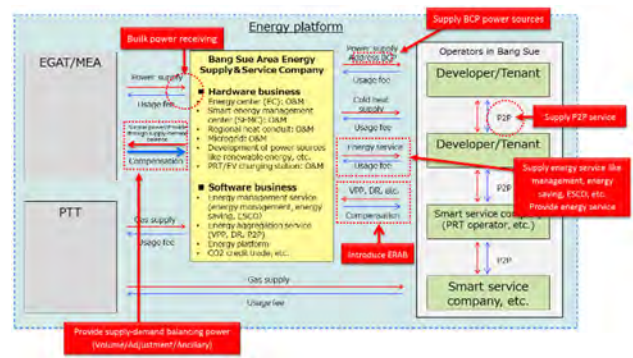
ภาพที่ 12 แนวความคิดเกี่ยวกับ AEMS

- ❖ การสร้างระบบนิเวศเชื่อมโยงระหว่าง smart energy และ smart energy: ระบบ smart energy จะประสานกับระบบ smart mobility และทำหน้าที่ส่งกระแสไฟฟ้า (รวมถึงกระแสไฟฟ้าที่มาจากพลังงานทดแทนด้วย) ให้แก่รถ PRT สร้างให้เกิดเป็นระบบนิเวศของระบบการขนส่งสาธารณะภายในบริเวณที่ทำให้เกิดการระดมสิ่งแวดลอมน้อยลง ในขณะเดียวกัน จะมีการติดตั้งแบตเตอรี่เก็บพลังงานที่รถ PRT โดยแบตเตอรี่ดังกล่าวจะเป็นตัวปรับอุปสงค์อุปทานต่อพลังงาน โดยมุ่งหวังว่าจะมีการนำไปใช้ประโยชน์ต่อได้หลากหลายวัตถุประสงค์ ด้วยระบบเช่นนี้จะก่อให้เกิดเป็นระบบนิเวศระหว่างระบบระบบ smart energy และระบบ smart mobility



ภาพที่ 13 การประสานระหว่างระบบ Smart Energy และระบบ Smart Mobility

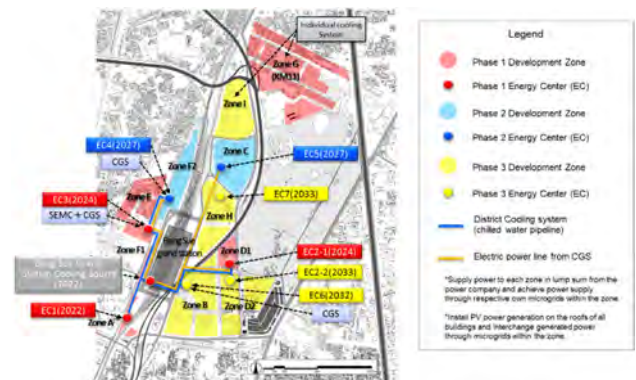
- ❖ รูปแบบในการจัดหาพลังงาน: ระบบการจัดหาพลังงานในพื้นที่บริเวณบางชื่อจะเป็นการสร้างแพลตฟอร์มซึ่งประสานการจัดหาแหล่งพลังงานและบริการด้านพลังงานที่มีมูลค่าเพิ่มสูงเข้าไว้ด้วยกันสร้างเป็นโมเดลทางธุรกิจที่มีความล้ำสมัยในอาเซียน



ภาพที่ 14 โมเดลการจัดการพลังงานรูปแบบใหม่

(3) แผนการพัฒนา Smart Energy

- ❖ **Regional cooling network:** จะมีการจัดตั้งศูนย์พลังงานในโซน A B C E D1 D2 F2 และ H โดยจะใช้ 2 ระบบ คือ ระบบ regional cooling network ซึ่งเป็นโครงข่ายท่อน้ำเย็นเชื่อมโยงระหว่างโซน (สำหรับโซน A, B, E, D1, D2 และ F2) และระบบทำความเย็นที่ทำงานเสร็จสิ้นภายในโซนนั้นๆ เลย (โซน C, D1 และ H)
- ❖ **Microgrid:** ระบบ Microgrid จะถูกสร้างขึ้นตามสายของตนเองในแต่ละโซน ซึ่งจะมีการจ่ายพลังงานไฟฟ้ารวม ในส่วนของพลังงานไฟฟ้าแสงอาทิตย์จะถูกติดตั้งบนหลังคาของทุกอาคารสิ่งอำนวยความสะดวก เพื่อให้เกิดการบริหารพลังงานภายใต้แต่ละ EMS
- ❖ **มาตรการสำหรับกรณีฉุกเฉิน:** จะมีการส่งกระแสไฟฟ้าสำหรับกรณีฉุกเฉินจากศูนย์พลังงานที่มีการนำระบบ CGS มาใช้ (โซน B E และ F2) ไปยังสถานที่สำคัญ คือ สถานีกลางบางซื่อ ศูนย์การแพทย์ (โซน D1) โซน MICE (โซน C) ซึ่งจะช่วยส่งเสริมความมั่นคงด้านพลังงานให้กับบริเวณพื้นที่ดังกล่าว



ภาพที่ 15 แผนร่างการพัฒนา

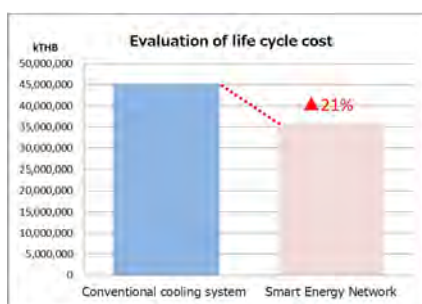
(4) ข้อดีของเครือข่าย Smart Energy

❖ ผลดีในการลดการปล่อยก๊าซคาร์บอนไดออกไซด์:

เครือข่าย smart energy ในบริเวณพื้นที่บางซื่อ เมื่อเทียบกับกรณีการใช้ระบบปรับอากาศแยกส่วนแบบดั้งเดิมคาดว่าจะช่วยลดการปล่อยก๊าซคาร์บอนไดออกไซด์ได้ประมาณร้อยละ 28

❖ ต้นทุนรวมตลอดวงจรชีวิต (Life Cycle Cost):

เครือข่าย smart energy ในบริเวณพื้นที่บางซื่อช่วยลดต้นทุนรวมตลอดวงจรชีวิตได้ราวร้อยละ 21 เมื่อเทียบกับกรณีใช้ระบบปรับอากาศแยกส่วนแบบดั้งเดิม



ภาพที่ 16 การเปรียบเทียบต้นทุนตลอดวงจรชีวิต

3.3 Smart Environment

(1) ภาพรวม

Smart Environment เป็นองค์ประกอบที่เป็นข้อบังคับที่ต้องประกอบอยู่ในโครงการเมืองอัจฉริยะของประเทศไทย มีการเสนอประเด็นเกี่ยวกับ Smart Environment หลายประการ โดยคำนึงถึงลักษณะของพื้นที่บริเวณบางซื่อ

(2) หลักการพื้นฐานของ Smart Environment

ได้มีการนำเสนอประเด็นสำคัญและวิธีการปฏิบัติสำหรับ Smart Environment ดังต่อไปนี้



ภาพที่ 17 เทคโนโลยีและบริการด้าน Smart Environment ที่นำเสนอ

- ❖ **เครือข่ายสีเขียว:** ควรมีการพัฒนาเครือข่ายสีเขียวบริเวณรอบสวนจตุจักร เพื่อให้เกิดสภาพแวดล้อมตามธรรมชาติที่ร่มรื่น สามารถเดินเท้าสัญจรได้ (green network) ประเด็นนี้ควรมีการอธิบายไว้ในแผนการพัฒนา อีกทั้งควรมีการระบุหน่วยงานผู้ปฏิบัติงานในกลุ่มแนวทางการพัฒนาเมืองบริหาร
- ❖ **ระบบติดตามสภาพแวดล้อม:** แนะนำให้มีการนำมามาตรการดังต่อไปนี้ไปดำเนินการเพื่อให้เกิดเป็นเมืองที่มีการ

ตระหนักถึงความสำคัญของสิ่งแวดล้อม (1) การเก็บและเปิดเผยข้อมูลเกี่ยวกับสิ่งแวดล้อม เช่น ดัชนีมลพิษทางอากาศ และ (2)การนำระบบจัดการสิ่งแวดล้อม เช่น ระบบจัดการคำร้องทุกข์เกี่ยวกับสิ่งแวดล้อมมาใช้ เป็นต้น

- ❖ **การจัดการน้ำและสิ่งปฏิกูล:** การจัดการขยะและสิ่งปฏิกูลควรดำเนินงานร่วมกับกรุงเทพมหานคร ลดการทิ้งขยะที่เป็นของแข็งด้วยการส่งเสริมให้เกิดการรีไซเคิลและการนำกลับไปใช้ซ้ำ รวมทั้งการใช้ระบบแยกขยะที่มีการนำเทคโนโลยีเข้ามาประยุกต์ใช้จะทำให้ประสิทธิภาพในการจัดการขยะดียิ่งขึ้นอีกด้วย สำหรับการจัดการน้ำและสิ่งปฏิกูล ควรมีการส่งเสริมให้มีการรีไซเคิลน้ำ และดูแลคุณภาพของน้ำโดยรวมมือกับการประปานครหลวง
- ❖ **การขนส่งสาธารณะที่เป็นมิตรต่อสิ่งแวดล้อม:** สนับสนุนโครงสร้างระบบบริการขนส่งสาธารณะที่เป็นมิตรต่อสิ่งแวดล้อม เช่น การให้บริการด้านการขนส่งคมนาคมด้วยรถ EV การส่งเสริมการแชร์จักรยาน รวมไปถึงการจัดโซนที่ให้ความสำคัญกับผู้เดินเท้าเป็นอันดับแรก และทางเดินลอยฟ้า ตามแนวคิด TOD
- ❖ **การจัดการภูมิทัศน์ที่เหมาะสมและมาตรการเกี่ยวกับเสียงรบกวนและแรงสั่นสะเทือน:** ควรมีการควบคุมการจัดการภูมิทัศน์ตามคู่มือแนวทางการพัฒนาเมือง เสียงรบกวนและแรงสั่นสะเทือนควรได้รับการผ่านควบคุมผ่านการใช้เทคโนโลยีต่างๆ เช่น การใช้วัสดุป้องกันเสียง การเทคอนกรีตเพื่อดูดซับเสียง รอยต่อบนถนนที่ดูดซับเสียง ซึ่งเป็นเทคโนโลยีที่นำไปใช้แล้วเห็นผลประจักษ์ในกรณีของถนนในญี่ปุ่น เป็นต้น
- ❖ **การจัดทำแนวทางการพัฒนาเมืองและการจัดตั้งหน่วยงานบริหารพื้นที่:** แนะนำให้จัดทำแนวทางการพัฒนาเมืองเพื่อเป็นเครื่องมือสำคัญในการพัฒนาพื้นที่บริเวณบางซื่อให้เป็นแบบแผนเดียวกันโดยแนวทางดังกล่าวจะช่วยกระตุ้นให้ผู้พัฒนาพื้นที่ในแต่ละโซนปฏิบัติตามกฎเกณฑ์ในด้านสิ่งแวดล้อม กฎเกณฑ์เกี่ยวกับภูมิทัศน์ของเมือง และกฎการป้องกันภัยพิบัติ โดยมีการจัดตั้งหน่วยงานในการบริหารพื้นที่เพื่อเป็นผู้บังคับใช้แนวทางดังกล่าว และประสานงานระหว่างผู้เกี่ยวข้อง

3.4 แพลตฟอร์มข้อมูลเปิด (Open Data Platform) และศูนย์เมืองอัจฉริยะ (Smart City Center)

(1) แนวคิดแพลตฟอร์มข้อมูลเปิด (Open Data Platform)

แพลตฟอร์มข้อมูลเปิดเป็นการรวบรวม ผสมผสาน ข้อมูลต่างๆ เพื่อใช้ในวัตถุประสงค์ต่างๆ เช่น การบริหารเมือง การสำรวจและวางแผนเพื่อส่งเสริมธุรกิจ มุ่งหวังให้ แพลตฟอร์มดังกล่าวมีบทบาทในการช่วยเหลือการจัดตั้งธุรกิจ และบริการใหม่ที่มีการนำเครือข่าย 5G และเทคโนโลยี IoT มา ใช้



ภาพที่ 18 แนวคิดเรื่องแพลตฟอร์มข้อมูลเปิด

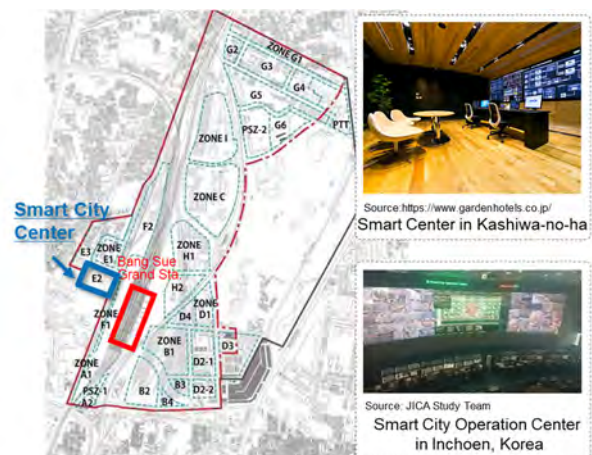
แพลตฟอร์มข้อมูลเปิดช่วยสนับสนุนการสร้างบริการ จัดตั้งธุรกิจใหม่ของบริษัทเอกชน เช่น บริษัท start-up ที่ต้องใช้ ข้อมูลมากมาย การสร้างสภาพแวดล้อมเช่นนี้จะทำให้พื้นที่ บริเวณบางซื่อกลายเป็นศูนย์รวมของภาคเอกชนที่แสวงหา โอกาสทางธุรกิจ ซึ่งคาดว่าจะทำให้สินทรัพย์ภายในพื้นที่ บริเวณดังกล่าวมีมูลค่าสูงขึ้นตามไปด้วย ในการผลักดันให้เกิด สภาพแวดล้อมดังกล่าวจำเป็นต้องดำเนินการดังต่อไปนี้

- การจัดตั้งศูนย์เมืองอัจฉริยะ
- การเก็บรวบรวมและเปิดเผยข้อมูลเปิด: ให้บริการเก็บ รวบรวมและเปิดเผยข้อมูลสิ่งก่อสร้างและลักษณะพื้นที่แบบ 3D ข้อมูลเกี่ยวกับสภาพการจราจรและพลังงานไฟฟ้า
- การติดตั้งไฟเบอร์ออฟติก: ติดตั้งไฟเบอร์ออฟติกเพื่อรักษา คุณภาพสัญญาณ 5G (เช่น eMBB, eMTC และ URLLC เป็นต้น) ในพื้นที่บริเวณบางซื่อ

- การติดตั้งกล้องวงจรปิด: นำกล้องวงจรปิดที่ใช้สำหรับ มาตรการแก้ไขปัญหาการจราจรติดขัดและช่วยด้านกลยุทธ์ ด้านการตลาดของสถานที่เชิงพาณิชย์ รวมทั้งแอปพลิเคชัน สำหรับใช้งานมาใช้

(2) การจัดตั้งศูนย์เมืองอัจฉริยะ

เสนอให้มีการจัดตั้งศูนย์เมืองอัจฉริยะในบริเวณโซน D ศูนย์เมืองอัจฉริยะจะเป็นอาคารขนาดใหญ่ ประกอบด้วย ออฟฟิศสำหรับบริหารกิจการเกี่ยวกับบริการอัจฉริยะ (smart service) ศูนย์ข้อมูลขนาดเล็ก อีกทั้งยังมีสิ่งอำนวยความสะดวก ที่ช่วยพัฒนาสภาพแวดล้อมความเป็นอยู่ของประชาชนใน บริเวณนั้น เช่น ศูนย์การเรียนรู้ตลอดชีพ ศูนย์ชุมชน เคา์เตอร์ ติดต่อหน่วยงานของรัฐ เป็นต้น เพื่อจัดตั้งศูนย์เมืองอัจฉริยะ ความร่วมมือจากร่วมกับหน่วยงานที่เกี่ยวข้อง เช่น กรุงเทพมหานคร และสำนักงานส่งเสริมเศรษฐกิจดิจิทัลเป็นสิ่ง ที่ขาดไม่ได้



ภาพที่ 19 บริเวณและภาพจำลองศูนย์เมืองอัจฉริยะ

ตารางที่ 1 แผนเกี่ยวกับสิ่งอำนวยความสะดวกต่างๆในศูนย์เมืองอัจฉริยะ

Facility Plan	Functions	Cooperation with:
Monitoring Room	Space (control rooms) to display CCTV and collected data on large monitors	BMA, RTP
Data Center	Server room to store software and data needed to implement the smart service business	CAT/DEPA
Exhibition Room	Exhibition room to introduce smart city service	CAT/DEPA
Work/ Conference Space	Work/Conference space to address staff and visitors	CAT/DEPA
Energy Plant	Facilities to install cogeneration and cooling systems	MEA EGAT
Community Space	Space for lifelong learning center or administrative consultation service	BMA
PRT Parking Lot	PRT parking lot, inspection, and recharging space	BMA

4.1 เงื่อนไขในการพิจารณาโครงสร้างการดำเนินงาน

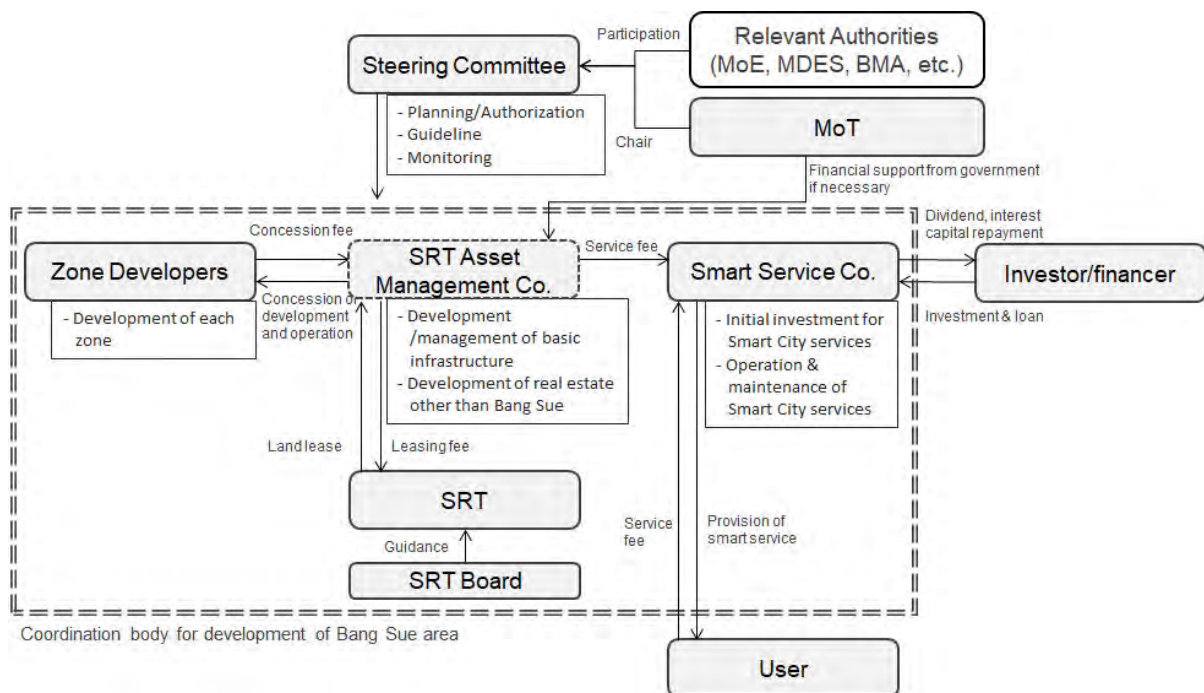
ในการพิจารณาโครงสร้างการดำเนินงานในการพัฒนาพื้นที่บริเวณบางซื่อโดยรวมได้นำเสนอแนวทางโดยคำนึงถึงการพัฒนาอย่างเป็นแบบแผนเดียวกันและการเข้ามามีส่วนร่วมของภาคเอกชนเป็นพื้นฐาน อีกทั้งยังได้หารือกับทางรัฐบาลไทยและได้นำเจตจำนงและสภาพการปัจจุบันของทางการไทยมาพิจารณาร่วมด้วย ทั้งนี้จะให้ความสำคัญกับ 3 ประเด็น ดังนี้

- ❖ **การตัดสินใจระดับสูงในด้านนโยบายและการประสานงาน:** ในการดำเนินงานโครงการพัฒนาขนาดใหญ่และเป็นการพัฒนาระยะยาวเช่นกรณีพื้นที่บริเวณบางซื่อนั้น จำเป็นต้องมีการจัดตั้งหน่วยงานในฐานะหน่วยงานระดับสูงของรัฐบาล ซึ่งจะมาทำหน้าที่ประสานงานระหว่างภาครัฐกับหน่วยงานที่เกี่ยวข้อง และบริหารโครงการ

- ❖ **การจัดตั้งบริษัทบริหารสินทรัพย์ของการรถไฟแห่งประเทศไทย (Asset Management Company: AMC):** การจัดตั้ง AMC ขณะนี้อยู่ในขั้นตอนอนุมัติขั้นสุดท้าย เนื่องจาก AMC จะได้รับมอบหมายให้ ควบคุมดูแลทรัพย์สินของทางการรถไฟแห่งประเทศไทย จึงควรทำหน้าที่เป็นหน่วยงานหลักในการพัฒนาพื้นที่บริเวณบางซื่อ
- ❖ **การเสริมศักยภาพทางเทคนิคและการเงินให้กับการรถไฟและ AMC:** ทั้งการรถไฟและ AMC ที่กำลังจะจัดตั้งขึ้นใหม่ต่างไม่มีประสบการณ์ในการพัฒนาเมืองอัจฉริยะ อีกทั้งยังมีข้อจำกัดอย่างมากในด้านงบประมาณ จำเป็นต้องมีการเสริมศักยภาพในส่วนที่ยังขาด

4.2 แนวคิดเกี่ยวกับโครงสร้างการดำเนินงานโดยรวม

จากเงื่อนไขข้างต้น จึงขอเสนอโครงสร้างการดำเนินงานโดยรวม บทบาทหน้าที่และโครงสร้างของแต่ละหน่วยงานดังต่อไปนี้



ภาพที่ 20 โครงสร้างการดำเนินงานโดยรวมในการพัฒนาพื้นที่บริเวณบางซื่อ

(1) คณะกรรมการขับเคลื่อน

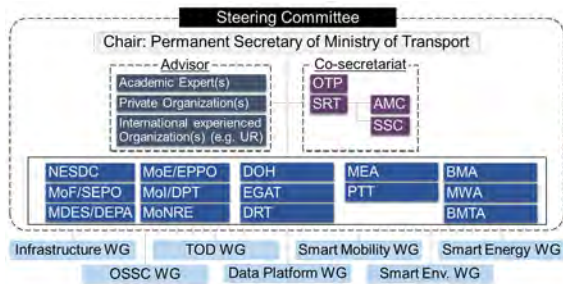
สำหรับคณะกรรมการขับเคลื่อน เสนอให้ปลัดกระทรวงคมนาคมเป็นประธานคณะกรรมการ โดยมีกระทรวงคมนาคม (สำนักงานนโยบายและแผนการขนส่งและจราจร) และการรถไฟแห่งประเทศไทยเป็นฝ่ายเลขานุการ โดยคณะกรรมการจะ

เป็นผู้ตัดสินใจเกี่ยวกับนโยบาย แผนการพัฒนา และนโยบายการบริหารเมืองโดยเร่งด่วน

โดยนโยบายพื้นฐานคณะกรรมการฯ นอกจากจะสนับสนุนโครงการด้วยการประชุมหาความเห็นชอบจากผู้มีส่วนเกี่ยวข้องแล้ว ยังมีหน้าที่ในการควบคุมความคืบหน้าของการพัฒนาอีกด้วย

นอกจากนี้คณะกรรมการยังมีอำนาจในการอนุมัติ master plan และแนวทางการพัฒนาอีกด้วย

สำหรับการประสานงานเกี่ยวกับ smart service การพิจารณาการผ่อนปรนกฎหมาย การดำเนินธุรกิจ smart service เป็นบริการเชิงพาณิชย์ ควรมีการจัดตั้งคณะทำงานภายใต้คณะกรรมการขับเคลื่อน



ภาพที่ 21 ฝั่งองค์กรของคณะกรรมการขับเคลื่อน

(2) บริษัทบริหารทรัพย์สิน (Asset Management Company: AMC)

AMC จะเป็นหน่วยงานผู้รับผิดชอบการพัฒนาพื้นที่บริเวณบางซื่อโดยรวม และประสานงานกับหน่วยงานที่เกี่ยวข้อง AMC จะเช่าซื้อที่ดินจากการรถไฟแห่งประเทศไทย ทำการพัฒนาที่ดิน หรือนำที่ดินไปให้เอกชนผู้พัฒนาที่ดินเช่าซื้อต่อ AMC จะเป็นผู้ดูแลสัญญาเช่าซื้อกับเอกชนผู้พัฒนาที่ดิน และสัญญาให้บริการกับทางบริษัท Smart service (SSC)

ในการพัฒนาโครงสร้างพื้นฐาน เช่น ถนน การระบายน้ำ น้ำประปา การจัดการขยะและสิ่งปฏิกูล ในพื้นที่บริเวณบางซื่อ AMC จะประสานงานกับหน่วยงานที่เกี่ยวข้อง เช่น กรุงเทพมหานคร การประปานครหลวง การไฟฟ้านครหลวง เป็นต้น

นอกจากนี้ AMC ยังจะต้องนำค่าสัมปทานจากบริษัทผู้พัฒนาพื้นที่ไปจ่ายเป็นค่าบริการให้กับ SSC เป็นเงินทุนให้กับ SSC ที่เป็นผู้ให้บริการ smart service ซึ่งทำกำไรได้ยาก AMC จะพิจารณาการให้บริการ smart services ร่วมกับ SSC

หากการจัดตั้ง AMC ล่าช้าหรือจัดตั้งไม่ได้ การรถไฟแห่งประเทศไทยจะต้องเป็นผู้รับผิดชอบแทนในส่วนของ AMC

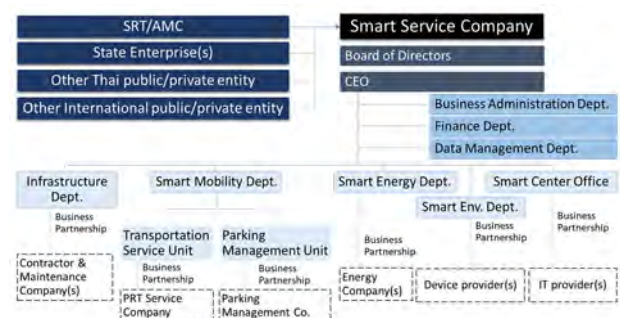


ภาพที่ 22 ฝั่งองค์กรของ AMC

(3) บริษัท Smart Service (SSC)

SSC จะเป็นหน่วยงานที่ดำเนินการทั้งก่อสร้างดำเนินงาน บริหารงาน ซ่อมบำรุงโครงสร้างพื้นฐานที่เป็นพื้นฐานของบริการภายในเมืองอัจฉริยะ โดยเฉพาะอย่างยิ่ง เป็นผู้ให้บริการ smart service แก่บริษัทผู้พัฒนาพื้นที่ ประชาชนภายในพื้นที่ และผู้มาเยือนผ่านเทคโนโลยีสมัยใหม่ SSC จะพิจารณาให้บริการ smart services ร่วมกับ AMC

อาจจัดตั้ง SSC ในรูปแบบ Special Purpose Vehicle (SPV) ซึ่งรัฐบาลไทยเป็นผู้กำหนดผู้ถือหุ้นและต้องได้รับการอนุมัติจากคณะรัฐมนตรี (ซึ่งโดยส่วนใหญ่ผู้ถือหุ้นจะเป็นรัฐวิสาหกิจ) หรือรูปแบบกิจการร่วมค้า (joint venture) ระหว่างการรถไฟแห่งประเทศไทยกับหน่วยงานอื่นเช่น รัฐวิสาหกิจอื่น ซึ่งภายใต้รูปแบบนั้น นอกจากคาดว่าหน่วยงานทั้งภาครัฐและภาคเอกชนจากต่างประเทศจะสามารถเข้าร่วมได้ในอนาคต



ภาพที่ 23 ฝั่งองค์กรของ Smart Service Company

(4) บริษัทผู้พัฒนาพื้นที่

บริษัทผู้พัฒนาพื้นที่แต่ละโซนจะได้รับการคัดเลือกโดยการประมูล โดยแยกเป็นแต่ละโซน โดยเริ่มจากโซน A จนถึง I และเริ่มทำการพัฒนาตามสัญญา ได้รับผลตอบแทนจากการพัฒนา และจ่ายค่าสัมปทานตามสัญญาให้กับ AMC



แนวความคิดเกี่ยวกับโมเดลธุรกิจ

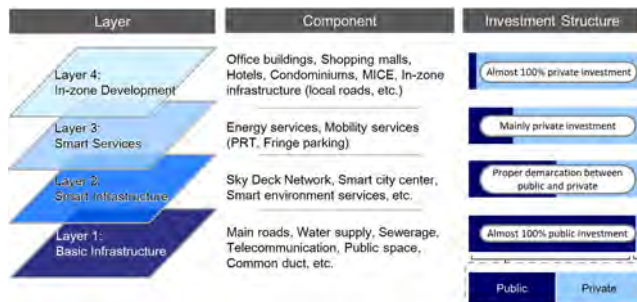
5.1 การร่วมลงทุนและการประเมินมูลค่าโครงการ

(1) การร่วมลงทุน

เงินลงทุนในโครงการพัฒนาพื้นที่บริเวณบางซื่อจะมาจากงบประมาณของภาครัฐ รัฐวิสาหกิจ เงินลงทุนจากเอกชน ผู้พัฒนาพื้นที่ และเงินทุนของบริษัท Smart service การจัดหาเงินทุนเพื่อนำมาใช้ในการพัฒนาโครงสร้างพื้นฐานและสิ่งอำนวยความสะดวกของเมืองอัจฉริยะจะแบ่งออกเป็น 4 ระดับ ตามลักษณะของโครงสร้างพื้นฐานและสิ่งอำนวยความสะดวกนั้นๆ และลักษณะของหน่วยงานผู้ดำเนินการ

ระดับที่ 1 โครงสร้างพื้นฐานทั่วไปจะได้รับการพัฒนาโดยใช้เงินลงทุนจากงบประมาณภาครัฐหรือเงินทุนจากรถไฟแห่งประเทศไทยซึ่งเป็นเจ้าของพื้นที่ ระดับที่ 2 โครงสร้างพื้นฐานสำหรับการเป็นเมืองอัจฉริยะ ส่วนหนึ่งจะเป็นการลงทุนจากภาคเอกชน ระดับที่ 3 กิจกรรม smart service

SSC และภาคเอกชนอื่นจะเป็นผู้ลงทุน ระดับที่ 4 การพัฒนาในแต่ละโซน โดยหลักการจะเป็นการลงทุนโดยภาคเอกชน



ภาพที่ 24 การลงทุนในแต่ละระดับ

(2) การประเมินค่าใช้จ่ายในการลงทุน

ทางคณะผู้ศึกษาได้คำนวณต้นทุนทั้งหมดเบื้องต้นบนฐานขององค์ประกอบเมืองอัจฉริยะที่ได้นำเสนอไปและต้นทุนต่อหน่วยเบื้องต้น การประเมินต้นทุนในการลงทุนดังสรุปได้ในตารางที่ 2

ตารางที่ 2 ต้นทุนในการลงทุนประเมินตามระดับและระยะของการดำเนินงาน

Category			Approximate cost (Million THB)			
			Total	Phase 1	Phase 2	Phase 3
Layer 1	Basic Infrastructure	Major Road	134	24	19	91
		Zone Boundary Road	277	111	21	145
		Other (Water, etc.)	4,817	2,884	832	1,101
	Disaster Prevention		32	13	6	13
	Green Network		37	13	6	18
Layer 2	Sky Deck (Outside the Zones)		2,318	1,534	457	327
	Smart Environment		19	18	1	0
	Smart City Platform		745	377	171	198
Layer 3	Smart Mobility		3,376	1,398	1,062	916
	Smart Energy		11,140	3,905	2,795	4,440
TOTAL (Layer 1~3)			22,895	10,277	5,370	7,249
	Buildings	Office	42,089	20,222	5,691	16,177
		Commercial facility	34,767	9,226	10,706	14,835
		Residence	172,568	65,532	39,439	67,597
		Hotel	17,343	5,852	4,282	7,208
		Cultural facility	8,723	4,758	3,965	0
		Public office	4,758	4,758	0	0
	Inter-zone Infrastructure		1,147	643	93	411
	Sky Deck (Inside the Zones)		3,932	1,606	620	1,705
TOTAL (Layer 4)			285,327	112,597	64,796	107,933
TOTAL			308,222	122,874	70,165	115,183



5.2 แนวความคิดเกี่ยวกับโมเดลธุรกิจ

(1) โมเดลทางธุรกิจของเมืองอัจฉริยะที่น่าเสนอ (กรณีพื้นฐาน)

ในการพิจารณาเกี่ยวกับบริเวณพื้นที่บางซื่อ เนื่องจากที่ดินของบริเวณพื้นที่บางซื่อ (ทั้งหมดราว 370 เฮกเตอร์) เป็นของการรถไฟแห่งประเทศไทย ดังนั้นกิจกรรมการพัฒนาต่างๆ รวมถึงการพัฒนาโครงสร้างพื้นฐานจึงควรบริหารงานโดยการรถไฟแห่งประเทศไทย การรถไฟแห่งประเทศไทย หรือ AMC อาจไม่มีขีดความสามารถพอทั้งในด้านงบประมาณ และความรู้ด้านเทคนิค ดังนั้นจึงคาดหวังว่าการจัดตั้ง Smart Service Company จะส่งผลให้มีความสามารถเพียงพอในการระดมทุน และบริหารการพัฒนาเมืองอัจฉริยะตามที่ได้ออกเสนอในการศึกษาครั้งนี้



ภาพที่ 25 ภาพแนวคิดเกี่ยวกับกระแสเงินตามโมเดลธุรกิจที่น่าเสนอ

ในกรณีพื้นฐาน โครงสร้างพื้นฐานในระดับ 1-3 SSC เป็นผู้รับผิดชอบ หลังจาก AMC ได้รับค่าสัมปทานจากบริษัทผู้พัฒนาพื้นที่เป็นที่เรียบร้อยแล้ว ก็จะแบ่งรายได้ส่วนหนึ่งไปให้กับทาง SSC เป็นค่าบริการ smart service เป็นผลตอบแทนจากที่ SSC ได้ลงทุนขึ้นต้นไปในส่วนของการบริการด้าน Smart energy และ mobility services คาดว่าจะสามารถคุ้มทุนได้โดยอาศัยค่าบริการจากผู้ใช้งานเพียงอย่างเดียว

(2) องค์ประกอบทางด้านธุรกิจ

กิจการเมืองอัจฉริยะของ SSC จะประกอบด้วยธุรกิจดังต่อไปนี้:

- **Smart Mobility:** ดำเนินการระบบรถโดยสาร PRT และให้บริการที่จอดรถรอบนอกพื้นที่
- **Smart Energy:** ให้บริการและบริหารงานเกี่ยวกับพลังงานผ่านระบบ cogeneration ระบบ regional cooling ภายในพื้นที่

- **Smart Environment:** บริหารพื้นที่สีเขียว และพื้นที่เปิดสาธารณะ

- **ศูนย์เมืองอัจฉริยะ:** ดำเนินการและบริหารงานศูนย์เมืองอัจฉริยะ

- **Smart Infrastructure:** ดำเนินการและบริหารงานโครงสร้างพื้นฐานอัจฉริยะ เช่น เครือข่ายทางเดินลอยฟ้า เป็นต้น

ในส่วนบริการด้าน Smart Mobility และ Smart Energy เป็นธุรกิจที่สร้างรายได้ได้โดยตรงได้จากผู้ให้บริการ ในขณะที่ธุรกิจอื่นเช่น smart Environment ศูนย์เมืองอัจฉริยะจะสามารถดำเนินการได้โดยอาศัยรายได้จากค่าบริการจากการรถไฟ และ AMC

5.3 การวิเคราะห์ความคุ้มค่า

ที่ดินของบริเวณพื้นที่บางซื่อโดยพื้นฐาน (ทั้งหมดราว 370 เฮกเตอร์) เป็นของการรถไฟแห่งประเทศไทย แต่อย่างไรก็ตาม อาจมีบางกรณีที่มีการแบ่งเขตการพัฒนาโครงสร้างพื้นฐานได้ เนื่องจากพื้นที่กว้างเกินกว่าจะได้รับการพัฒนาจากหน่วยงานเพียงหน่วยงานเดียว และการพัฒนาบางข้อสามารถชี้ตัวควรได้รับความสำคัญในฐานะโครงการระดับชาติ เนื่องจากโครงการบางข้อสามารถชี้ตัวเป็นหนึ่งในโครงการเร่งรัดของการพัฒนาเมืองอัจฉริยะและเป็นประตูเชื่อมโยงอาเซียนแห่งใหม่ ซึ่งได้รับคาดหวังว่าภาครัฐควรเข้ามามีส่วนร่วมมากขึ้น

การวิเคราะห์ความคุ้มค่าครอบคลุมทุกธุรกิจของ SSC โดยจะแบ่งออกเป็น 4 กรณี ตามแผนการลงทุน ดังปรากฏในตารางที่ 3

กรณีที่ 1 เป็นกรณีที่การรถไฟแห่งประเทศไทยจะลงทุนในเงินลงทุนเบื้องต้นให้ก่อนได้รับรายได้จากผู้พัฒนาในแต่ละโซน กรณีที่ 2 เป็นกรณีที่หน่วยงานภาครัฐและรัฐวิสาหกิจจะลงทุนในโครงสร้างพื้นฐาน (รวมทางเดินลอยฟ้า) กรณีที่ 3 (กรณีพื้นฐาน) ซึ่ง SSC จะเป็นผู้ดำเนินการโครงสร้างพื้นฐานทั้งหมดและทางเดินลอยฟ้า (นอกโซนพัฒนา) และกรณีที่ 4 ซึ่ง SSC และหน่วยงานภาครัฐจะช่วยรับผิดชอบการลงทุนในโครงสร้างพื้นฐานบางส่วน

สำหรับระดับของค่าบริการ smart service ได้ตั้งเงื่อนไขไว้ให้สามารถคุ้มทุนได้สำหรับทางเลือกที่ 3 ซึ่งเป็นกรณีพื้นฐาน จากผลการวิเคราะห์ความคุ้มทุน ตามโมเดลธุรกิจที่นำเสนอไป เมื่อถึงจุดที่เกิดความคุ้มทุน ก็จะ能够帮助ลดการขาดดุลของการรถไฟฟ้า

อย่างไรก็ตาม สิ่งที่เราควรระวังคือความคุ้มทุนนั้นขึ้นกับอุปสงค์ต่อบริการเป็นอย่างมาก ดังนั้นหากมีวางแผนแผน

ธุรกิจของ SSC เสร็จสิ้นเรียบร้อยแล้ว เห็นควรให้มีการพิจารณาในรายละเอียดอีกครั้ง นอกจากนี้ แผนการในการลดความเสี่ยงและการจัดการที่มีความยืดหยุ่นเป็นสิ่งสำคัญในการรักษาให้เกิดความคุ้มทุนและสามารถดำเนินธุรกิจต่อไปได้อย่างยั่งยืน

ตารางที่ 3 ผลการวิเคราะห์ความคุ้มทุน

Category			Case1	Case2	Case3 (Base Case)	Case4
Demarcation						
Layer 1	Basic Infrastructure	Major Road	AMC/SRT	Public	SSC(w/ SF)	Public
		Zone Boundary Road	AMC/SRT	Public	SSC(w/ SF)	SSC(w/ SF)
		Other (Water, telecom, etc.)	AMC/SRT	Public	SSC(w/ SF)	Public
	Disaster Prevention		AMC/SRT	Public	SSC(w/ SF)	Public
	Green Network		AMC/SRT	Public	SSC(w/ SF)	Public
Layer 2	Sky Deck (Outside the Zones)		AMC/SRT	Public	SSC(w/ SF)	SSC(w/ SF)
	Smart Environment		SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)
	Smart City Platform		SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)	SSC(w/ SF)
Layer 3	Smart Mobility		SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)
	Smart Energy		SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)	SSC(w/o SF)
Layer 4	Inter-zone Development		Private	Private	Private	Private
Criteria						
Coordination in infrastructure development			★★★	★	★★★★	★★
Financial burden on SRT (especially for initial cost)			★	★★★★	★★	★★★
Financial burden on Public			★★★	★	★★★	★★
Execution capability of the agency			★	★★★★	★★	★★★
Risk distribution(too much risk on one agency)			★	★★	★	★★★
Public sector involvement			★	★★★★	★	★★★
Private sector involvement and future prospect			★	★	★★★	★★★
Smart Service Co.	Project IRR (2020-61)		39.4% (36.2%)	39.4% (36.2%)	8.7% (14.9 %)	20.8 % (26.1 %)
	Average of ROE (2034-61)		22.6 % (25.8%)	22.6 % (25.8%)	5.8% (15.1%)	14.7% (21.9%)
AMC (SRT)	Accumulated NCF (2034) (Million THB)		17,719 (17,267)	28,514 (28,062)	27,753 (27,240)	28,254 (27,802)
	Accumulated NCF (2061) (Million THB)		112,185 (111,733)	131,316 (130,863)	130,554 (139,942)	131,056 (130,604)

SSC(w/ SF): การลงทุนของ SSC แบบมีค่าบริการ SSC(w/o SF): การลงทุนของ SSC แบบไม่มีค่าบริการ

* กำหนดค่าบริการที่ทางกรรถไฟฟ้าแห่งประเทศไทยจ่ายให้กับ SSC ไว้ที่ร้อยละ 33 (2565-2576) และร้อยละ 14 (2577-2604) ของรายได้ของการรถไฟฟ้าที่ได้รับเป็นค่าเช่าที่ดินจากบริษัทผู้พัฒนาที่ดินตามลำดับ

** ตัวเลขในวงเล็บรวมบริการด้าน Smart Mobility เนื่องจากความคุ้มทุนของบริการด้าน smart mobility service ค่อนข้างผันผวนตามความต้องการ (ขึ้นกับความผันผวนของความต้องการใช้บริการ) รายได้ในส่วนของ smart mobility จึงถูกแยกออกจากการประเมินความคุ้มทุนของการรถไฟฟ้าและ SSC ถ้า SSC สามารถทำรายได้ได้อย่างเพียงพอจากบริการ smart mobility อาจพิจารณาเปลี่ยนแปลงค่าบริการที่ AMC จ่ายให้กับกรรถไฟฟ้าได้



6.1 แผนปฏิบัติการในการขับเคลื่อนโครงการ

(1) ประเด็นปัญหาในการดำเนินโครงการ

ดังกล่าวข้างต้นการพัฒนาบางข้อสมารถชี้ดีเป็นการนำศักยภาพที่มีออกมาใช้อย่างเต็มที่ สนับสนุนนโยบายไทยแลนด์ 4.0 อีกทั้งยังถือเป็นตัวอย่างในการพัฒนาเมืองในรูปแบบใหม่ ซึ่งจะสร้างประโยชน์ให้กับสังคมไทยเป็นอย่างมาก

อย่างไรก็ตาม มีประเด็นปัญหามากมายที่ต้องแก้ไขและจำเป็นต้องเร่งดำเนินการอย่างรวดเร็ว เนื่องจากโครงการดังกล่าวมีขนาดใหญ่ อีกทั้งระยะเวลาดำเนินงานยาวนานจึง โดยเฉพาะอย่างยิ่งการพัฒนาในระยะแรกที่จะต้องสอดคล้องกับการก่อสร้างสถานีกกลางบางซื่อและสายรถไฟฟ้าสายสีแดงใกล้จะเปิดดำเนินการ ให้สอดคล้องกับการพัฒนาเครือข่ายคมนาคมดังกล่าว

ในบรรดาประเด็นปัญหามากมาย ทางคณะผู้ศึกษาขอเสนอประเด็นปัญหา ซึ่งเป็นประเด็นสำคัญและจำเป็นต้องได้รับการแก้ไขอย่างเร่งด่วน 3 ด้าน ดังนี้

	Challenge 1: High level decision making and coordination
- Implement necessary deregulation measures - Approval and authorization of plans and actions	
	Challenge 2: Fulfil financial gaps and technical capabilities
- Finance for initial investment - Technical capability to lead Smart City project	
	Challenge 3: Mechanism for integrated development
- Phased infrastructure development - Interface coordination among stakeholders - Incorporation of private sector skills and expertise	

(2) มาตรการที่นำเสนอและประเด็นสำคัญที่ควรพิจารณา

จากประเด็นปัญหาที่ได้กล่าวไว้เบื้องต้น ทางคณะผู้ศึกษาจึงขอเสนอมาตรการและประเด็นสำคัญที่ควรพิจารณาดังนี้

Measures for Challenge 1

Establishment of Steering Committee

- ❖ Establish clear roles and responsibility among related organizations
- ❖ Allow flexible arrangement, setting up of a Working Group for specific issues

Measures for Challenge 2

Establishment of AMC, and SSC

- ❖ Ensure transparent governance structure and independence
- ❖ Address demand risk mitigation and arrange incentive schemes
- ❖ Recruitment and capacity building

Measures for Challenge 3

Formulation of Integrated Infrastructure Development Plan, Smart City Development Plan, and City Development Guidelines

- ❖ Establish guidelines and incentive scheme to coordinate development
- ❖ Ensure coordination of plans at various levels – integrated infrastructure design, Master Plan, District Plan, District Plan, Zone plan, Smart Service F/S

6.2 แผนปฏิบัติการ

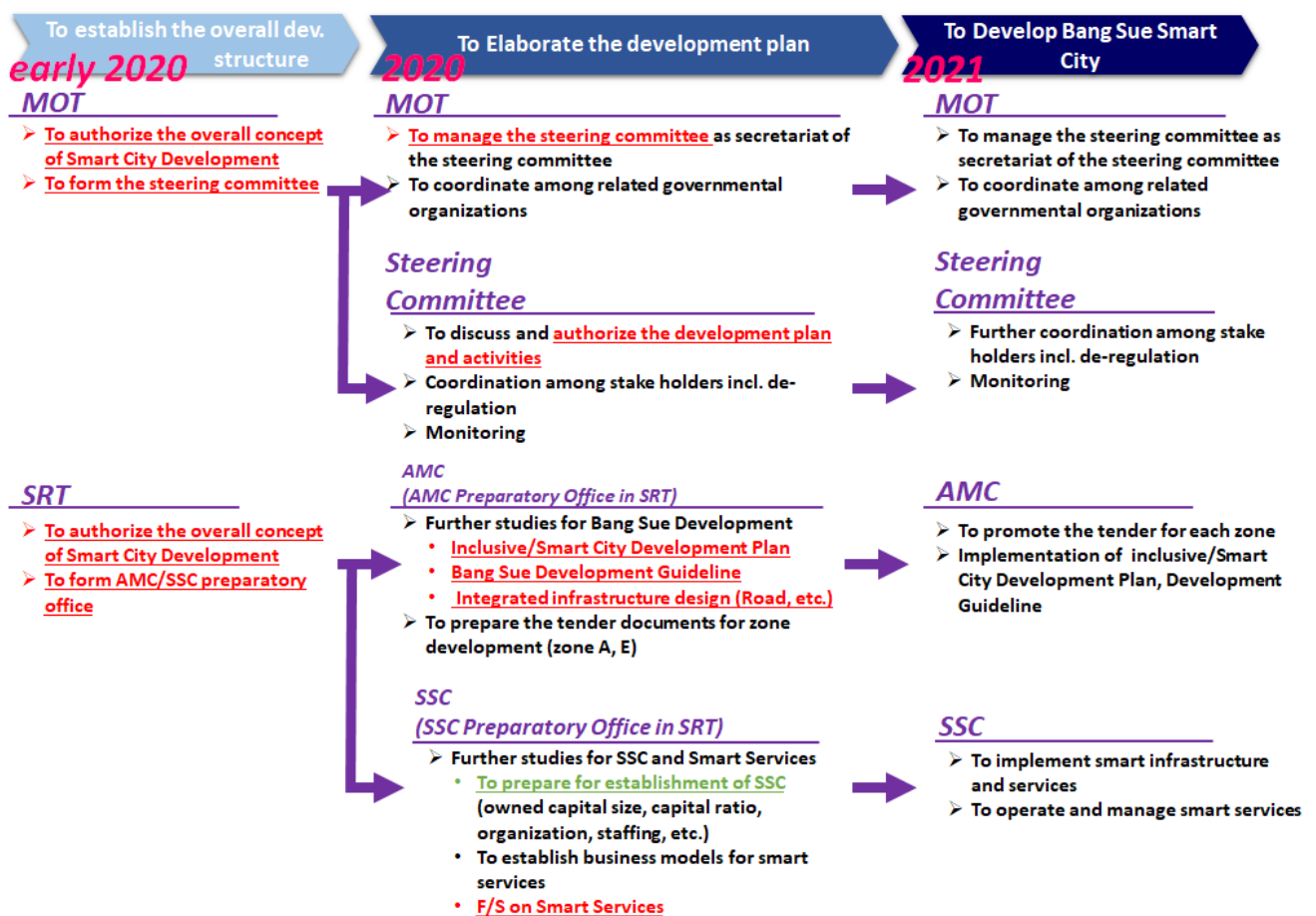
ทางคณะผู้ศึกษาได้รวบรวมประเด็นที่ควรเร่งดำเนินการและสรุปแผนปฏิบัติการเพื่อผลักดันให้บางข้อสมารถดีขึ้นในปี 2564 ซึ่งเป็นปีที่สถานีกกลางบางซื่อและรถไฟฟ้าสายสีแดงเริ่มเปิดให้บริการ โดยมีกิจกรรมที่ควรดำเนินการในแต่ละปีดังต่อไปนี้

- **ต้นปี 2563:** แนวคิดเมืองอัจฉริยะได้รับการอนุมัติจากกระทรวงคมนาคมและการรถไฟแห่งประเทศไทย มีการจัดตั้งคณะกรรมการขับเคลื่อนโดยการริเริ่มของกระทรวงคมนาคม มีการจัดตั้งหน่วยงานเตรียมความพร้อมในการจัดตั้ง AMC และ SSC ภายใต้การรถไฟแห่งประเทศไทย (ซึ่งหน่วยงานดังกล่าวจะเป็นหน่วยงานดำเนินโครงการแทนในระหว่างที่รอจัดตั้ง AMC และ SSC)
- **ภายในปี 2563:** แผนงานและกิจกรรมในการพัฒนาที่เป็นรูปธรรมได้รับการอนุมัติจากคณะกรรมการขับเคลื่อน AMC (หรือหน่วยงานจัดตั้ง AMC) จัดทำแผนการพัฒนาโครงสร้างพื้นฐาน โดยรวม แผนพัฒนาเมืองอัจฉริยะ และแนวทาง

การเมือง SSC (หรือหน่วยงานจัดตั้ง SSC) ศึกษาเบื้องต้นเกี่ยวกับการดำเนิน smart service

- ภายในปี 2564: หน่วยงานสนับสนุนการพัฒนาเมืองอัจฉริยะที่ทางคณะผู้ศึกษาเสนอไป คือ คณะกรรมการขับเคลื่อน AMC และ SSC พร้อมดำเนินงาน อีกทั้งโครงสร้างเชิงสถาบันที่จัดตั้งขึ้นตามแผนและแนวทางพัฒนานี้ควรมีการจัดตั้งแล้วเสร็จด้วยเช่นกัน

ดังได้กล่าวไว้เบื้องต้น การเร่งจัดตั้งหน่วยงานในการพัฒนาเป็นสิ่งที่ได้รับการคาดหวัง ซึ่งรวมการจัดตั้งคณะกรรมการขับเคลื่อน AMC และการเตรียมการจัดตั้ง SSC นอกจากนี้ยังคาดหวังให้มีการจัดทำแผนการพัฒนาเมืองอัจฉริยะให้เป็นรูปธรรมยิ่งขึ้นต่อจากการศึกษาในครั้งนี้ และสร้างให้เกิดการพัฒนาเมืองอัจฉริยะได้ภายใต้การตัดสินใจด้านนโยบายที่รวดเร็วของคณะกรรมการขับเคลื่อน



ภาพที่ 26 แผนปฏิบัติการถึงปี 2564

6.3 บทสรุป: การขับเคลื่อนบางข้อเสนอแนะที่ดี

จากนี้ไปหน่วยงานผู้ปฏิบัติงานฝั่งไทยโดยมีสำนักงานนโยบายและแผนการขนส่งและจราจรและการรถไฟแห่งประเทศไทยเป็นแกนหลักจะมีการประชุมหารือ ประสานงานระหว่างผู้เกี่ยวข้อง โดยมีผลการศึกษาในครั้งนี้เป็นพื้นฐาน อีกทั้งคาดหวังว่าจะมีการแบ่งปันแนวความคิดเกี่ยวกับการพัฒนาเมืองอัจฉริยะในพื้นที่บริเวณบางซื่อแก่หน่วยงานที่เกี่ยวข้องทางฝั่งไทย นอกจากนี้ เนื่องจากการพัฒนาพื้นที่บริเวณบางซื่อเป็นโครงการระยะยาวต่อเนื่องจากนี้กว่า 10 ปี คาดหวังว่าเนื้อหาที่ได้นำเสนอในรายงานฉบับนี้จะได้รับการนำไปปฏิบัติ

ในเร็ววัน และอาจมีการปรับเปลี่ยนตามช่วงระยะเวลาที่ผ่านมา ซึ่งการพัฒนาในโครงการนี้ไม่เพียงเป็นตัวอย่างการพัฒนาเมืองอัจฉริยะที่ล้ำสมัยสำหรับประเทศไทย หากแต่เป็นตัวอย่างสำหรับภูมิภาคอาเซียนโดยรวม

Main Part

1. Introduction

1.1 Background and Objectives

Bang Sue area, the target area of this study, will incorporate 6 intersecting lines in and around Bang Sue Grand Station while functioning as a terminal for long and middle distance buses. Accordingly, the district is envisaged to become *Bangkok's new central station and public transport hub*, and an alternative to Hua Lamphong Station. Moreover, the district is planned to incorporate urban business functions as the new *Gateway of Bangkok*, while embodying the contemporary urban development concept of a *Smart City*.

The development plan for the area as an urban hub for integrated business functions was proposed in a previous study, “Data Collection Survey on Urban Redevelopment in Bang Sue Area” (hereafter referred to as the *previous study*). In the previous study, a development vision and a draft concept paper were proposed, while the idea for Bang Sue area’s development into a *Smart City* was partially presented as well. Furthermore, the *Smart City development* of Bang Sue area has been conceived as “Phahonyothin Transportation Hub” in the ASEAN Smart City Network (ASCN), thereby identified as one of Thailand’s priority projects for its Smart City development. Nevertheless, the proposal remains conceptual, and its specific contents are yet to be examined to the full extent.

On the other hand, the development of Bang Sue area will be mainly led by private companies on land owned by SRT. In principle, the Thai Government’s expected role in the Bang Sue area development project will be to support the formulation of development plans and establishment of systems and structures that will contribute to inducing private investment, rather than actively promoting infrastructure development through public investment or external debt.

Considering the above-mentioned situation, this study shall support the realization of Bang Sue Smart City development through proposing a specific vision of a *Smart City* in Bang Sue area to the Thai Government and stakeholders. The project framework (including project implementation structure and financing, as well as the roadmap for realization, etc.) shall also be elaborated and a consensus developed among the stakeholders concerned with the area development.

This study is aimed at supporting the realization of a Smart City for 100 ha of Bang Sue area, or covering the whole 360 ha Bang Sue area if necessary, as the new *symbol of Bangkok/Thailand* by proposing a Smart City development plan. This Smart City development plan will include the infrastructure development and spatial planning, the real estate development plan, as well as the project implementation plan which will outline the steps for its realization.

In formulating the plan, local conditions will be fully considered while coordination with the counterpart will be ensured through close discussion. The potential of incorporating advanced Japanese smart technologies shall also be considered.

1.2 Project Area

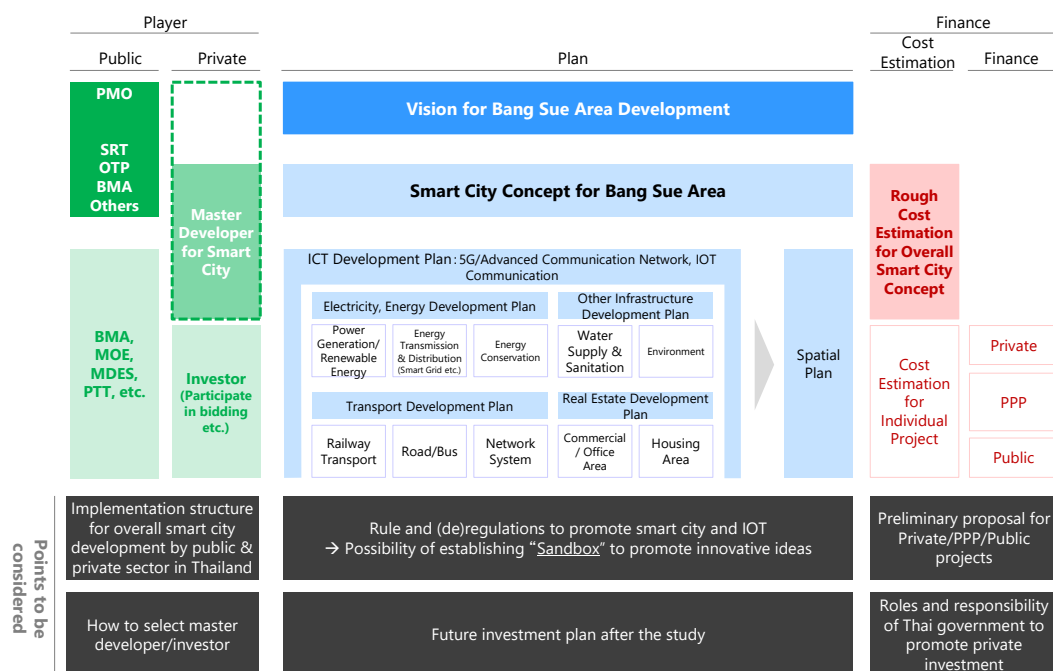


Source: Material provided by JICA, compiled by the Study Team

Figure 1.1 Bang Sue area

1.3 Outline of the Study

- 1) To review JICA's previous study of the Bang Sue M/P and understand the current organizational structure and planning on the Thai side for Bang Sue Smart City development (ex. related committees, PMO, etc.).
- 2) To analyze the relevant legal systems for smart city development and propose the items which shall be enacted, such as deregulation in the area.
- 3) To analyze and propose smart city technologies (efficient energy management, reusable energy, transportation, water usage, mitigation of disaster risks, etc.). For transportation in particular, proposed transport system shall be quantitatively analysed.
- 4) To analyze energy demand and a suitable energy control system including utilities in the area.
- 5) To design the concept and propose a roadmap to realize Bang Sue Smart City.
- 6) To propose an organizational structure with related Thai agencies and an investment/financing scheme.
- 7) To implement an Invitation Program to Japan.
- 8) To hold seminars in Bangkok and Tokyo.

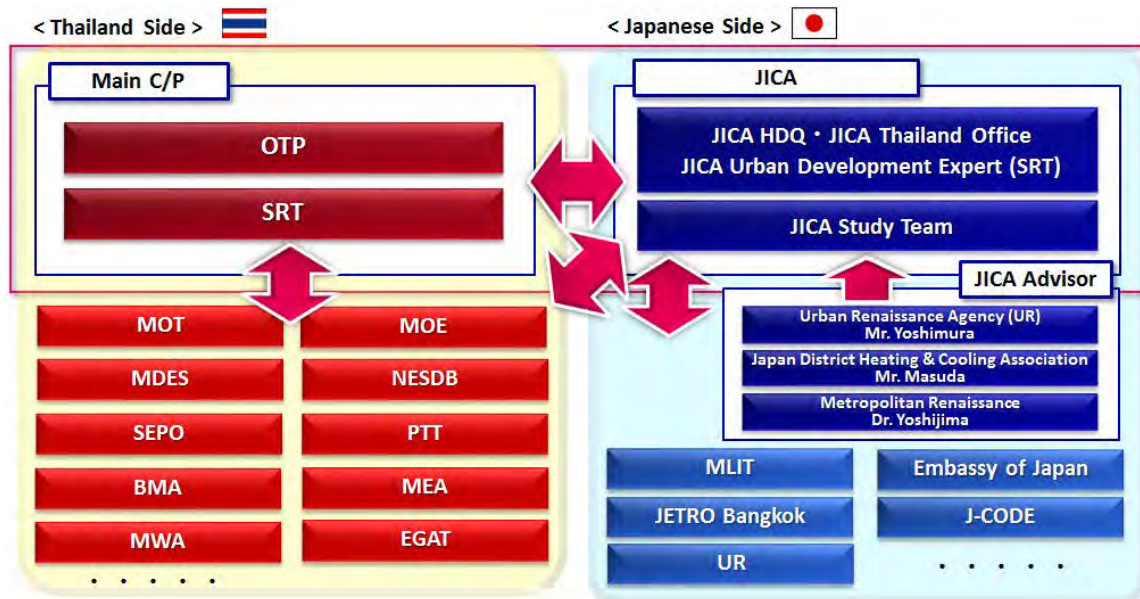


Source: JICA Study Team

Figure 1.2 Outline of the Study

1.4 Study Implementation Structure

The Study implementation structure is as shown below:



Source: JICA Study Team

Figure 1.3 Implementation Structure

1.5 Study Schedule

The study schedule is as shown below.



Source: JICA Study Team

Figure 1.4 Study Schedule

Study Team activities in Thailand from Oct. 2018 to October 2019

■ First Mission : 5th Nov. 2018 – 23rd Nov. 2018

Date	Meeting	Discussion Points
7 th Nov. 2018	ICR Meeting	(Explanation of ICR to relevant ministries, and discussion on the way forward.) • This Study on Bang Sue Smart City shall be in line with previous JICA Study. The Study shall contribute to proposing more concrete smart city concept and technology. • The Master Plan proposed by previous JICA Study has got the Board approval of SRT, and now passed to NESDC to be approved. • Issue on transportation and mobility shall be an important factor for Bang Sue as a new gateway for Bangkok. • Developing the area and the infrastructure system in an integrated manner shall be emphasized. Jatujak Park and Energy Complex also shall be considered. • Bang Sue Smart City Project shall be presented in ASCN in June 2019.
14 th Nov. 2018	Discussion with OTP	(Discussion on the existing infrastructure and mid to long term plan in Bang Sue Area, Institutional framework for transportation policies, urban planning and other relevant issues, and Smart City implementation structure for Thailand, and relevance to Bang Sue.) • Part of Zone G (KM11) is planned to be developed in Phase 1 (~2022). • The existing Bus Terminal in Zone C is planned to be moved to the area in front of BTS Mo Chit station, but its schedule is not so clear. • The proposed Personal Rapid Transit (PRT) system would be good idea. Autonomous driving system is interesting, but need to check safety and legal issues. • Smart City Criteria for 7 Smart Components is now under discussion in Thai Gov, and JICA Study team was requested to hold workshops for each Smart Criteria. • JICA Study Team is to support OTP in studying Smart City criteria and provide support to each working group.

Date	Meeting	Discussion Points
16 th Nov. 2018	Meeting with Minister and Deputy Minister of MOT	(Explanation of ICR to Minister, and discussion on the way forward.) • Smart component of: mobility, energy, and environment should be focal area for Bang Sue. Smart technology and service for these area shall be studied further and proposed through the JICA Study. • Smart City Criteria for 7 Smart Component would be publicized in Jan. 2019. • The JICA Study Team shall provide support for energy infrastructure and Zone A development, with coordination with SRT.
20 th Nov. 2018	Discussion with SRT	(Discussions on Smart Energy and Zone A development) • SRT would coordinate with the Study Team on proposed energy system of Gas Cogeneration. • About Smart Energy, Co-generation plant would be difficult to be implemented due to space availability, legal and regulation issues, financing, development structure, etc. We need to form a working team to discuss inviting MEA, EGAT, PTT, SRT, and JICA Study Team. • SRT and JICA Study Team would closely coordinate on Zone A development, especially regarding the infrastructure and energy system interoperation.

■ Second Mission : 10th Dec. 2018 – 21st Dec. 2018

Date	Meeting	Discussion Points
12th Dec 2018	Discussion with DEPA	(Institutional framework and support schemes regarding Smart City initiatives in Thailand) • Bang Sue is categorized as Smart City in “Green Field” hence all Smart Criteria (7) would need to be considered. • KPIs for each Smart Component would be developed and used for criteria of BOI incentives. • DEPA is mainly focusing on Smart City Project in cities and have developed some funding support program for Smart City activities. • Demonstration project of 5G could be approved with proper application, not limited to Huawei.
14th Dec 2018	Discussion with SEPO	(Outline of Thailand Future Fund (TFF), Governance structure for state owned enterprises in Thailand, SEPO’s stance on Bang Sue Smart City Development project) • Thai Gov. now prefer PPP to TFF. • About the PPP tender for Zone A, revenue sharing scheme with SRT shall be well considered. • About SRT’s participation for Bang Sue Development, conflict of interest and securing innovativeness of an entity shall be considered.
18th Dec 2018	Site visit to Grand Station and discussion with SRT	(Current situation and future plans for the infrastructure and utility facilities in the Area) • There is a chiller plant for A/C of the Bang Sue Grand Station. • There is a plan to newly construct on/off ramp along KamphaengPhet Rd. (need to check with EXAT)
19th Dec 2018	Discussion with OTP	(Schedule for Japan visit program and candidate sites to visit) • We need to consult with H.E. Minister Arkorm to coordinate. • Besides site visit of Smart City Project in Japan, we also want to know how to realize the projects (financing, business scheme, structure, government role. etc.).
20th Dec 2018	Discussion with DEPA	(5G and IoT implementation, Digital Park) • There is one 5G test bed in Siracha and working group has been formed. Legal matters are covered by ETDA (Electronics Transactions Development Agency) and coordination with private companies are by NTBC. • Digital Park project is now under PPP tender process and would be the first Complete Smart City in Thailand (covering 7 Smart City Criteria). • BMA has implemented CCTVs to monitor traffic conditions, which is open to public (BMAtraffic.com)
21st Dec 2018	Discussion with BMA	(Initiative by Bangkok Metropolitan Administration for realizing compact city, new Bangkok Comprehensive Plan, Bang Sue Development) • New Bangkok Comprehensive Plan will be publicized in early 2019 and some new incentives and schemes will be introduced.

Date	Meeting	Discussion Points
		• Since around 100 years ago (the era of Rama I), Bang Sue area have been planed to be “Intermodal Transport City”. • Land use of Bang Sue area is categorized in red (Commrecial:C4) and Blue (public use), no detail land use plan have been developed under BMA.
Dec. 13 - 21, 2018	Theme-based workshop	Smart Mobility: MOT, OTP, MOE, BMA, SRT, PTT, BMTA, etc. • Feasible mobility technology and ideal technology for Bang Sue area, including automated driving, connected car, MaaS concept, etc. Smart Economy: MOF, NESDC, DEPA, BOI, OTP, SRT, etc. • Feasible technology or system for Bang Sue, including e-commerce or e-payment Smart Governance: OPDC, DEPA, CAT, OTP, SRT • Administrative procedure, public service, etc., leveraging data platform Smart People: MOTS, MDES, DEPA, CAT, MDE, OTP, SRT • Universal design, lifelong learning, etc. Smart Living: MOI, MOPH, DEPA, EGAT, OTP, SRT • Healthcare service, service for tourists, etc. through IoT or smartphone application Smart Energy: MEA, EGAT, PTT, PEA, OERC, EPPO, OTP, SRT • Significance of diversified energy and area-based energy management through cogeneration and their application to Bang Sue area Smart Environment: PTT, DPT, BOI, ONEP, OTP, SRT • Adoption of waste treatment, water and sewerage, air pollution measures and greenery development in Bang Sue area

* PTT: PTT Public Company Limited, BMTA: Bangkok Mass Transit Authority, BMA: Bangkok Metropolitan Administration, MOE: Ministry of Economy, MOTS: Ministry of Tourism and Sports, NESDC: National Economic and Social Development Council,

MOT: Ministry of Transport, OTP: Office of Transport and Traffic Policy and Planning, SRT: State Railway of Thailand, MOF: Ministry of Finance, DEPA: Digital Economy Promotion Agency, CAT: CAT Telecom Public Company Limited, MOI: Ministry of the Interior, MOPH: Ministry of Public Health, EGAT: Electricity Generating Authority of Thailand, MEA: Metropolitan Electricity Authority, PEA: Provincial Electricity Authority, OERC: Office of the Energy Regulatory Commission, EPPO: Energy Policy and Planning Office, Ministry of Energy BOI: Board of Investment of Thailand, JICA: Japan International Cooperation Agency

ONEP: Office of the Natural Resources and Environmental Policy and Planning, Ministry of Natural Resources and Environment

■ Third mission: 12th Feb. 2019 – 22nd Feb. 2019

Date	Meeting	Discussion Points
13th Feb. 2019	Meeting with SRT	(Energy, Mobility and business scheme) • Meetings have been held with PTT, EGAT, MEA and others to discuss smart energy business. However, specific system has not been decided. • It is highly likely to require approval from the cabinet on the development of sky observation deck. Coordination with OTP is needed on proposed sky deck network. • SRT expected to set up a business company for each zone in the execution process of development projects. The establishment of the business company is not preferable as integrated development, which is to be explained in the study team’s presentation of the IT/R meeting.
14th Feb. 2019	ITR meeting	(Energy, Mobility and business scheme) • As it is recognized that immediate consultations are important in the implementation of smart city, it is desirable to prioritize the implementation structure and scheme over other discussion issues in the briefing to the minister. • As proposal for mobility-related issues especially in Bang Sue is significant, it is desirable to realize development in line with TOD concept. • As Smart Energy proposals (cogeneration, local cooling system) are related to development for Zone A, consideration is needed with SRT or other private business operators.
15th Feb. 2019	Discussion with SRT Board	(Energy, Mobility and development management system)

Date	Meeting	Discussion Points
		- As investments are needed on the development of smart city infrastructure, including energy, it is important to consider financial scheme. - As PTT is expected to independently develop pedestrian deck between Mo Chit Station and Phahonyothin Station and other facilities, it is effective to consider Mobility with PTT. - AMC is thought difficult to manage all project. First, it is important to set up Steering Committee so that the stakeholders concerned can discuss and coordinate.
15th Feb. 2019	Briefing to the Minister of Transport	(Business execution system and way to proceed with future surveys) - Although a national-level committee has been set up at this point in time, it is also desirable to establish ministerial-level committees as a cross-ministerial coordinating function. - Regarding the implementation plan, detail consideration on Zone A or sky deck is needed in line with the concept. - It is necessary to consider investment costs and the implementation structure with specific investment entities in mind. - Bang Sue Smart City concept could be presented at ASEAN Smart City Network (ASCN) scheduled in the first and second weeks of June.
21st Feb. 2019	Meeting with OTP	(TOD survey in Thailand and invitation program to Japan) - OTP is separately conducting TOD surveys in Thailand. It is desirable to collaborate with JICA Bang Sue project as needed. - Three officials are to be invited to Japan after Songkran Festival (mid-April).

■ Fourth mission: 18th April 2019 – 29th April 2019

Date	Meeting	Discussion Points
19th April 2019	Meeting with OTP	(Invitation to Japan and Smart City Seminar scheduled in Tokyo) - Visit to Ecoful Town in Toyota City, Aichi Prefecture is preferable, considering study tour for mobility in the invitation to Japan. - Mr. Chayatan Phromsorn, OTP Deputy Director General, will make a presentation on Thai's efforts to develop smart city in Thai Smart City Seminar scheduled in Tokyo.
23rd April 2019	Meeting with SRT board members	(Gas cogeneration and project steering entity) - It is desirable to discuss with PTT for the proposed gas cogeneration in the energy field, since PTT has experience and knowledge. - It is important to collaborate with Bang Sue Grand Station on energy and mobility. - It is necessary to work out the entire plan and establish a structure to steer the project to realize integrated area development.
25th April 2019	Meeting with SRT Red Line construction team	(Infrastructure development plan and Grand Station structure in Bang Sue area) - Confirm development plans and their entities in Zones A and E, and their neighboring areas. - Confirm route planning for pedestrians in the exit for Bang Sue Grand Station or its surrounding area.

■ Invitation program to Japan: 15th May 2019 – 19th May 2019

- Invitation members Mr. Chayatan Phromsorn, OTP Deputy Director General
 Ms. Puttamon Ratajeen, OTP Policy & Analyst (Expert Level)
 Mr. Ekapon Akarapanitkorn, OTP Civil Engineer (Professional Level)

Date	Meeting	Discussion Points
15th May 2019	Visit to MLIT (Ministry of Land, Infrastructure, Transport and Tourism)	- Meeting with Mr. Tokunaga, Assistant Vice-Minister for Engineering Affairs, Minister's Secretariat, MLIT - MLIT's introduction on smart city projects in Japan

Date	Meeting	Discussion Points
15th May 2019	Visit to Yokohama Minato Mirai	- Yokohama Minato Mirai development project introduced by Urban Renaissance Agency (UR) - Onsite study tour to Minato Mirai
16th May 2019	Visit to Kashiwa-no-ha Smart City	- Study tour to Kashiwa-no-ha Smart City - Introduction on concept and projects in Kashiwa-no-ha Smart City
16th May 2019	Thai Smart City Seminar held in Roppongi Academy Hills <No. of attendees: 135>	- Thai smart city projects presented by Mr. Chayatan Phromsorn, OTP Deputy Director General - Bang Sue area development plan and its current status explained by Mr. Fujita, JICA expert. - Bang Sue Smart City development briefed by JICA study team leader Kannami
17th May 2019	Visit to Ecoful Town in Toyota City, Aichi Prefecture	Introduction on smart city projects in Toyota City
18th May 2019	Visit to Osaka Umekita area	- Umekita area development project introduced by Urban Renaissance Agency (UR) - Onsite study tour to Umekita area
18th May 2019	Visit to Hanshin Building, Osaka Hug Museum and NEXT21	- Tour on cogeneration system in Hanshin Building - Presentation and tour on energy-saving technology - Presentation and tour on energy-saving technology for residence

■ Fifth mission: 28th May 2019 – 8th June 2019

Date	Meeting	Discussion Points
30th May 2019	Meeting with OTP	(Traffic policy and project implementation structure in Bang Sue area) - OTP considers that both structural and non-structural measures are needed to flexibly respond to traffic demand in the Bang Sue area. - It would be desirable to propose project setup or operation, related to the establishment of council, based on the case of Umekita area development or Kashiwa-no-ha Smart City development.
5th June 2019	Meeting SRT deputy Governor Mr. Voravuth	(Role of AMC, infrastructure development entity and way forward) - It is recognized to be difficult that Asset Management Company (AMC) plays a vital role in Bang Sue smart city development just after the setup of AMC. It is also difficult to cover the initial investment related to area infrastructure development due to difficulty in financing. - It is necessary to have rough project cost estimate regarding sky deck and other infrastructure development and discuss with stakeholders concerned. - The infrastructure plan, considered in this study, and its drawings are expected to be reflected to Zone E plan or the entire master plan which is to be formulated after the study.
5th June 2019	Meeting with SRT Board	(Setup of Steering Body, prioritization of projects implementation scheme) - The establishment of Steering Body or similar structure is urgently needed to monitor Bang Sue development status. Participation from Japanese institutions including JICA/UR with advice based on Japan's experiences would be appreciated in setting up the structure. - Although there are many challenging issues on Bang Sue development, SRT Board considers the opening of Bang Sue Grand Station in 2021 to be an important milestone. There is a need to clarify prioritized issues to be solved by 2021 together with their directions. - It is necessary to keep in mind that government budget for public infrastructure projects is limited.

■ Sixth Mission : 18th Sep. 2019 – 20th Sep. 2019

Date	Meeting	Discussion Points
18th Sep 2019	Meeting with SRT deputy Governor Mr. Voravuth	(SRT's role, implementation structure and opinion on Smart Service Co.) • SRT is discussing with state owned company such as PTT, on the idea of setting up a company to provide Smart City-related services, however, nothing concrete is decided. • The establishment of AMC is expected to be authorized with approval from the Cabinet, but specific date is not clear. • SRT is generally in line with the Study Team's proposal on setting up a Smart City-related company, however budgetary limitation is an issue that needs to be addressed.
19th Sep 2019	Meeting with OTP	(Role of AMC, implementation structure and way forward) • Asset Management Company (AMC) is expected to play a central role in managing Bang Sue smart city development. • For successful implementation, recruitment of the leader of AMC would be important. • The development of infrastructure shall, in principle, be initiated by SRT, as the landowner. Cost sharing may also possible among public entities upon individual consultation and negotiation.
20th Sep 2019	Meeting with PTT	(Implementation structure, business schemes) • PTT, along with other state owned enterprises, shall cooperate closely with SRT to realize Smart City development in Bang Sue. • To come up with a viable business scheme would be one of the most important issue to take the project forward. Incentive schemes and public support would also be important. • PTT would be willing to seek business opportunity with various companies, including that of Japan. It would be meaningful if a Government-to-Government cooperative framework could be established.

■ Seventh Mission : 4th Nov. 2019 – 8th Nov. 2019

Date	Meeting	Discussion Points
6th Nov 2019	Draft Final Report Presentation	(Way forward for implementation) • The recommendation for Thailand side towards realization of Bang Sue area development project are: to set up Steering Committee for decision making and coordination, to have AMC to be responsible for the project; establish Smart Service Company (SSC) to provide Smart City infrastructure and service; and to establish overall plan. • The report would be a reference for related organizations in Thailand towards implementing the Smart City project.
7th Nov 2019	Thai Smart City Seminar in Bangkok <No. of attendees: 80>	• Plan of Bang Sue area development and Smart City concept, presented by SRT Deputy Governor Mr. Voravuth • Smart City development projects in Thailand, presented by OTP Mr. Ekapon • Bang Sue Smart City development briefed by JICA study team leader Kannami
7th Nov 2019	Briefing to the Minister of Transport	(Introduction of Bang Sue project and discuss way forward) • Bang Sue development is a project with huge potential and there is a big expectation in Thailand. • The adverse impact from development, such as environmental issues and traffic congestion is a concern for the project. • Continued cooperation of Japan would be beneficial for realization of Bang Sue Smart City.

2. Understandings of the External and Internal context of Bang Sue Smart City Development

2.1 Review of the Histories of Urban Development in Bangkok

2.1.1 Review up to Thailand 3.0 Era

It would be insightful to look back over the history of Urban Development in Bangkok when envisioning the future of Bangkok. Thailand 4.0 defines the progress of socio-economic development of Thailand with 4 stages of “Thailand 1.0” to “Thailand 4.0”.

Thailand 1.0 is the period of modernization before 1960. In this period, Thai society is based on rural society with agriculture-based economy, which is before starting industrialization. Thailand 2.0 is the period of take-off of modernization and industrialization of Thailand, which corresponds to the period between 1960 and 1987 (the year of Plaza Agreement). Thailand starts modernization and industrialization with promoting light industry and resource-based industry with lower labor cost. Then, Thailand 3.0 is the period of take-off of economic development. After the Plaza Agreement in 1987, FDI to Thailand sees drastic increase. Many factories of heavy industry, particularly export-oriented manufacturing factories were established at Bangkok Metropolitan Area (BMR) and Eastern Seaboard Area. Thailand enjoys being a middle-developed country with continuous economic growth, however, Thailand, at the same time, starts to suffer negative aspects of economic development like economic disparity, congestion and pollution. Therefore, Thailand policy gradually shifted its emphasis on “people-centered development” and sufficient economy”.

Following this definition of 4 stages, urban issues and urban development in Bangkok could be summarized as the table below.

	1.0 ~ 1960	2.0 1960 - 1987	3.0 1987- 2018	4.0 2018-
Key Direction	Modernization of Thai Society	Start Industrialization and Modernization	Take-off and Enter Middle-developed Country Sufficient Economy Peoples-centered Development	Value-based Economy Sustainable Development Smart and Eco
Populations	Slow population growth	- Faster population growth - Migration	Over-concentration of Population into BMR	- Deceleration of population growth - Depopulation in rural area
Leading Economy	- Agriculture - Cottage industry	- Light industry - Import-substitution industry	- Heavy Industry - Assembling manufacturing with FDI - Tourism	- High value added manufacturing - R&D, Management, financing business,
Urban Issues in Bangkok	- Defense and security - Disaster prevention - Satisfaction of basic human needs - Safety and security - Urban expansion for population increase	- Infrastructure development in large cities - Urban poor - Urban expansion - Traffic congestion	- Mitigation of traffic jam - Flood protection - Urban environment - Decentralization (to release over-concentration and reduce economic disparity) - Global competition	- Mitigation of traffic jam - Flood protection - Barrier free for all peoples under aged society - Greenhouse effect gas - Respond to innovations (AI, ICT/ IOT etc.)
Urban Development in Bangkok/BMR	- Transfer Capital to Bangkok (1782) - Expansion of Rattanakosin - Sampeng and Klong Kasem Development - Ram IV(Thanon Trong) and New Road (Charoen Krung Road) - Suwan Dusit Project - Tram development (in1894)	- Town and Country Planning Act (1975) - Slum Clearance - NHA housing	- Expressways - Urban Railways (BTS in 1993, MRTA Blue in 2004, MRTA Purple in 2016) - Land Readjustment Act (2004) - Large shopping complex developments - Mubaan development in suburban area	- Smart city (mobility management , energy, saving with renewable energy, smart peoples and living, smart governance, smart environment, smart economy) - Eco-city/ low carbon city - Sustainable city

Figure 2.1 Urban Development by Stage

Urban Development 1.0 (Thailand 1.0 era; ~Mid-20th century) was the era in which original landscape of Bangkok took its shape. In 1557, French Fort was constructed along Chao Phraya

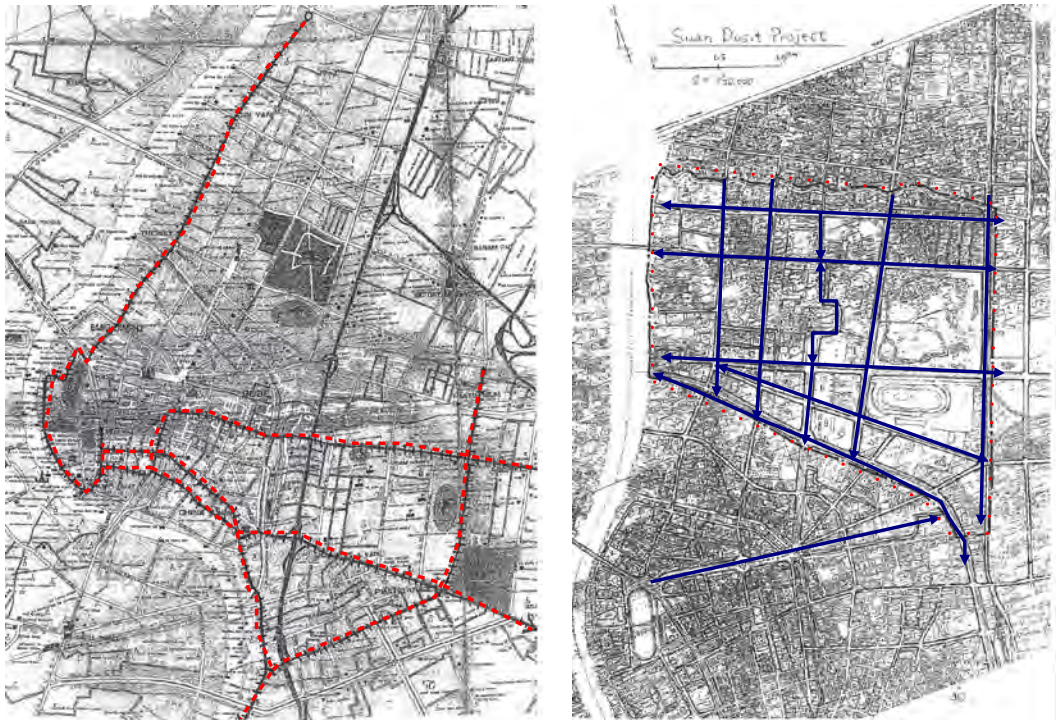
River that was the Origin of Bangkok. In 1782, King Rama I moved capital to Bangkok and constructed the Palace at the place of French Fort. In 19th century, urban area of Bangkok was expanded with many Channels and “Soi”, of which land scape is called “Venice of Orient”. In this era, Bangkok was an international city with many races and various businesses, which generated unique and different landscape in downtown (Chinese shophouses) and suburban area (Thai local houses). In late 19th century, there were two modernization and urban development projects; 2 tram lines (1894), Suwan Dusit Project (1899~1902, 570 ha, 400 to 600m basic land block).

Thailand Urban Development 2.0 (Thailand 2.0 era; 1960s~1980s) was the era of industrialization. Population growth speeded up and population migration started from rural to urban areas for finding better jobs, especially to Bangkok. The migrants generated many urban poor who lived at slum areas and worked in the informal sector. Accordingly, Thailand Urban Development 2.0 can be considered as the era in which population migration to Bangkok increased and poverty alleviation was an issue. Accordingly, major urban issue was providing reasonable housing for the urban workers as well as uplifting living environment at slums.



Credit: Japan Thailand Business Forum (JTBF)

Figure 2.2 Old landscape of Bangkok – Krung Kasem Canal (left) and Ploenchit Road (right)



Source: Project on the Development of the Method of Urban Development in Thailand (left), JST (right)

Figure 2.3 Tram lines (left) and Suwan Dusit Project (right)



Credit: Japan Thailand Business Forum (JTBF)

Figure 2.4 Tram lines

The period of Thailand 3.0 was the period of take-off of Thai economy with lots of FDI. Although Thailand enjoyed continuous economic growth, however, gradually faced negative aspects of economic development like regional economic disparity, congestion and pollution in Bangkok. In particular, traffic congestion, which was started at the era of Thailand Urban Development 3.0, heavily influenced peoples' life and economic activities. Accordingly, Thailand Urban Development 3.0 (Thailand 3.0 era; 1980s~2018) was considered as the era in which Bangkok was confronted with some actual urban issues associated with big cities, such as environment deterioration, chronic traffic congestion and flooding etc.

In this period, many transport infrastructures like expressways, road and bridges, and urban railways (BTS in 1993, MRTA Blue in 2004, MRTA Purple in 2016) were constructed by reclaiming channels or on the existing roads. Depending upon economic growth and rise of income level, many investments went to real estate businesses, old buildings were replaced by high-rise building developments and large shopping complex developments in downtown and rice field was reclaimed with residential area developments in suburban area. These developments drastically changed landscape of Bangkok.

2.1.2 Urban Development under Thailand 4.0 Era and Bang Sue Development

The Thai society under the “Thailand 4.0” faces the depopulation and aged society. Enhancement of productivity and added value is essential for sustainable economic development for Thailand in future. Thailand needs to shift its core economic activities to high-value added service from labor-oriented processing industry. For this, Bangkok would be well situated to become a place to foster “new high-value added service”.

Furthermore, new innovative technologies are actively promoted through the “Thailand 4.0” policy. In particular, AI technologies, ICT/IOT technologies as well as robotics technologies is expected to become a “Game Changer” for economy and society, which could qualitatively and quantitatively influence the requirement for urban facility, infrastructure, and land use.

On the other hand, Bangkok would be expected to play a more active role in meeting to new social demands such as: care to aged peoples and handicapped, safety and security against disaster and eco-friendly, in particular low carbon emission, which is a national commitment at Paris Agreement of COP24¹.

¹ Thailand committed 7% of CO2 reduction in 2030 in Paris Agreement.

Considering the history of urban development at Bangkok, development of Ratanakhosin area was implemented at the time of drastic change of country (generation of new dynasty). The “canal” was center piece of the new urban development, considering the geopolitical aspects regarding safety and security, efficiency of transport and economy. The water-front area of the canal generated a functional business space for global trading businesses. Bangkok was a global city with various peoples from 17th century.

Suwan Dusit Development Project was implemented by the Royal Thai Government at the beginning of 20th century, which led to a drastic change of structure of society and political system in Thailand. Thailand experienced the change to the constitutional monarchy from absolute monarchy. The Suwan Dusit Development Project was a symbol of new political structure. The project led to expansion of urban area, and newly generated the modern landscape (Thai-European style) to the Bangkok which remains along Ratchadamnoen Avenue.

The project is regarded highly as a project symbolizing the “3rd Industrial Evolution” that led to further development of Bangkok, especially formation of basic road network pattern as well as urban railway network of Bangkok.

Reflecting on these past developments, Bang Sue development could also be regarded as a modern version of Rathanakhosin or Suwan Dusit development. Now is the time of “Thailand 4.0” or “4th Industrial Evolution”, which is expected to bring drastic change with new innovative technologies. Similarly to Ratanakhoin and Swan Siam developments, Bang Sue are development is expected to be the flagship project to realize Smart City as a new urban style for “Thailand 4.0” or “4th Industrial Evolution”. Bang Sue is well situated for this, because the area is presented with a large space to create new urban area in Bangkok. Accordingly, Bang Sue area is expected to be a unique site which incorporates innovative solutions for urban issues such as mobility management, energy saving (management) and eco-friendly environment with cutting-edged technologies, to embody “4th Industrial Evolution”. In this regard, Bang Sue Smart City shall be positioned as the prototype of urban development in 21st century, which could serve as a model for other urban areas in Thailand or in ASEAN countries with the following roles/functions:

- Realization of efficient mobility
- Realization of Eco-friendly and low carbon society
- Enhancement of safety and security
- Provision of universal services for all people
- Development of competitive business environment for globalization
- Development of a Regulatory Sand Box to introduce cutting-edged technologies for future Thailand

2.2 Smart City Projects in Asian Countries

2.2.1 ASEAN Smart City Network (ASCN)

ASCN is a framework for cooperation and collaboration between cities for the Smart City Project. Led by Singapore and promoted by the countries of ASEAN, its first annual meeting was held in July 2017. The project is to be officially launched at the ASEAN summit on November 2018. Since Thailand chairs the ASEAN Summit in 2019, Thailand Government also hosts the ASCN in 2019.

26 ASEAN cities have been selected as pilot-cities, and its scheme is to form action plans for the Smart City development from 2018 to 2025. Three sites from Thailand: Bang Sue, Chonburi (AMATA), and Phuket, have been identified as ASCN.

Listed below are the 26 cities that have been selected:

- Cambodia (3 cities) : Battambang, Phnom Penh, Siem Reap
- Indonesia (3 cities) : Makassar, Banyuwangi, Jakarta
- Malaysia (4 cities) : Johor Bahru, Kuala Lumpur, Kota Kinabalu, Kuching
- Myanmar (3 cities) : Nay Pyi Taw, Mandalay, Yangon
- Philippines (3 cities) : Cebu, Davao City, Manila
- Singapore (1 city) : Singapore
- Thailand (3 cities): Bangkok, Chonburi, Phuket
- Lao PDR (2 cities) : Luang Prabang, Vientiane
- Vietnam (3 cities) : Da Nang, Hanoi, Ho Chi Minh
- Brunei (1 city) : Bandar Seri



Source: Ministry of Foreign Affairs of Singapore, "ASEAN Smart City Network"

Figure 2.5 26 ASEAN Smart Cities

2.2.2 Smart City Projects in Asian Countries

(1) Singapore

Singapore is one of the region's leading cities for smart city initiative. Singapore places emphasis on developing digital technologies which contribute to realizing digital society and digital economy. The two notable projects that are currently promoted are introduction of e-payment system, and of National Digital Identity (NDI).

A seamless, secure, and integrated e-payment system is being developed which enables cashless payment and an integrated payment platform for business processes. This is aimed to reduce business costs associated with cash and checks, increase convenience for daily payments for consumers, and potentially promote new business and services with the collaborative platform.

National Digital Identity system is targeted to be operational by 2020 with progressive trials for digital signatures to facilitate paperless transactions. It will be a nationally-available means for an individual to prove his legal identity in the digital realm. It will be issued to all residents and can be used for seamless and secure transactions with both the public and private sector.

(2) Indonesia

Another country that constitutes the smart city initiative is Indonesia. Through digital transformation and accessibility enhancement, the country contemplates on bringing innovative transformations to the cities of DKI Jakarta, Makassar, and Banyuwangi.

The capital of Indonesia, Jakarta, expands on its vision of becoming “a city leading forward towards happy citizens”. Their focus lies in the creation of new jobs through the implementation of a platform which connects research institutes and potential entrepreneurs. The city also plans on introducing a new transit payment system, OK OTrip, where they wish to integrate transit payments to one cashless system.

Similarly, Makassar visualizes a “Liveable World Class City for All” by promoting the socio-economic growth it is currently going through. They insist on ensuring an improved healthcare system for all, where they plan on building seamless services with highly accessible data. Moreover, Makassar plans to install an integrated online tax collection system in order to increase the city's revenues.

Banyuwangi is rather fixated on mitigating physical boundaries—improving accessibility at all levels. One of their primary targets is to encourage and strengthen their citizens with the acquisition of IT skills, and thus inducing industrial growth. Another priority for Banyuwangi is to create inclusive economic growth: they are planning on developing their local tourism industry through improving the citizens' access to public amenities and information services.

(3) Thailand

Thailand is also part of the smart city initiative, with the cities of Bangkok, Chonburi and Phuket assigned as their pilot-cities. The three cities, each having their unique vision, aim to empower the region by adopting cutting edge technology to work on their focus areas.

Bangkok, the capital of Thailand, aims to become a Visitor-Friendly International Community

by creating a new central district. They are focusing on forming a transport hub in the Bang Sue area anticipating that it will alleviate the stress in the existing terminal, as well as cut down the commuting time. Furthermore, they are contemplating on a Smart City Plan for Pahonyothin, by establishing a New Central District full of attractions, involving various transport systems.

Chonburi aspires to become a self-reliant, energy-efficient city which operates on renewable energy sources and sustainable environment management. The city puts their focus on a Smart Grid Project which requires a systematic energy management and an energy storage structure. They also intend to work on the Waste to Energy Plant in order to resolve the issues of waste generated in Chonburi.

Phuket, which relies heavily on tourism industry for its regional economy, envisions to realize sustainable tourist development. One of Phuket's priorities is to construct a City Data Platform using real-time data in order to closely observe on their residents and tourists, and improve the city's efficiency, utilities, and businesses. Another major concern is to realize a safe city for all by using Big Data. Phuket plans on expanding their CCTV coverage along with collaborations with Cloud companies.

In addition to Smart City development initiative under ASCN, there are many other plans for Smart City development. It is important to understand the relative position of Thailand and Bang Sue in the context of the competition among cities for Smart City development. First, in terms of Smart City policy at the state-level, Thailand is promoting Smart City development under "Thailand 4.0" initiative, and has several schemes to financially or institutionally support private companies or local governments. This would be regarded as one of the advantages for Thailand. Second, from city-level, the unique aspect for Bangkok's Smart City development initiative is that a specific area is designated as project site (area based approach). In other cities such as Singapore or Kuala Lumpur, project site is not necessarily identified, but identifies specific technologies or services to be promoted (technology based approach). In Bang Sue, various technologies could be introduced and developed by linking unique attributes of the city and advanced technologies.

(4) Other ASEAN countries

The visions and projects for each of the ASEAN Smart City Network are as summarized below:

Table 2.1 Visions and priority projects of ASCN cities

Country	City	Vision	Priority Issue 1	Priority Issue 2
Cambodia	Battambang	To achieve a socially responsible, environmentally friendly and economically successful city whilst retaining Battambang's unique character.	<u>Urban Street and Public Space Management</u> In order to improve liveability, Battambang plans to upgrade public street and space design, organise street vendors, and better the infrastructure for informal settlers. This will be done through development of market, low-cost housing and skills upgrading.	<u>Solid and Liquid Waste Management</u> Battambang aspires to become a green and healthy city. To this end, Battambang will move away from river-based natural waste management to sewage and wastewater management systems. Works on drainage systems are being carried out by the Battambang provincial authority and Chinese partners supported by the Asian Development Bank. However, the city needs to develop additional drain and sewage infrastructure.
	Phnom Penh	To improve the urban environment, to enhance citizen's quality of life.	<u>11 Sidewalks Rejuvenation Project</u> Phnom Penh aims to increase pedestrianisation through the rejuvenation, restoration and repurposing of the sidewalks for 11 boulevards. The project is expected to deliver traffic de-congestion and public space benefits by managing unlicensed street vendors and illegal parking.	<u>Improving Efficiency of Phnom Penh Public Transit</u> Improve urban public transport mobility and active mobility (pedestrian paths)
	Siem Reap	Siem Reap as a beautiful, unique and ideal tourist destination, characterised by the harmony of Khmer history, arts and nature.	<u>Smart Tourist Management System</u> Siem Reap's vision is to be a liveable, smart, clean, safe and sustainable city for both local residents and tourists alike, through the use of security enhancement systems such as CCTVs and traffic sensors.	<u>Solid Waste and Wastewater Management</u> This project seeks to develop infrastructure for solid waste and wastewater management, to ensure a high-quality environment. This can be done by capitalising on technology and data management systems, which would allow for feedback loops to improve planning and implementation.
Indonesia	Makassar	The city's vision is "To Create Makassar as Liveable World Class City for All"	<u>Improved Health Care</u> Provide citizens with improved and well integrated health care services. Makassar seeks to ensure that all citizens have easy and direct access to health care services. The city plans to develop a healthcare ecosystem that connects various healthcare entities and enables easy exchange of data. Access to health care services will also be made seamless such that people can access these at any place, any time.	<u>Integration of Online Tax Services</u> Makassar plans to increase the city's revenues through improved tax collection via an integrated e-tax system. Through personal mobile applications and one-time submission platforms, citizens and businesses will be encouraged to file taxes. Taxes including building and land tax, parking tax, local revenue tax, advertisement tax, will be brought under an integrated tax filing and payment platform.
	Banyuwangi	To develop an integrative system of government, accelerate development through the optimization of information technology, build a reliable generation through education, promote partnerships for basic infrastructure, and create inclusive economic growth through tourism based development.	<u>Spearing Industrial Growth through Education</u> Banyuwangi is on its journey to break physical boundaries with technology. The physical constraints of its villagers in trading goods will be addressed through upskilling the youth and the residents with digital entrepreneurial skills. Banyuwangi seeks to collaborate with private entities to impart knowledge on e-commerce and online trading through inclusion of customised IT modules in the skills curriculum. All the 24 subdistricts will be covered under the digital-based learning programme for students.	<u>Creating Inclusive Economic Growth Through Tourism-Based Development</u> Harnessing the community-wide benefits of eco-tourism, Banyuwangi is working towards developing its local tourism industry, with collaboration and support of strategic partners. To ensure overall development, Banyuwangi plans to improve citizen's access to public amenities, and information services.
	Jakarta	Jakarta – a city leading forward towards happy citizens	<u>Job Creation Through Linking Research Institutes and Potential Entrepreneurs</u> This project aims to create new jobs by providing platforms for innovations arising from research institutions to evolve into business ideas. It would require an information sharing system to encourage synergies between research institutions and potential entrepreneurs.	<u>OK O'Trip Integrated Transit Cashless System</u> To integrate all Jakarta transit payment systems into one cashless system to improve urban mobility, enhance modal share and reduce travel time, while keeping travel affordable.
Malaysia	Johor Bahru	To develop Johor Bahru smart city into a strong and sustainable metropolis of international standing.	<u>Iskandar Malaysia Urban Observatory (IMUO) Tool for Decision Making, Stocktaking and Measurement</u> To ease decision-making in planning and to improve government transparencies in tracking development, policies and targets, Johor Bahru aims to improve its planning approval process via informed decision-making. Johor Bahru plans to develop a Central Data Centre, the Iskandar Malaysia Urban Observatory (IMUO) to collate, update, analyse, manage and disseminate data.	<u>Integrated Urban Water Management Blueprint which Include Sourcing of New Water Solutions and Enhancement</u> In 2018, Johor Bahru's water reserves could only meet 8% of the water demand, and is expected to decline to 5% in 2019. Through an Integrated Urban Water Management blueprint, Johor Bahru is determined to improve water sustainability practices to increase water reserves by 20% all year round and to source for new water sources through innovation and technology. Johor Bahru

Country	City	Vision	Priority Issue 1	Priority Issue 2
			IMUO will also function as a Knowledge Hub to improve regional urban knowledge, and as a Monitoring and Assessment Centre to monitor development progress. IMUO could also provide technical services that aid programme monitoring and capacity building for policy implementation at the city and regional level.	plans to upgrade existing water plants with advanced technology and smart water management systems.
	Kuala Lumpur	Kuala Lumpur envisions to be A World Class Sustainable city by 2020.	Kuala Lumpur Urban Observatory In line with the Master Plan, the KL Urban Observatory is a Central Data Repository to collate, update and disseminate social, economic and physical data for planning purposes. This is a collaborative effort by the local authorities, residential associations and government agencies. Coordination is needed for more effective planning to improve the liveability of Kuala Lumpur.	Kuala Lumpur Pedestrian and Bicycle Lane In line with the Kuala Lumpur Pedestrian and Bicycle Master Plan 2019-2028, Kuala Lumpur aims to be a world-class liveable city through promoting a healthier lifestyle among city folks and allowing for a convenient and safe commute for pedestrian and cyclists. The project has started in the city centre area where Kuala Lumpur has built an 11km dedicated bicycle lane.
	Kota Kinabalu	Transforming Kota Kinabalu into a Clean, Green and Liveable City.	Integrated Public Transport System This project aims to create a seamless and quality public transport travel experience to attain sustainable transport plans by 2030. This project includes an Integrated Bus Rapid Transit (BRT), Light Rail Transit (LRT), and Bus Lanes Project.	Integrated Solid Waste Management This project aims to develop efficient and effective governance and transform the city into a clean, green and liveable city with sustainable waste management. It will encompass comprehensive action plans for effective waste collection and waste processing in order to reduce the generation of waste and toxic emissions from the landfill.
	Kuching	Kuching envisions to improve the quality of life and achieve smart city status through digital transformation.	Smart Mobility – Integrated Smart Traffic Light System This project aims to ease the traffic congestion in Kuching city through smart management of the traffic flow using digital technology. Out of the 140 signalised junctions, only 32 have been digitally connected and managed as the pilot projects only cover 4 major routes. The government plans to expand the project to cover all major urban roads and signalised junctions in Kuching City so as to coordinate the traffic flow with better synchronised traffic lights and provide ‘real time’ traffic information.	Integrated Flood Management and Response System This project aims to better alert the response team or the Disaster Committee, to flooding events to ensure safety of the people and property. An efficient monitoring and response system will reduce the occurrence of flash floods and waterlogging in flood prone areas.
Myanmar	Nay Pyi Taw	To be a green, liveable, and environmentally sustainable city that also serves as the center of knowledge/global market hub. By promoting core infrastructures and high quality of life, Nay Pyi Taw aims to become the role model in Myanmar.	Affordable Housing and Low Cost Housing Project The project involves the construction of medium-rise low-cost affordable housing for retired government employees. The old townships of Pyinmana, Lewe, Tatfone and their semi-urban areas will be need to be developed with infrastructure amenities to support new affordable housing projects.	International Comprehensive University Proposed as an Education Hub, the first International University in Myanmar includes an Engineering School, Business School, Medical School, and Art and Design School. Collaborating with Korea, Nay Pyi Taw’s Comprehensive University is to be constructed on a 250 acre-wide land near the Diplomatic Zone, where the Smart City Initiative Project is partially implemented. While the Hotel Zone has been completed, funding assistance is required for the rest of the development.
	Mandalay	Mandalay aspires to be a city with safe and smooth mobility.	Traffic Congestion Management In light of the increasing vehicle ownerships that results from population growth and the ease of import laws, the number of motorcycles and private car ownership peaked at 2016, resulting in traffic challenges. Reliable and up-to-date traffic data, and strategic management of road conditions by road infrastructures such as traffic lights, guard rails and road signs could address the traffic congestions in Mandalay, thereby improving road safety.	Solid Waste and Waste Water Treatment Good solid waste and waste water management, to ensure quality water supply.
	Yangon	An Attractive International Port and Logistics Hub – A city of Blue, Green and Gold.	Conservation of Yangon City Downtown Area Yangon, a city with unique heritage features and identity, aspires to transform into a well-developed and sustainable economic hub where its people can live and work peacefully. Conservation of its heritage and buildings could boost Yangon’s attractiveness as a tourist destination. Towards transforming its heritage areas, Yangon has planned a Downtown Area Conservation project. Under this plan, the streetscape, infrastructure and amenities at Pandosan Street will be improved, and the heritage buildings lying vacant will be repurposed for sustainable and compatible uses such as Food & Beverage outlets, bookstores, and offices. Traffic conditions in this area will also be eased. To facilitate efficient planning in this area, Yangon will need to define its zoning regulations.	Low Cost Rental Housing and Transit Oriented Development Western Yangon has nearly 30,000 workers employed in its industries. Due to inadequate housing options in the industrial zone, these workers commute long distances to get to work every day. In order to improve the city’s public rental housing system and the socio-economic status of its workers, the Yangon City Development Committee has planned to develop the Hlaing Tharyar Township as a sustainable development, anchored around principles of Transit-Oriented-Development. This township will house low-cost rental housing, with Smart City elements (traffic management, environmental protection, and security) such that workers can reside in the Industrial Zone safely. A highway bus terminal will be built between Yangon and Ayeyarwaddy division, for smooth transit.

Country	City	Vision	Priority Issue 1	Priority Issue 2
Philippines	Cebu	By upgrading Bus Rapid Transit (BRT) Systems and CCTV cameras, Cebu City aims to support urban growth with improved urban mobility and security.	<u>Automated Citywide Traffic Control Systems</u> Through the Automated Citywide Traffic Control Systems project, Cebu City aims to enhance traffic regulation and enforcement, and improve information collection and sharing. The operation of the intelligent traffic control system entails the installation of necessary sensors, equipment and infrastructure.	<u>Bus Rapid Transit (BRT) System</u> As Cebu faces traffic congestion challenges, it has plans to establish, operate, maintain and substation a BRT to provide efficient intra-city mass transportation. Improvements to the current transportation system will help to reduce commuting time. Under this project, Cebu aspires to start operations of Phase 1 of BRT by 2021, and to further extend BRT Phase 1 by 15km in the Phase 2 in 2025.
	Davao City	Davao City envisions to create a community that harnesses digital connectivity and technological advancement in providing high-quality living and a safe and secured environment for the Dabawenyos.	<u>Converged Command and Control</u> Using intelligent surveillance and upgraded communication capabilities, Davao City will develop technological solutions that enable efficient inter-agency collaboration for improved public safety and planning. The Public Safety and Security Command Center (PSSCC) is specifically tasked to orchestrate all undertakings related to safety and security, and to lead multi-agency mechanisms for incidents beyond the purview of a single agency. A converge command & control solution will enable the PSSCC to link with agencies and gather near-time critical information. By 2021 Davao City plans to upgrade the capability of the PSSCC by increasing the coverage area of the CCTVs to cover all intersections and key facilities.	<u>Intelligent Transport and Traffic Systems with Security</u> Davao City aims to use technology to address the growing transportation challenges. The city seeks to enhance traffic management capabilities by leveraging on latest technology and innovations. Under this project Davao City will install sensors, equipment and infrastructure that support the operation of an intelligent traffic control system and public safety initiatives. The solutions developed for improved traffic and transport management will also be integrated with other security management systems.
	Manila	Governance at the Palm of your Hands.	<u>Command Centre Upgrade (Transport/ Disaster Prevention/ Security)</u> Rehabilitation and Reorientation of our Command Centre to a cloud-based system, to be more responsive to concerns of Manila residents and visitors. This would include connecting Traffic/Peace and Order/Disaster Monitoring into a Command / Administration and Supervision/Response-able Centre.	<u>E-Education</u> Development of joint-instruction Tutorial Applications, based on Department of Education's (DepEd) curriculum that can run on mobile phones which will allow students to practice study or review lessons with teacher supervision. These will be partly implemented with construction of Internet-ready classrooms, acquisition of computer and presentation equipment and distribution of tablets to all public elementary and high school teachers. It is part of an ongoing project of DICT and City of Manila in the installation of Free Wifi areas.
Singapore	Singapore	To transform Singapore through technology.	<u>E-Payments</u> Providing seamless, secure, and integrated e-payment platforms, options for cashless payments, and integrating e-payments into business processes from end to end. It will result in: - Reduced business costs associated with handling cash and cheques - Increased daily transactional convenience to consumers - Potentially new and innovative services riding on e-payments platforms We want to explore cross-border collaboration and linkages for e-payments systems.	<u>National Digital Identity (NDI)</u> The National Digital Identity (NDI) will be a nationally-available means for an individual to prove his legal identity in the digital realm. It will be issued to all residents and can be used for seamless and secure transactions with both the public and private sector. It is planned to be operational in 2020, with progressive trials for digital signatures to facilitate paperless transactions. We want to explore cross-border collaboration and recognition of digital signatures.
Thailand	Bangkok	To be a Visitor-Friendly International Community with a New Central District filled with various attractions and infrastructures.	<u>Transport Hub Development at Bang Sue Area</u> Serving as the main stop for the High-Speed Rail, the Bang Sue Central Railway will function as the hub of the new Commuter Rail System that provides new lines serving the areas near the city centre. The Transport Hub Development aims to overcome the existing infrastructural pressure on the existing terminal while simultaneously reducing commuting time.	<u>Smart City Plan</u> The Smart City Plan of Pahonyothin aims to be the ideal place for visitors with its strong international community, and the New Central District full of attractions. Coined as the Gateway to City of Angels, Pahonyothin is to consist of various transport systems such as pedestrianization, cycling, bus and metro.
	Chonburi	To be a self-reliant, energy-efficient city with renewable energy sources and sustainable environmental management	<u>Smart Grid Project</u> This project aims to move Chonburi forward to be a self-reliant, energy-efficient city with renewable energy sources and sustainable environmental management. It entails the management of electrical networks, generation systems, transmission systems and power distribution systems, with a systematic energy management and energy storage structure.	<u>Waste to Energy Plant</u> This project aims to address the waste treatment and management issues arising from the generated waste at Chonburi, and to source for renewable energy integration and regional smart micro-grids, which is aligned with the relevant National Plans on built infrastructure developments in Thailand.
	Phuket	With tourism accounting for 97% of its Gross Domestic Product, Phuket's smart city vision	<u>City Data Platform</u> Using real-time big data from sources such as free-WiFi and CCTVs, Phuket plans to build a City Data Platform that allows for better understanding of residents and tourists in Phuket. The City Data Platform functions to build big	<u>Phuket Eagle Eyes – Safe City based on Big Data Harvesting and Analytics CCTV Safe City</u> With the vision of making Phuket a safe city for all, Phuket aims to maximise the coverage area of CCTVs by inviting private firms and corporations to share

Country	City	Vision	Priority Issue 1	Priority Issue 2
		is to achieve sustainability in its tourism development	data that can aid the city administration in more efficient and accurate planning of infrastructure, public utilities, common amenities etc. The data will also provide valuable insights to businesses and start-ups in their analysis.	their CCTV generated data with the government. While video analytics and CCTVs have been implemented and integrated since 2017, Phuket plans to expand the coverage of CCTVs. Phuket city government seeks to collaborate with Cloud companies to take this project forward
Lao PDR	Luang Prabang	A city of tourism centre and regional connection, Luang Prabang envisions to be a clean, green, liveable environment and smart city with the world heritage in the core by 2025.	<u>Heritage Wetland Restoration for City Green Spaces and Habitats</u> Located in the northern Laos, Luang Prabang has 183 ancient wetlands and small ponds previously used by surrounding households for food production and local drainage. So far, 22 wetlands were rehabilitated, while the associated drainage systems and tourism infrastructures were constructed. Unrestored wetlands, however, are biologically degraded and polluted with increasing urban development pressure, detracting the inherent heritage values of the city. Restoring these wetlands and small ponds to their original values can lead to—improved green spaces, enhanced eco-tourism / ecological diversity, new tourism enterprises around the wetlands, wastewater treatment storm water retention to prevent floods, and restoration of heritage values of the city.	<u>Construction of Concrete Alleyways and Footpaths</u> Famous for its numerous Buddhist temples and monasteries, Luang Prabang aims to complete the upgrading of 44 paths within 5 years in order to encourage pedestrianisation and to reduce dependency on polluting vehicles. Registered as an UNESCO World Heritage Site in 1995, Luang Prabang's tourism industry has been fundamental for the city's economic growth. As part of this project, Luang Prabang seeks to upgrade existing footpaths, improve amenities in order to improve visitor experience.
	Vientiane	Vientiane envisions environmentally friendly urban development with—peace, clean, green, light, charm and prosperity. By organizing e-governance and applying high-technology solutions, the city aims to improve the quality of their people's lives for their future.	<u>Establishment of Drainage System</u> Incorporating drainage management systems into the city Master Plans and socio-economic development plans, Vientiane Capital aims to effectively improve the operation and maintenance of the drainage system. Each year, the city is flooded for at least 5 months. The existing master plan doesn't capture information on the drain infrastructure, resulting in data gap among government agencies. An upgraded drainage system can increase Vientiane Capital's urban resilience with fewer flooding incidents. Support in the form of funding for the operation and maintenance of drainage systems, and strong enforcement of development control is required.	<u>Sustainable Transport Plan</u> Increasing population, poor road quality, and inadequate public transport systems have resulted in traffic congestion on Vientiane Capital's streets. Vientiane Capital needs to synchronise its Sustainable Transport Plan with its Master Plan to ensure better landuse and transport integration. The city seeks to collaborate with key stakeholders such as private transport corporations and local transport department to identify underlying transport issues and develop a strategic roadmap specifying the short-term and long-term action plans.
Vietnam	Da Nang	Da Nang envisions itself to be a smart, liveable, and sustainable city by 2030. With a citizen-centric strategy, Da Nang aims to deliver high quality of life and sustainable environment for citizens while ensuring economic growth and competitiveness.	<u>Intelligent Traffic Control System</u> To reduce traffic congestion and improve logistical efficiency, Da Nang plans to upgrade the existing traffic control system to effectively collect, manage and analyse comprehensive traffic information. This requires the installation of a CCTV network and associated software to detect traffic flow and violations. The desired outcomes include sharing real-time data and information on transport to be used by both the public and private sectors, reducing travelling time, enhancing public transport management, and improving control and supervision of traffic conditions.	<u>Smart Water Management</u> In the context of rapid urbanization, climate change, and environmental degradation, efficient water resource utility is crucial to enhance quality of life while ensuring sustainability in Da Nang city. Da Nang aims to improve water supply, drainage, and wastewater treatment for higher water quality and reliability and lower operational costs.
	Hanoi	A green, culturally-rich, civil and modern city with sustainable development to create a better life for the people by 2030. As the national political centre, Hanoi places its economic, trade, investment, culture and social priorities at heart.	<u>Intelligent Operation Centre (IOC)</u> With the current public transport systems not well integrated with city's geography, the inter-modal hub and spoke system has yet to evolve. The establishment of an Intelligent Operations Centre will enable Hanoi to manage information and resources across all sectors. This would aid leaders in decision-making and responding to emergencies. Hanoi's urgent need is to have a centralized management system for monitoring and controlling signals and sensors, and for capturing visual information to effectively coordinate transport management.	<u>Development of Intelligent Transportation</u> With a clear strategic focus to provide access to better-managed public transport, Hanoi aims to reduce congestion and improve logistical efficiency. Using technology platforms to generate and collect traffic data, Hanoi will improve transport services and communication with the people.
	Ho Chi Minh	Ho Chi Minh City's vision by 2025 is to attain rapid and sustainable economic development through optimal resource utilization and citizen-centric governance.	<u>Integrated Operations Centre (IOC)</u> This project will be the 'brain' of the Smart City by integrating daily information and resources across all sectors in Ho Chi Minh City. Data and information will be collected and integrated from CCTV, sensors, and operation centres in all government sectors.	<u>Integrated and Unified Emergency Response Centre</u> Ho Chi Minh City plans to develop an integrated and unified emergency response centre for security and public order issues, fire-fighting and prevention, as well as medical services by 2020. The response centre will include upgraded features such as automatic location and number identification, Computer Aided Design / Geographic Information Systems for resource management and

Country	City	Vision	Priority Issue 1	Priority Issue 2
				operation, integrated video surveillance systems and IP Call Centre management software.
Brunei	Bandar Seri Begawan	To Develop Kampong Ayer as the Jewel of Bruneian Heritage and facilitate its growth as part of Bandar Seri Begawan's smart city development plan.	Revitalization of Kampong Ayer (Water Village) Located to the South of Bandar Seri Begawan, the village of Kampong Ayer has been identified as an integral part of Bandar Seri Begawan's sustainable and smart city development plan. Kampong Ayer will be redeveloped into a liveable city with a sustainable environment and a diverse economy with a distinct Bruneian identity.	Clean River Management Project To overcome the challenges related to waste generation, waste collection and disposal, Bandar Seri Begawan is determined to put in place an institutional framework that promotes sustainable waste management practices. Specifically, the city seeks to restore the quality of the Brunei River. Brunei's move towards being a smart and sustainable city involves strengthening regulatory and enforcement measures related to effluent discharges into the River and management of waste through latest technological interventions.

2.2.3 Smart City development in Asian countries

Taking a look at smart city development in Asian countries other than the ASEAN countries, China and South Korea have promoted smart city development as a national policy. Several urban redevelopment project has been implemented in Japan at a railway depot like the Bang Sue area, though the projects have not necessarily been implemented as “smart city” project.

This section covers Umekita urban development project in Osaka and Kashiwa-no-ha Smart City in Chiba Prefecture as redevelopment cases for the former railway site, and also reviews smart city development in China and South Korea thereby summarizing suggestions to the Bang Sue Area.

Table 2.2 Case study and perspective

Case	Perspective of case study and suggestion to Bang Sue
Japan: Umekita Area Development	Area development and implementation structure
Japan: Kashiwa-no-ha Smart City	Smart City concept and function
South Korea	Digital infrastructure development and Skywalk for Seoul Station
China	Urban management with data platform

(1) Japanese case: Umekita Area development

1) Overview

Osaka Station North District (Umekita area) is located around the former Umeda Freight Terminal, north of JR Osaka Station. The area has been designated as Urgent Urban Redevelopment Area – an area applicable for urban redevelopment area - in 2012, and is currently being redeveloped. Out of the total area of approximately 32.3 ha, about 8.6 ha had been developed as first phase development zone (Umekita Phase I) and Grand Front Osaka was opened in April 2013 as its centerpiece. Umekita Phase II zone (approx. 23.7 ha) is currently being developed.

2) Area development by steps (Phase I development)

The steps regarding area development was compiled as reference for the Bang Sue area development. Generally, the process of area development could be distinguished into several phase: formulation the entire design concept; establishment of the basic plan; selection of developers; basic infrastructure development; and area development. Responsible promotion organizations have been set up in accordance with respective phases.

The following table shows the series of events by period.

Table 2.3 Umekita Area development by phase

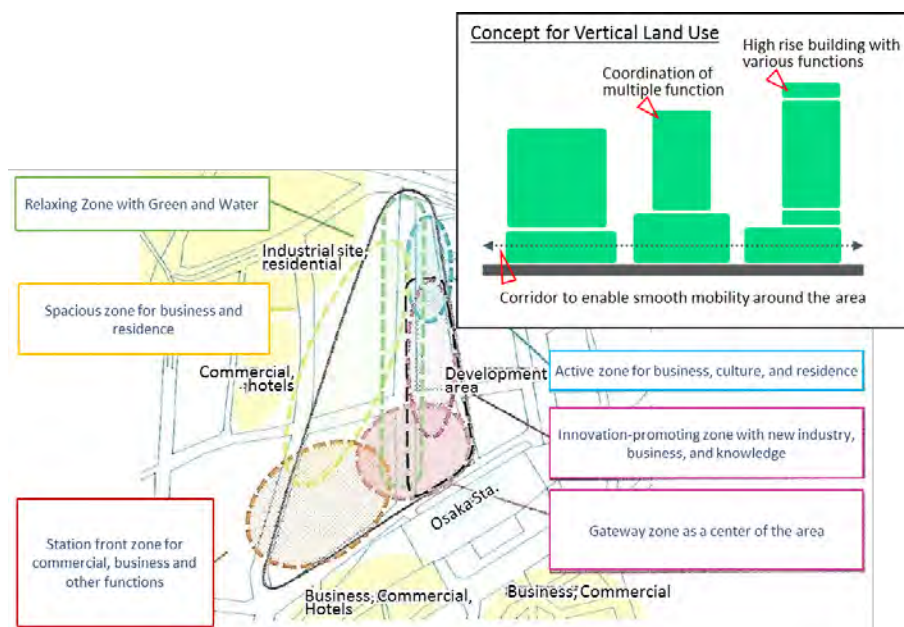
Period	Events
Mar. 2002	Gathering for Urban Redevelopment in Osaka North District.
Aug. 2002	Establishment of a committee to formulate entire development plan for Osaka North District.
Sep. 2002 - Mar. 2003	Implementation of international competitions for concept design.
Oct. 2003	Osaka City released “Grand Plan for Osaka Station’s North District.” *Starts development of 7-ha area that is unrelated to freight transfer, as first phase development.
Mar. 2004	Establishment of Area Development Promotion Committee for Osaka Station North

Period	Events
	District
Jul. 2004	Osaka City Office released “Basic Plan for Area Development in Osaka Station North District.”
Nov. 2004	Establishment of Umekita Area Development Promotion Agency.
Dec. 2004	Definement of Development Plan for Phase I development area.
May 2005	Explanation to developers regarding B block tender.
Jun. 2005	Commencement of basic infrastructure development (Permission for land readjustment project)
Feb. 2006	Commencement of application process for A/B/C block developers.
May 2006	Selection of B block developer.
Nov. 2006	Selection of A/C block developers.
Dec. 2006	Establishment of Committee for Phase I development Zone.
Nov. 2009	Establishment of Umeda Area management committee.
Mar. 2010	Commencement of building construction in Phase I development zone.
Feb. 2011	Area name decided as “Umekita”.
May 2012	Establishment of Grand Front Osaka TMO.
Apr. 2013	Commercial opening of Grand Front Osaka

The established organizations for respective development phase and its roles are as follows.

1st Step: “Grand Concept Design” Formulated by Osaka City

- Years 2002 to 2003: Held “international concept competitions” to decide the development concept which would be the base for Area development plan.
 - Committee was set up with coordination with the local government, business community. International competition was held in which academic experts, renowned architects were included for the reviewing committee.
 - 966 proposals were submitted.
 - The total amount of prize: 20 million yen.
- Oct. 2003: Osaka City Office formulated “Grand Concept for Osaka Station’s North District.” based on proposals in the international competitions.

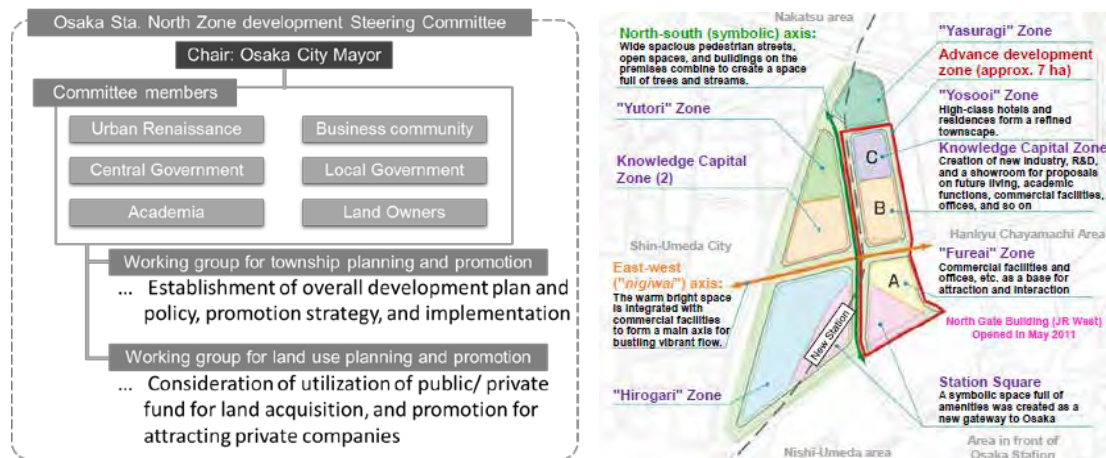


Source: Materials provided by UR

Figure 2.6 Image of Grand Concept for Osaka Station’s North District

2nd Step: Establishment of Area Development Promotion Committee for Osaka Station North District and Formulation of Basic Plan

- March 2004: Set up the promotion committee chaired by Osaka City Mayor.
 - Role: Consider and discuss, based on Grand Concept, the development plan, business plan, and town management, to build a consensus for the basic policy and to execute the projects, etc.
- Jul. 2004: Formulation of “Basic Plan for Area Development in Osaka Station North District.”



Source: Materials provided by UR

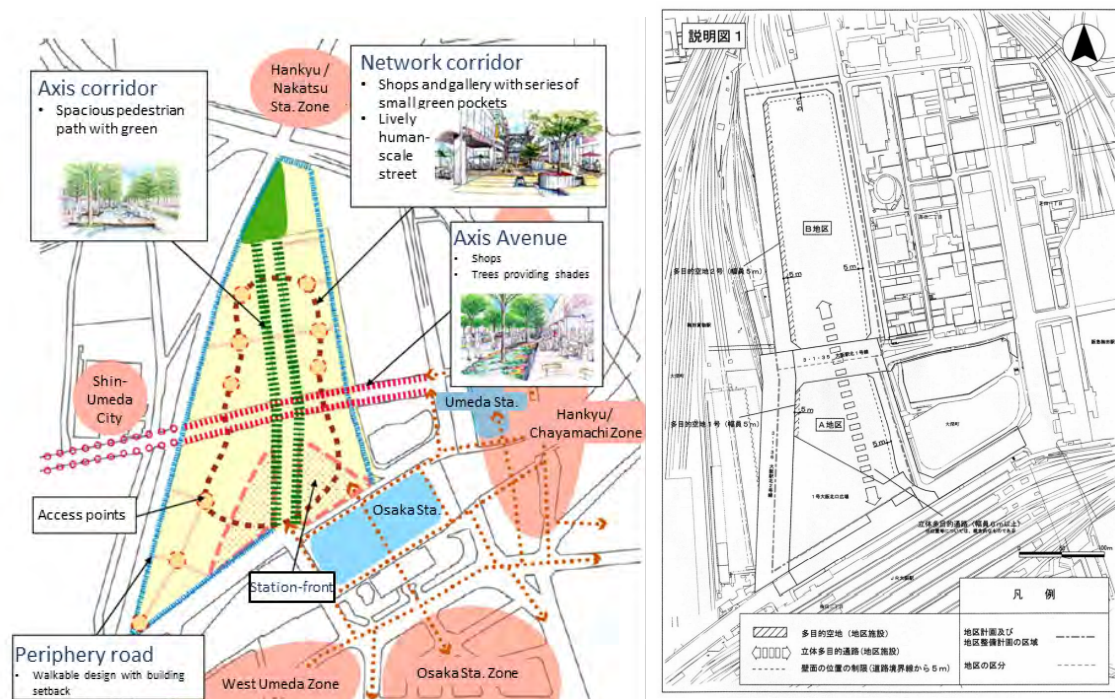
Figure 2.7 Organization Structure for Urban Development Promotion Committee (Left) and Basic Plan (Right)

3rd Step; Establishment of Grand Front Osaka TMO and Implementation of Town Management

- May 2012: Establishment of Grand Front Osaka TMO.(Town Management Organization)
 - Role: The role for TMO is to manage the town in a sustainable and integrated manner through public-private cooperation in order to: vitalize the area; improve the environment; develop business projects for strengthening community. This would contribute to enhancing added values in the development area. TMO is established through the participation of area developers.

3) Construction of Sky Deck

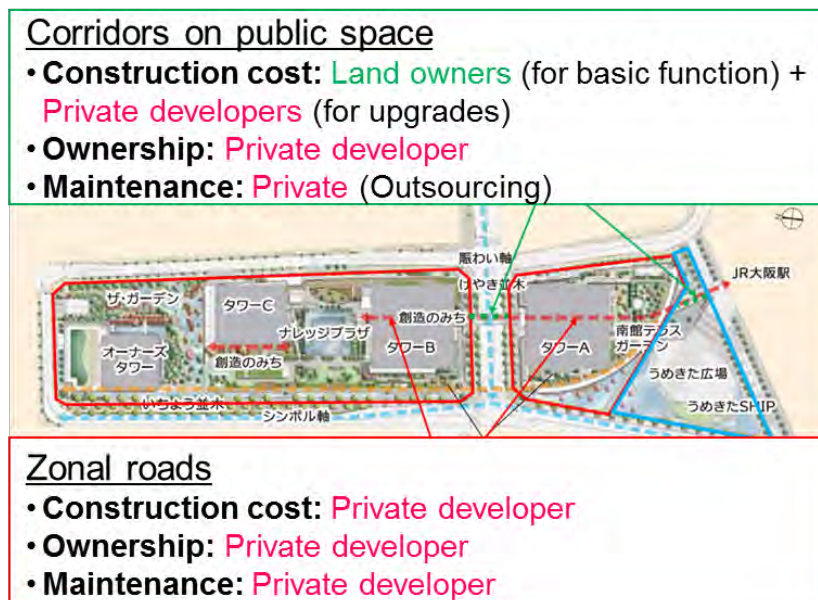
- Development of a network of pedestrian corridor was stipulated in the Basic Plan for Area Development in Osaka Station North District. Based on the Plan, it was specified in the district plan that “the Sky Deck shall connect Osaka Station and B-1 zone via Zone A to form a comfortable and safe pedestrian corridor network, while at the same time considering cityscape”.
- TOR for the developers for the area stipulated that the developer shall conform to the Basic Plan and the district plan. Also the tender documents clarified the responsibility and cost to be borne by the entity in charge of land adjustment (in this case UR), and thus the development and management of pedestrian corridor was stipulated as item to be proposed by the tenderer.



Source: Materials provided by UR

Figure 2.8 Pedestrian network image (left), and facility plan in district plan (right)

- As for the construction cost, the private developers were in charge of the section on the private land, whereas the land owners covered the cost for ensuring minimum required function for passage for the section on the public land. It is worth noting that the capital borne by UR (as an implementing body) for Sky Deck on the public land was raised upon the sale of the land owners' land from the land adjustment project. Also, the upgrade portion for the corridors on public space was borne by the private developers.



Source: Materials provided by UR

Figure 2.9 Cost allocation for Sky Deck construction

4) Implications for Bang Sue Development

Establishment of committee with stakeholders' participation and formulation of Basic Plan under the committee

At the time of formulating a basic plan for Umekita development project, the governor of the local government was appointed as chair of the committee, with participation from national government organizations, private economic federations, academic experts and land owners as members. In addition, Urban Development Promotion Agency was set up as an implementation organization to realize the development plan, whereby planning or coordinating to realize integrated development as a national projects.

For Bang Sue Area development, no committee have been set up for stakeholders to coordinate. The responsibility for the project is almost solely left to SRT, and thus formulation of common understanding, discussions or coordination has not been sufficient. It is desirable to set up a committee for Bang Sue development project, in which basic plan would be formulated and executed with coordination among stakeholders.

Specifically, it is proposed that a development committee, equivalent to Umekita Development Promotion Committee, should be set up under Thailand's Transport Ministry OTP as the council head. The committee is expected to authorize the basic policy or plan for the entire development. In addition, SRT Board (or a consultative body that centers around SRT Board) could take up the role of development promotion organization, similar to Umekita Area Development Promotion Committee. Through these institutional set up, realization of integrated development whereby planning of suitable infrastructure and facility and efficient and effective coordination of zone development would be expected.

Implementation of development based on Overall Development Plan

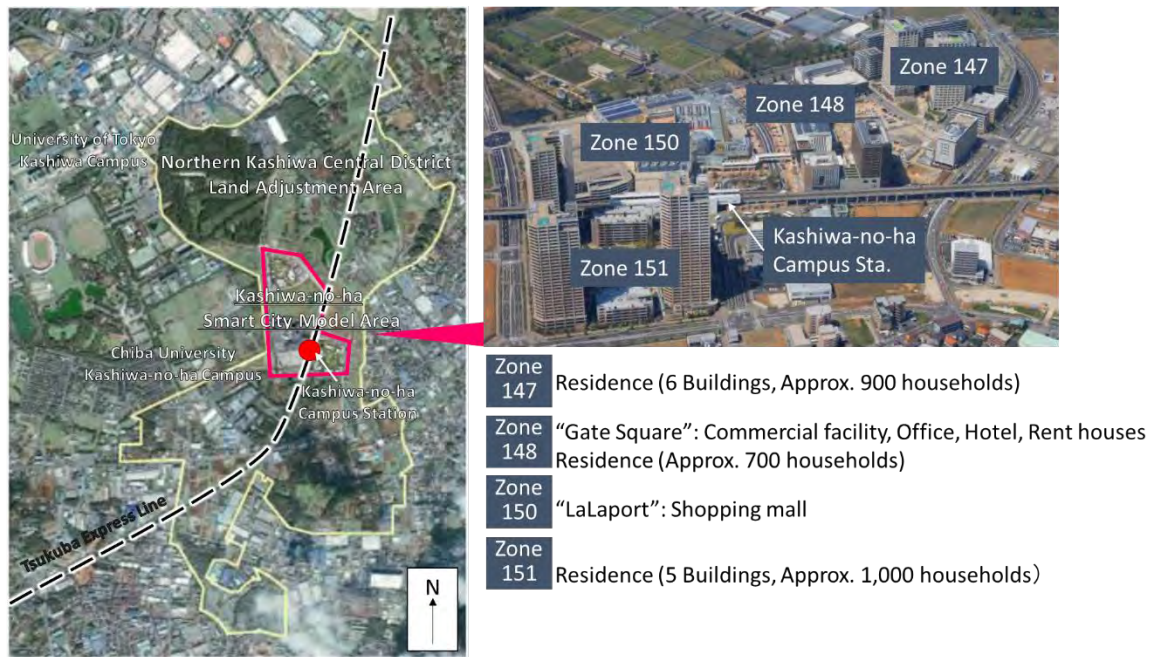
In the Umekita development project, respective stakeholders were gathered to formulate the overall development plan, and development process was kept in line with the overall plan.

Although the overall development plan for Bang Sue Area were considered through OTP or JICA studies, the plans were not necessarily being referred. Currently, the plans are revised separately at each zones, while development projects have been implemented independently. It is important to set up a committee in order to coordinate the overall development plan for Bang Sue area, and also to ensure that the developers would follow the established development plan.

(2) Japanese Case: Kashiwa-no-ha Smart City

1) Overview

Kashiwa-no-ha Smart City, located in the suburbs of the Tokyo metropolitan area, is an area around Kashiwa-no-ha Campus Station on Tsukuba Express Line that opened its operation in 2005. Since the operation of the line, land reallocation projects and development by private operators have resulted in construction of condominium apartments, large-scale commercial facilities or hotels.



Source: Compiled by JICA Study Team, based on press release documents published by Mitsui Fudosan Co., Ltd.

Figure 2.10 Kashiwa-no-ha Smart City

Table 2.4 Development Scale for Kashiwa-no-ha Smart City

Developer	Mitsui Fudosan Group (Mitsui Fudosan Co., Ltd./Mitsui Fudosan Residential Co., Ltd.)
Area	Approx. 14.2 ha
No. of houses	Approx. 2,700
Project Size	Approx. 125 billion yen (Expected as of March, 2018)
Planned Land Use	Residence (Approx. 2,700 houses), hotel (166 rooms), commercial facilities (Approx. 7 million visitors annually), office (No. of employees: approx. 1,000)

Source: Compiled by Study Team, based on press release documents published by Mitsui Fudosan Co., Ltd.

This smart city aims to solve urban problems in collaboration with public, private and academic sectors, especially in the field of: energy, traffic, and aging society. For this, three pillars are set out: “Environmental symbiosis city”, “Healthy longevity city”, and “New industry creation city”.

2) Service and facility by theme in Kashiwa-no-ha Smart City

The major services or facilities are described below, based on the three themes of “Environmental symbiosis city,” “Healthy longevity city” and “New industry creation city.”

“Environmental symbiosis city”: Establishment of energy management system and green, comfortable pedestrian space

“Gate Square” located at zone 148 introduces Area Energy Management System (AEMS), based in “Kashiwa-no-ha Smart Center” under ICT system, in order to operate, manage and control energy for the entire town. It adopts lithium ion battery system (approx. 3,800 kWh of storage capacity), solar power generation (approx. 720 kW of total power output) and gas generator for emergency use (approx. 2,000 kW of power output). These systems are used to interchange electricity through smart grid and achieve power peak cut and energy saving. Furthermore, even if power supply is suspended by electric power companies, about 60% of day-to-day power volume can be supplied to the town for three consecutive days, achieving a business continuity plan (BCP) and a life continuity plan (LCP).

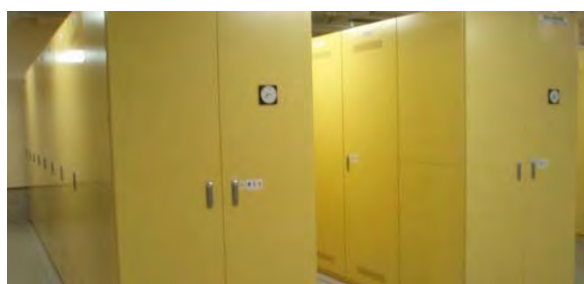
In addition to AEMS, the town block adopts home energy management system (HEMS) to monitor and visualize energy consumption status with tablet terminal or other equipment in the house, commercial facility and individual office facility, encouraging residents or tenants to consume energy in an optimal manner.



Kashiwa-no-ha Smart Center



Rooftop solar power generation



Latium iron battery system



HEM system (Image)

Source: Based on press release documents distributed by Mitsui Fudosan Co., Ltd.

Figure 2.11 Energy System in Kashiwa-no-ha Smart City

Meanwhile, a 1.5-m wide personal mobility lane, installed along the pathway to boost mobility in Zone 148, allows Segway or other next-generation vehicles to run on, though they are not permitted to drive on the Japanese public road. The area aims to build the sustainable mobility system, while demonstrating cutting-edge technologies.

As for road space, moreover, sidewalks with planting or comfortable greenery space or roads for cyclists are developed in an effort to create vibrant town landscape.



Personal Mobility Lane



Road Space

Source: Based on press release documents distributed by Mitsui Fudosan Co., Ltd.

Figure 2.12 Road Space in Kashiwa-no-ha Smart City

“Healthy longevity city”: Service supporting healthy lifestyle

“Machi-no-Sukoyaka-Station (Health Station for Town)”, installed on one floor of a commercial facility, includes medical facilities under the theme of disease prevention, based on the healthcare concept of “from treatment to prevention”. Several businesses that supply exercise, diet or other health advice are stationed in the facility.

Furthermore, “A-Shi-Ta (meaning tomorrow in Japanese)” Community Health Promotion Laboratory is installed as a hub to provide regional residents with various health checkup measurement services, professional advice and event/lecture programs so that residents can keep young and healthy, using state-of-the-art knowledge, services or products on beauty, diet/nutrition, oral function, walk, and nursing-care prevention.



Source: Based on press release documents distributed by Mitsui Fudosan Co., Ltd.

Figure 2.13 “A-Shi-Ta” Community Health Promotion Laboratory and Available Equipment
“New industry creation city”: Innovation office and conference center

Innovation center “KOIL,” located in “Gate Square” of Zone 148, is designed under the concept of creating new industries by sharing knowledge, technologies and ideas. “KOIL” provides large-scale co-working space, a manufacturing atelier with 3D printers and other equipment, and cafes or studios for personal exchanges. And also, a conference center in “KOIL” accommodates about 400 visitors together with six small and large meeting rooms in order to hold a wide variety of exhibitions or meetings.



Co-working Space



KOIL Factory (Manufacturing Atelier)

Source: Based on press release documents distributed by Mitsui Fudosan Co., Ltd.

Figure 2.14 Innovation Office in Kashiwa-no-ha Smart City

3) Implications to Bang Sue

Problem-solving Approach

As described previously, Kashiwa-no-ha Smart City proposes an ideal smart city to tackle challenging issues, based on social problems in Japan like energy consumption or dwindling

birthrate and an aging population. As Bang Sue development is also a large-scale project positioned as a national project and expected as a model for other cities under ASCN's pilot project, it is desirable to promote development in the direction of solving social problems in Thailand or Bangkok.

Mobility Policy (Next-generation Vehicle Lane, Road Space)

Ensuring connectivity and mobility for visitors to Bang Sue Station so that they can easily access area facilities or neighboring stations is indispensable. As in the case of Kashiwa-no-ha Smart City, the personal mobility lane is built to introduce and demonstrate next-generation vehicles, this facility is effective for Bang Sue, too. As traffic demand density is high and travel distance is likely to be long in Bang Sue, the space for small public transport system can be considered.

It is also desirable to secure comfortable road space for regional mobility and safety.

Energy Measures (Energy Efficiency through AEMS, BCP at Emergency)

The area management system, based in a smart center as a hub, can be applied to the Bang Sue area. Considering stepwise development in Bang Sue, the smart grid system needs to be expanded in accordance with the phased development.

Meanwhile, as Bang Sue Grand Station is located in the business district with many users, it is important to establish sustainable energy system in preparation for emergency, as shown in Kashiwa-no-ha Smart City.

Promotion of Healthcare

As Thailand is also expected to age in the future, healthcare services are needed as described in Kashiwa-no-ha Smart City. As the Ministry of Health plans to build a medical complex facility (Medical Complex) in the Bang Sue Area, the facility could serve as a hub for healthcare measures.

(3) South Korea

1) Overview

South Korea government has been promoting large-scale smart city projects as a national policy, in cities such as Seoul, Incheon and Busan.

Local autonomies have an initiative in smart city development under the support of the national government, and have installed many CCTVs across the cities to comprehensively oversee traffic conditions, disasters and crimes. Information are typically provided through the digital signage.

The collected information is compiled on the platform, whereby the control center installed in each city monitors the information, contributing to town safety, traffic management, etc. in collaboration with the police and the fire department.

Furthermore, in Seoul, a sky deck connecting to Seoul Station has been developed. The deck was originally used for a highway but it has been refurbished as a pedestrian deck, and provides a comfortable network for pedestrians leading to the station.

2) Implications for Bang Sue Development

Establishment of Data Platform

The data platform was established covering the local autonomies in South Korea, and a wide

variety of information is organized and made available on the platform.

Such data platform that compile various data (CCTV image information, traffic information, building information, infrastructure status, energy information, etc.), and provide processed information in a usable, accessible, and secure form is proposed in Bang Sue Area as well. This would contribute to efficient urban management and creation of new business opportunity.

Sky Deck Network

The sky deck in Seoul Station offers comfortable pedestrian space, on which pedestrians can access to the surrounding facilities from the station on foot.

It is also proposed in the Bang Sue area that a sky deck should be built, and network formed centering on the Grand Station so as to offer comfortable pedestrian space and create connections and interactions among zones.

(4) China

1) Overview

China has continuously advanced its efforts on smart city development since the latter half of the 2000's. The 13th five-year program (from 2016 to 2020), stipulated in 2016, envisages to improve infrastructure and public services with the development of new digital technologies through smart city initiative. It is reported that around 500 Chinese cities are included in smart city projects in 2018.

The Chinese government has coordinated with IT firms in the smart city development project – notably four IT giants, called PATH: Pingan, Alibaba, Tencent and Huawei.)

For example, Alibaba has established its AI platform called ET City Brain, which “can immediately correct defects in the urban operation with the use of all kinds of real-time urban data and optimize the entire public urban resources.” The platform has been introduced to Hangzhou City and others, and is scheduled to be experimentally launched in Kuala Lumpur, Malaysia, as the first non-Chinese city.

2) Implication for Bang Sue Development

Utilization of big data and development of data platform for urban management could be referred to a certain degree in the Bang Sue Area. Meanwhile, in order to analyse traffic information and use it for traffic congestion measures, data need to be gained and analysed not only from the Bang Sue area, but also from wider areas. For example, AI-based management could be first implemented and demonstrated in the field of energy management.

2.2.4 Examples of urban development projects in the neighbouring countries in ASEAN under PPP scheme

(1) Urban development projects under PPP projects in ASEAN

Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development

Large-scale urban development projects under PPP scheme in ASEAN were observed since 1990s. One of the typical cases of such project is “SENAYAN SQUARE PROJECT” in Jakarta, Indonesia. It is a 40-year BOT project (1989 to 2036) between the Government of Indonesia and a private company to develop 19 ha national land.

Such large-scale urban development has been accelerated since 2000s, and more players have been involved. In case of Japan, construction companies were main player such large-urban development players before but other players, real estate, trading, transport operators and hotel operators were being involved such projects. Government of Japan has been also promoting the private sector's activity in ASEAN countries to make use of Japanese superiority in urban development in Transit Oriented Development (TOD), Smart City (in particular, energy saving, recycle, urban development in harmony with nature, safety & security and recycling). Typical promotion policies of the government are (i) promotion of overseas activities by independent administrative agencies (parastatals) and (ii) preparation of financial schemes (equity investment, loan, Yen loan and trade insurance) for overseas infrastructure development including urban development. The government has established an infrastructure development fund, "Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development (JOIN)" in corporation with private sector to enhance the equity investment in September 2014.

Since the establishment, JOIN has supported urban development projects indicated in Table 2.5. The following sections explain projects which provide lessons to Bang Sue development.

Table 2.5 Financial supports by JOIN for urban development in ASEAN

Month and year	Country and city	Name of the projects	Investment/debt guarantee amount	Development area
July 2016	Yangon, Myanmar	Urban Development Project - Landmark Project	Investment: USD20 mill	4 ha
October 2016	Jakarta, Indonesia	Mixed-use Urban Development Project in Bumi Serpong Damai City	Investment: JPY3.4 bill	6 ha
May 2017	Jakarta, Indonesia	Jakarta Garden City Project	Investment: JPY5.0 bill	8.5 ha
July 2017	Jakarta, Indonesia	Southeast Capital Project	Investment: JPY3.0 bill	12 ha
July 2017	Yangon, Myanmar	Redevelopment of the Defense Services Museum site	Investment: USD49.4 mill Guarantee: USD41.8 mill	1.6ha
December 2017	Jakarta, Indonesia	Mega Kuningan Project	Investment: JPY6.5 bill	1.1 ha
August 2018	Ho Chi Minh City, Vietnam	Waterpoint Project	Investment: JPY1.9 bill	165ha
December 2018	Chonburi Province, Thailand	Amata Nakorn Project	Investment: JPY0.6 bill	2.1ha

Source: JOIN website (<http://www.join-future.co.jp/english/our-mission/investments.html>)

Mega Kuningan Project

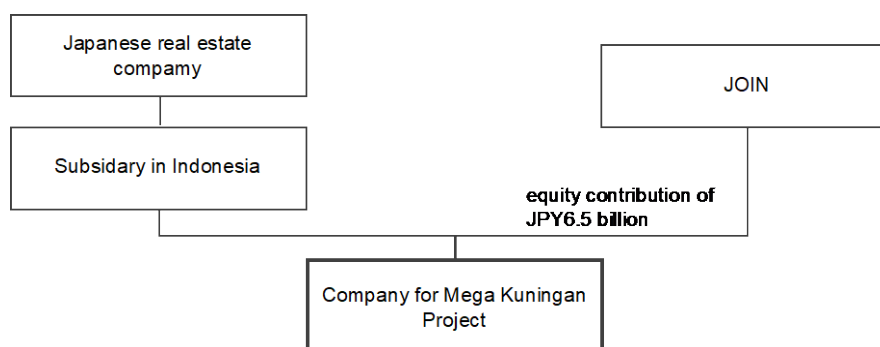
Mega Kuningan Project in Jakarta is the largest investment contribution project. The project is to develop a mixed-use complex urban area comprised of housings (sale and rent) and commercial facilities with total floor area is approximately 110,000m² in Mega Kuningan, one of the major redevelopment areas in Jakarta Central Business District (refer to Figure 2.15). The total investment cost is not published but it is estimated around JPY 20 billion.



Source: Press release from the development company

Figure 2.15 Location of Mega Kuningan Project

JOIN supported the project by JPY 6.5 billion of equity contribution to the project development company which is established under Indonesian subsidiary company of a Japanese real estate company. The Japanese real estate company intends that all process of the development and operation (land acquisition, plan, design, construction and operation & management) will be conducted by Japanese or Japanese-affiliated companies.



Source: Press release from JOIN (http://www.join-future.co.jp/english/news/pdf/20171222_01_01.pdf)

Figure 2.16 Implementation structure of the Mega Kuningan Project

Waterpoint Project (Phase 1)

Waterpoint Project is a residential development project (355 ha of total area) located in Ben Luc, the gateway to the Mekong Delta from Ho Chi Minh City (refer to Figure 2.17). The project has initiated by a leading Vietnamese real estate development company (Nam Long Investment), and the company prepared the project from 2000s.

The phase 1 project is a housing complex comprised of townhouses, villas, land plots, and public facilities on about 165 ha, which consists of around 3,000 houses, 20ha of park area, 17 ha of a university and 2.5 ha of the community area (refer to Figure 2.18). In order to carry out the Phase 1 project, Nam Long Investment has established a project company for the Waterpoint Project with other Vietnamese companies, and a Japanese private railway operator joined the member in June 2018. Total investment cost for the Phase 1 project amounts to VND 6,900 billion (USD300 million), and the Japanese private railway operator invested 35% of the total investment cost. JOIN decided to support the project and provided equity contribution of JPY1.9 billion to a SPC

established with the Japanese private railway operator as show in Figure 2.19. All investment cost for the Phase 1 project is prepared by the Joint Venture partners.

The Japanese private railway operator is going to operate high-speed bus between the project site and Ho Chi Minh City as well large-scale housing complex development.



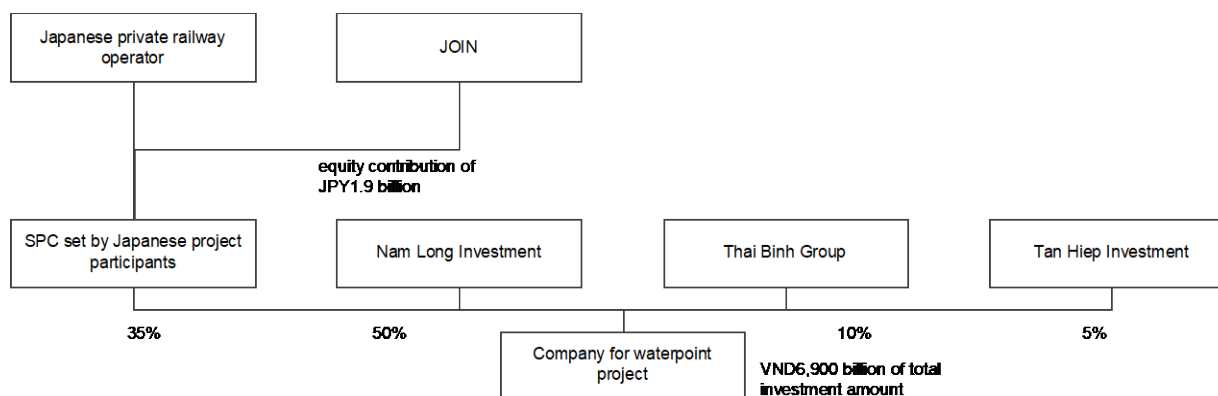
Source: Press release from JOIN (http://www.join-future.co.jp/english/news/pdf/20180824_01_01.pdf)

Figure 2.17 Location of Waterpoint Project



Source: Press release from JOIN (http://www.join-future.co.jp/english/news/pdf/20180824_01_01.pdf)

Figure 2.18 Development image of the Waterpoint Project



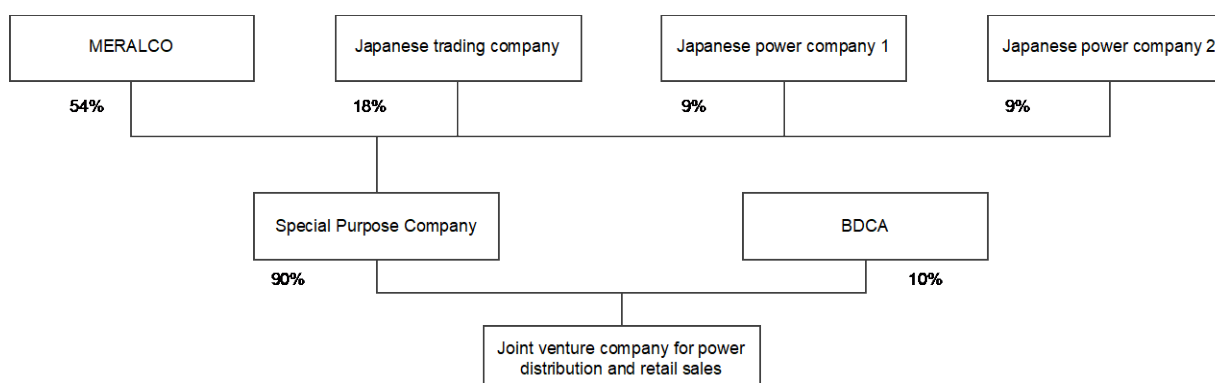
Source: Press release from JOIN (http://www.join-future.co.jp/english/news/pdf/20180824_01_01.pdf)

Figure 2.19 Implementation structure of the Waterpoint Project

New Clark City

New Clark City is a new city development project in Municipality of Capas, Province of Tarlac, Central Luzon. Total area is 9,450 ha, and it is one of the former Clark Air Force Base site utilization projects. The project of initiated by the Bases Conversion and Development Authority (BDCA), and the Philippine Congress approved House Resolution 116 in support of New Clark City in March 2015.

Phase 1A area (200ha) of the New Clark City is the National Government Administrative Center (200 ha) which will primarily host facilities for the Philippine government such as offices of various government agencies, government housing units, and other support services facilities. It also includes New Clark City Sports Complex (40ha) for 2019 Southeast Asian Games. Apart from the Phase 1A area, 288ha of land is being developed by Filinvest (local real estate development company). The area is used for the industrial area (around 120ha) and residential area.



Source: Press release from a power company

Figure 2.20 Implementation structure of a joint venture company for power distribution and retail sales for New Clark City Project

JOIN exchanged a MoU with the BDCA on development of New Clark City in March 2015, and has been supporting to connect relation between the BDCA and Japanese private sector. In April 2019, a Japanese consortium released an announcement that the consortium and Manila Electric Company (MERALCO) won the bidding to power distribution and retail sales. The companies will build a smart grid for New Clark City containing 45 km of power lines and about 30,000

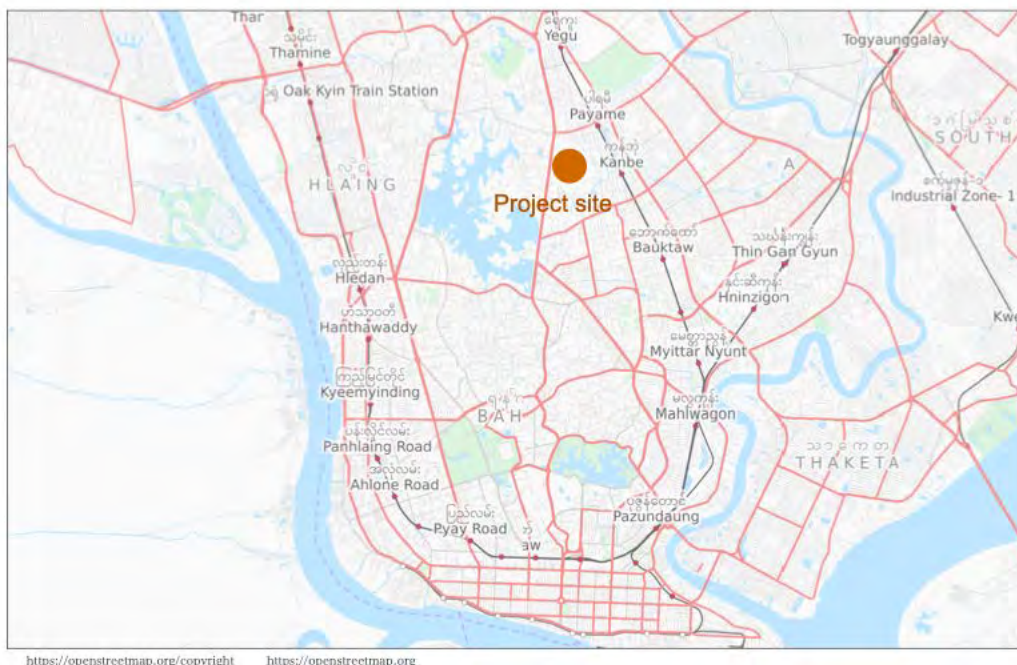
electricity meters that can transmit data. The city's power needs are projected at 250 MW. The consortium will form a Joint Venture Company shown in Figure 2.20.

Regarding water supply, the BDCA called open bid, and select a consortium which offers lowest unit price for water supply. The BDCA intends to form a joint venture like power distribution.

Japan Conference on Overseas Development of Eco-Cities

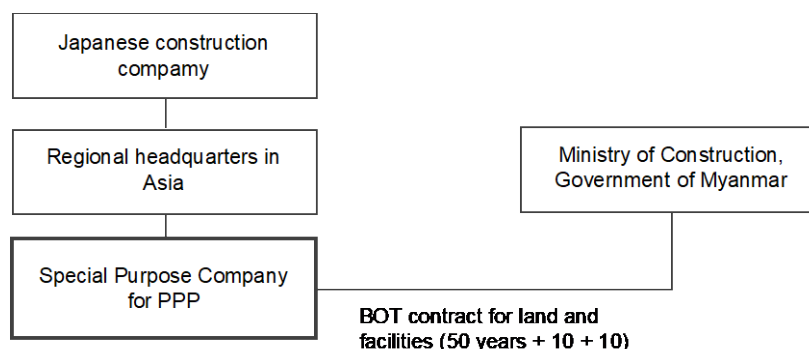
Another remarkable action of the Japanese PPP based urban development support for ASEAN city development is establishment of organizations like associations and conferences. This action is more private-driven one than establishment of the JOIN. “Japan Conference on Overseas Development of Eco-Cities (J-CODE) established in 2011 is one of such associations, and 57 companies relevant to design, construction and operation of real estates joined the organization.

J-CODE’s objectives is “To create eco-friendly and self-sustainable urban city in Asian countries using the technology and experience accumulated in Japan, and its major activities are (i) planning of overseas eco-friendly urban projects, (ii) information collection and sharing of overseas eco-friendly urban projects, and (iii) proposing institutions and policies for promoting overseas eco-friendly urban projects. After the J-CODE’s dialogues with Ministry of Construction in Myanmar, a Japanese company had BOT contract with the MOC for development of mixed-use complex (offices, hotels and commercial facilities; total floor area development (total floor area of 170,000 m²) in Yankin Township (total area of 2.7 ha, refer to Figure 2.21). The project is a new development model of public land for Myanmar, and it is 50-year (and twice of 10 year-extension) BOT project. Total investment cost is estimated around USD 400 million, and the land and facility are going to be transferred to the Government of Myanmar in the end of the contract (refer to Figure 2.22).



Source: Prepared by the study team based on the news release of the Japanese construction company

Figure 2.21 Location of Yankin Development Project



Source: Prepared by the study team based on the news release of the Japanese construction company

Figure 2.22 Implementation structure of the Yankin Development Project

Cooperation among public & private sectors of foreign countries and Japanese private sector: Tokyu Binh Duong Garden City

Tokyu Binh Duong Garden City (110 ha) is a part of Binh Duong New City (total area of 1,000 ha). Binh Duong New City is located around 30 km from Ho Chi Minh City, and it intends to accommodate 125,000 of residents and 400,000 working people in 2020 (refer to Figure 2.23). Development of the new city is initiated by the Investment and Industrial Development Joint Stock Corporation (BECAMEX IDC), which is a construction and urban development company owned by Binh Duong Provincial Committee. The Provincial Committee has relocated the central administrative office from old downtown to the new city area.

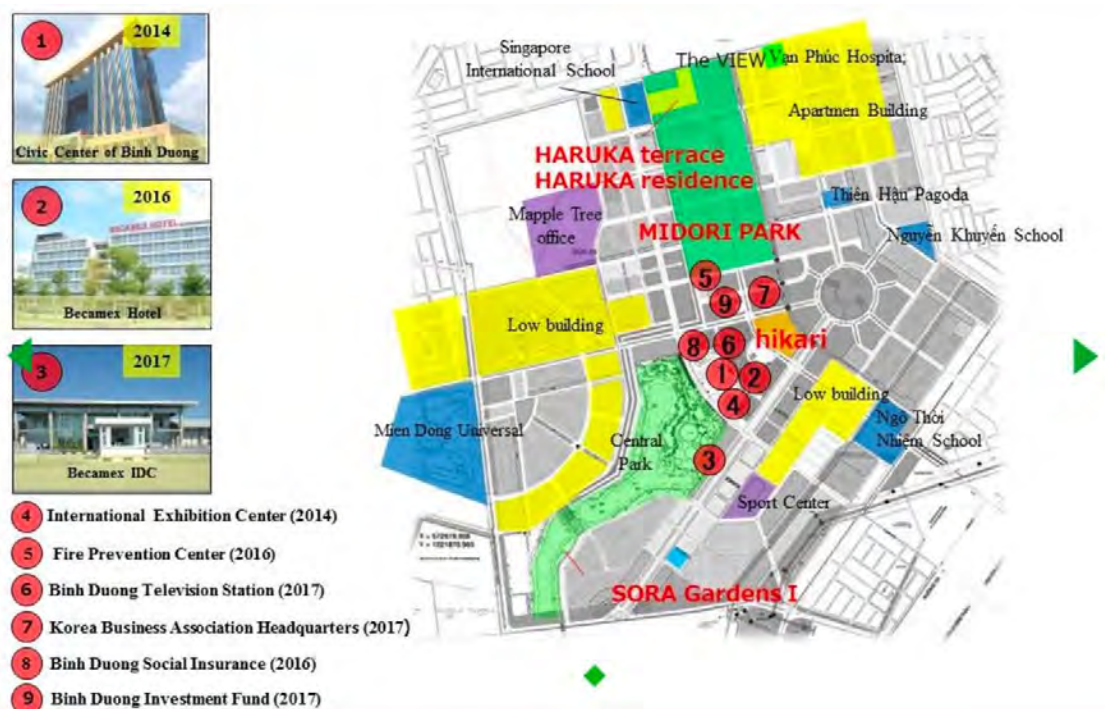


Source: BECAMEX Tokyu website

Figure 2.23 Location of Tokyu Binh Duong Garden City

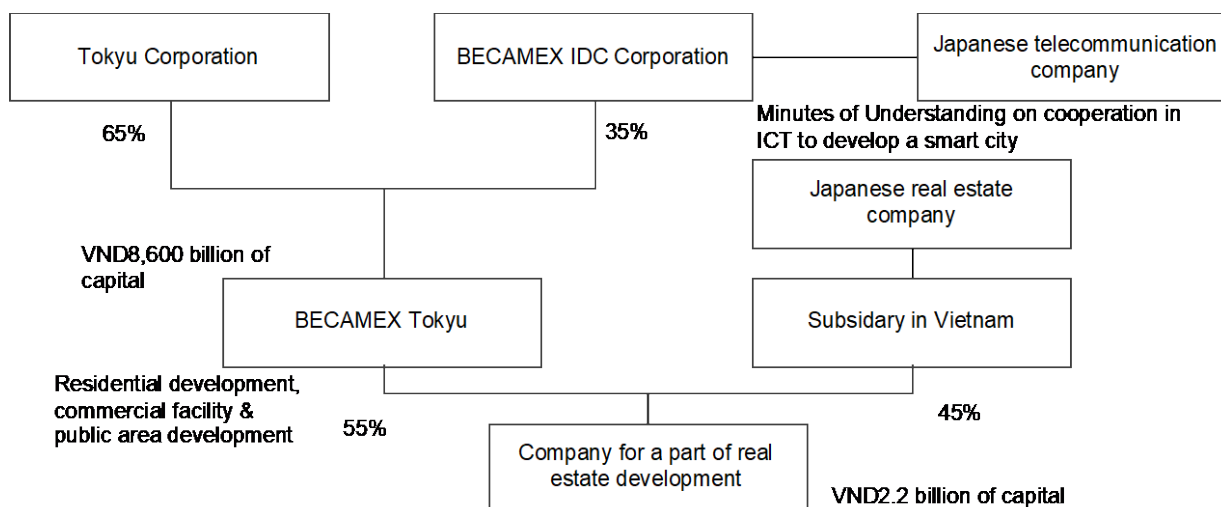
In order to develop the Garden City, Tokyu Corporation, a Japanese private railway operator formed a joint venture company, “BECAMEX Tokyu Co., Ltd” with the BECAMEX IDC in March 2012. Its total investment amount is VND 8,600 billion and Tokyu Corporation’s share accounts for 65% of the total. The BECAMEX Tokyu is developing around 7,500 houses, commercial facilities and offices at the Tokyu Binh Duong Garden City (refer to Figure 2.24). It also established a subsidiary, “BECAMEX Tokyu Bus Co., Ltd” in February 2014, and operates

7 bus lines as of June 2019 to connect the old down town and the new city.



Source: BECAMEX Tokyu website

Figure 2.24 Development image of the Tokyu Binh Duong Garden City



Source: Prepared by the Study Team based on the news release of BECAMEX Tokyu and other Japanese companies

Figure 2.25 Implementation structure of the Tokyu Binh Duong Garden City

In order to further residential development, a Japanese real estate company join the Tokyu Binh Duong Garden City development, and establish a joint venture company with BECAMEX Tokyu. In Addition, a Japanese telecommunication company made a Minutes of Understanding on cooperation in ICT sector to develop a smart city at Binh Duong New City (including Tokyu Binh Duong Garden City). Joint ventures with several Japanese companies are being implemented with BECAMEX IDC as the core in order to promote new urban development.

Lessons from urban development projects under PPP in ASEAN

Examples of urban development projects under PPP outside of Thailand shows the following characters.

- Availability of strong project initiator: local investment companies have a strong initiative in Waterpoint project, New Clark City and Tokyu Binh Duong Garden City, while Japanese companies have an initiative and freehand for decision making in Mega Kuningan Project and Yankin Project.
- Strong support from central or local government: local investment companies mentioned above are fully supported by the central government (New Clark City) and local governments (Waterpoint project and Tokyu Binh Duong Garden City); In case Japanese companies have initiatives, JOIN and J-CODE supports those projects.
- Simple finance procurement method: In most cases, development funds are not the projects themselves, but rather the ones gathered with the trust and self-funding of development companies. In two Vietnamese cases, almost of all investment cost for the Phase 1 project is prepared by the joint venture members. In case of Mega Kuningan Project, JOIN contributed a large financial support to the Japanese company.

(2) Examples of PPP projects in Thailand

Similar to other countries in Asia, the participation of private sectors in large-scale developments in Thailand has been growing.

In Thailand, Public Private Partnership (PPPs) has been employed as a main method to bring private sector to engage in development of infrastructures for a long time since the first PPP law in 1991. To supervise the PPP project to be consistent with country development plan and provide more clear directions, “Private Investments in State Undertaking Act” have been enforced in 2013 and this act covers various aspects of PPP projects comprehensively ranging from the definition of PPPs, the structure and the role of committee on PPPs, strategic plan on PPPs projects, to the whole process and procedures of PPP projects from applying, implementing to monitoring. Under the PPP scheme, the Private Investments in State Undertaking Committee will be the main committee who approve the project in principle and the State Enterprise Policy Office (SEPO) will act as the secretariat of the committee and the focal point to promote and facilitate PPP project in Thailand.

Under the Strategic Plan on Private Investments in State Undertakings 2017-2021, there are four subsectors which require private investment which are development of urban rail transit line, toll roads in metropolitan areas, public logistics port and high-speed rail line and other 19 subsectors which government encourage participation and investment from private sectors such as telecommunication networks, digital economy infrastructure, power infrastructure, real estate development for low to middle income population, and etc.

However, PPPs in Thailand still mainly concentrate in development infrastructures up until now as indicated in Table 2.6. Zone A development project of Bang Sue Area is on bidding based on the PPP law in 2013.

On 10th March 2019, “Joint State and Private Investment Act” came into force. It will replace the “Private Investments in State Undertaking Act,” and be a new PPP law. The new PPP law intends to expedite the joint investment process between the public and private sectors, empowered by the cabinet to tackle obstacles and any delays. For example, A Joint Investment Project with a value of THB 5 billion or more shall proceed according to criteria, procedures and conditions prescribed in the PPP Act. Joint Investment Projects with a value less than THB 5

billion shall proceed according to criteria and procedures determined and notified by the Public-Private Partnership Policy Committee. In the previous PPP law, THB 1 billion or more Joint Investment Project followed the PPP law.

According to Bangkok Post on 31st March, SRT Governor mentioned that “The Joint State and Private Investment Act, which came into force on March 10, opens the door for the SRT to lease its land to private developers instead of relying on Public-Private Partnership (PPP) deals”. It means that the new PPP law allow the SRT to call for an open bid for land leases without having to undergo an evaluation process with the PPP committee, the State Enterprise Policy Office and the cabinet. The scheme only needs to be approved by the SRT's board and the Transport Ministry².

² <https://www.bangkokpost.com/business/1653948/srt-ramps-up-efforts-to-lease-its-land>

Table 2.6 Examples of PPP projects in Thailand

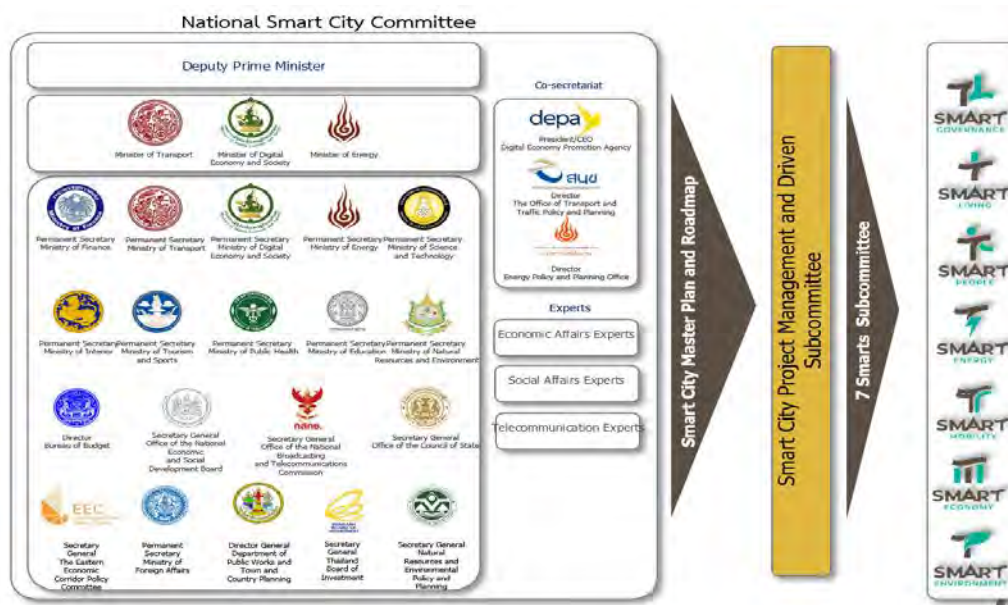
No.	Project Name	Project Owners	Investment Amount	Duration	Content of Project
			Mil Baht		
1	Monorail Yellow Line (Ladprao-Samrong)	Public: Mass Rapid Transit Authority of Thailand (MRT) Private: Eastern Bangkok Monorail Co., Ltd	43,104	33 years 3 months (3years3 months for construction and 30-year operating period)	- 30 kilometer extension and connecting line of existing monorail with 23 station, 1 maintenance center and 1 parking lots. - Private companies signed the contracts on Jun 20, 2017.
2	Monorail Pink Line (Kaerai-Minburi)	Public: Mass Rapid Transit Authority of Thailand (MRT) Private: Northern Bangkok Monorail Co., Ltd	45,764	33 years 3 months (3 years 3 months and 30-year operating period)	- 34.5 kilometer extension and connecting line of existing monorail with 30 station, 1 maintenance center and 1 parking lots. - Private companies signed the contracts on Jun 20, 2017.
3	Highway system Phrase 2 (Srirat Expressway)	Public: Expressway Authority of Thailand (EXAT) Private: Bangkok Expressway Public Company Limited (BECL)	n/a	30 years (Mar 1, 1990 – Feb 28, 2020) Operation start date: Mar 2, 1993	Construction and operating of highway (Build–operate–transfer Model)
4	Transferring the right to produce and sell water service project	Public: Provincial Waterworks Authority Private: Pathum Thani Water Co., Ltd.	n/a	25 years (Oct 15, 1998-Oct 14, 2023)	Water supply system (Build–operate–transfer Model)
5	Warehouse in Suwannabhumi Airport	Public: Airport of Thailand Private: WFSPG Cargo Co., Ltd.	n/a	20 years (Sep 28, 2009 - Sep 27, 2026)	- Providing warehouse service. - Ownership of the warehouse will be transferred to the governmental agency after the construction finished.
6	Udonrattaya Highway (Bangbon–Pakkret)	Public: Expressway Authority of Thailand Private: Northern Expressway Co., Ltd.	n/a	30 years (Sep 27, 1996 - Sep 26, 2026)	Construction and operating of Highway (Bangbo-Pakkret)
7	Energy pipe for aviation	Public: Airport of Thailand Private: Thai Aviation Refuelling Co., Ltd.	n/a	30 years (2006-2036)	Installing and operating of 2 energy pipelines in airport area
8	Train system (Chaleamratchamongkon Line)	Public: Mass Rapid Transit Authority of Thailand (MRT) Private: Bangkok Metro PCL	n/a	25 years (Jul 2, 2004–Jul 1, 2029)	- Designing, building and operating train system. - Ownership will be transferred to MRT after the contracts finished.
9	Operating of shipyard at Lamchabang Port	Public: Port Authority of Thailand Private: Unithai Shipyard and Engineering Co., Ltd.	n/a	30 years (Dec 18, 1990–Dec 17, 2020)	- Building and operating of shipyard. - Ownership on factory and office will be transferred to Port Authority of Thailand while the ownership of the machines such as cranes and forklifts will still be the asset of Unithai.
10	BTS System	Public: Bangkok Metropolitan Administration (BMA) Private: Bangkok Mass Transit System Public Company Limited	n/a	30 years (Dec 5, 1999 - Dec 4, 2029)	- Designing, building and operating train system. - Ownership will be transferred to BMA after the contracts finished.

Source: State Enterprise Policy Office

2.3 Smart City Projects in Thailand

2.3.1 Smart City Framework

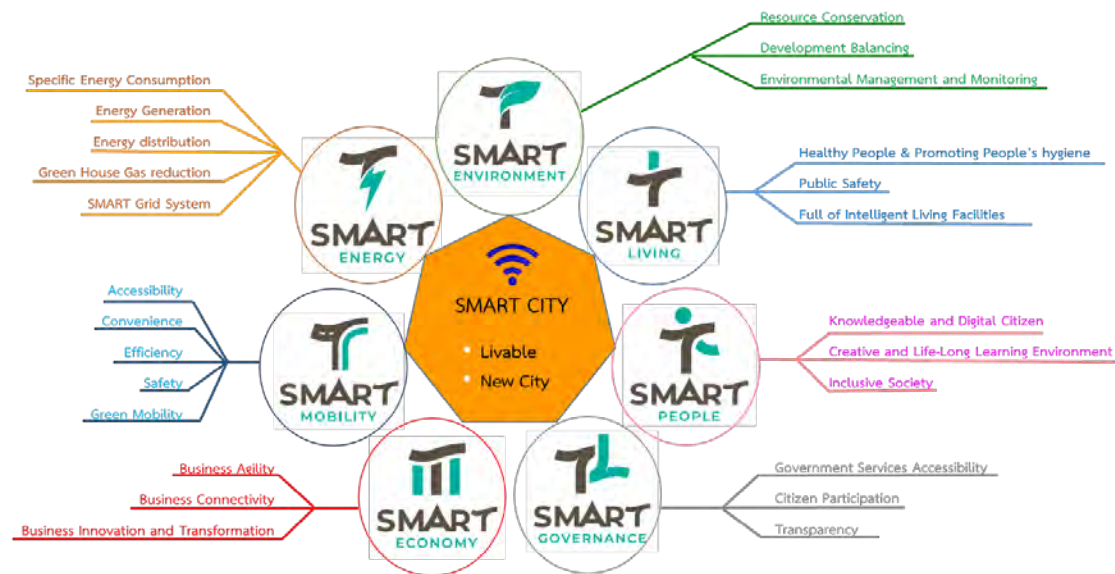
The Thai government has formed a “Smart City Steering Committee”, chaired by the Deputy Minister of Transport, and set seven criteria for becoming a Smart City, namely Smart Economy, Smart Mobility, Smart Energy, Smart Environment, Smart Governance, Smart Living and Smart People (shown in the figure below). A Working Group (WG) has been set up for each of the seven smart items and the relevant ministries have been assigned as the secretariat tasked with elaborating the details of the criteria for becoming a Smart City. The Office of Transport and Traffic Policy and Planning (OTP) is appointed as the secretariat for all seven smart items.



Source: OTP, presentation material at “Thailand Smart City Seminar”

Figure 2.26 Smart City Development Framework

In the Smart City framework which is under consideration in Thailand, Smart City projects and businesses that are approved by the Steering Committee and the Board of Investment (BOI) are entitled to special rights and privileges such as tax exemption. In a typical case, it is assumed that the landowner or area owner will submit a Smart City proposal to the Steering Committee, where it will be evaluated based on the pre-set criteria and KPIs. If the proposal is approved by the Steering Committee, the Smart City proposal will be presented to BOI for tax exemption privileges.



Source: OTP, presentation material at “Thailand Smart City Seminar”

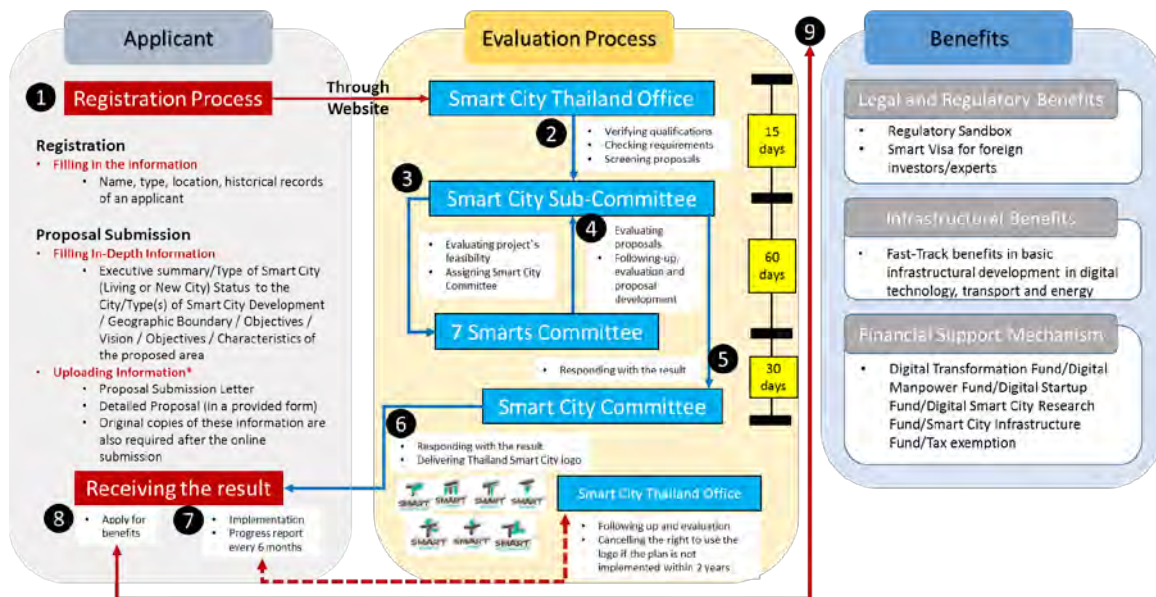
Figure 2.27 Seven smart fields

The Smart City application must meet the criteria for at least two Smart items including the “Smart Environment” criteria, which is a compulsory Smart Item that all Smart City projects must satisfy. The evaluation of the proposal is carried out based on the KPIs set for each criterion, and it will be judged on both aggregate and disaggregate scores. An eligible proposal must score more than 70 points in each selected criterion while also scoring more than 80 points in total average.

Bang Sue Smart City is one of the first target cities to become a Smart City under this framework. This study is currently communicating closely with the committee and each working group to follow the guidelines and help elaborate the criteria for being a Smart City.

It is generally understood that Smart City projects in Thailand are typically carried out primarily by the City Development Company established in each city, while also collaborating with the private sectors, local municipalities, and universities. The project plans are led by the local municipalities, and the necessary funds are gathered from the government, public support schemes, private investments, and other funds.

The necessary applications are submitted to the Smart City Sub-committee and Smart City Committee, which would be responsible for screening the proposals. The procedure regarding the application is as shown below.



Source: Compiled by the Study Team based on "Smart City Thailand Annual Report 2018"

Figure 2.28 Smart City application flow

2.3.2 Definition and specifications for Thailand Smart City

Smart City in Thailand is defined as below:

"Smart City" means a city that takes advantage of modern technology and innovation to increase the efficiency of the city service and management, reduce the cost and resource usage of the target city and citizens. It focuses on good design and participation of business and public sectors in urban development, under the concept of a modern and liveable city development, for people in the city to have a good quality of life and sustainable happiness.

Source: <https://smartcitythailand.or.th/>

The definition of seven smart in Thailand is as follows:

Table 2.7 Definition of Seven Smart components

Component	Definition
Smart Environment	Smart Environment means a city that considers impact on the environment and climate change by using technology to help manage systematically, such as water management, weather care, waste management, and disaster surveillance as well as increasing public participation in natural resource conservation.
Smart Economy	Smart Economy means a city that uses digital technology to create additional value in the economy and effectively manage resources such as intelligent agriculture city, intelligent tourist city, etc.
Smart Energy	Smart Energy means a city that can manage energy efficiently. Create balance between production and energy use in the area to create energy sustainability and reduce dependence on energy from the main power network system
Smart Governance	Smart Governance means a city that develops a government service system, to facilitate stakeholders who have access to government information by focusing on transparency and participation, and is continuously updated through the application of innovative services.
Smart Living	Smart Living means the city that has developed facilities, taking into account the Universal Design, providing people with good health and quality of life, safe and have a happy life.
Smart Mobility	Smart Mobility means a city that focuses on developing traffic systems and intelligent transportation to drive the country, by increasing the efficiency and connectivity of various transportation systems, also increasing convenience and safety in travel and transportation, including being environmental friendly.
Smart People	Smart People means a city that aims to develop knowledge, skills and the environment. It is also conducive to lifelong learning, reduce social and economic disparity, and openness for creativity, innovation and public participation.

Source: <https://smartcitythailand.or.th/>

For each of the Smart City components, a criteria is set. Initially, a specific KPI was set as criteria, but in the current arrangement, there is no specific KPI. The applicant is required to propose along the criteria, and the Committee would make the evaluation based on the proposal.

The criteria for Smart Mobility, Smart Energy, and Smart Environment is shown below.

Table 2.8 Smart Mobility Criteria

framework	goal	Criteria for consideration
1.The accessibility to transportation network/public transport (Accessibility)	1.1. Promoting the use of transportation systems	There is a plan to develop public transportation systems that cover the area
	1.2.Facilitng to provide the transportation services	There are plans to develop the facilities For all people (Universal Design)
2. Convenience in	2.1. Providing	There is a plan to develop information providing

framework	goal	Criteria for consideration
using utilities and facilities, including public transportation network (Convenience)	information to passengers	services about public transportation such as a channel to inform the location of public vehicles, waiting time informing system, etc.
	2.2.Parking management	There is a plan to promote the use of advanced parking management system such as Parking registration via online system, notification of parking status/parking guidance through the system
	2.3.Promoting cashless society	There are plans to promote the e-payment of transportation fees. e.g. e-ticket, Electronic Toll Collector (ETC), online ticket purchase, etc.
3.Efficiency in managing, transportation and traffic (Efficiency)	3.1.Traffic Management	There is a plan to develop automatic/ real time traffic management such as real time traffic light management, Bus Priority, traffic management center, etc.
	3.2.Providing information to passengers of information to travelers	There are plans to develop travel/traffic information services (for personal car)such as Intelligent signs, travel information channel (Website / App. / SMS), etc.
	3.3.Freight Management	There is a plan to manage freight cars such as GPS installation, bus control center
4.Safety in transportation	4.1.Safety in providing public transportation services	Having safety equipment in public transport vehicle as required by standard such as having a CCTV camera in the public transportation system, having security tools within public transportation systems (glass hammer, firefighting equipment, emergency door, emergency exits).
	4.2.Safety in the transport network	There are plans to develop safe network/transportation infrastructure, such as the installation of CCTV camera, and measuring vehicle speed equipment.
	4.3.Safety in the transport network	There is an electrical illuminating system throughout all route.
	4.4.Safety Management System	There is a plan to develop a safety management system and plan for emergency situations.
5.Promoting the usage of vehicles that help reducing pollution transmission (Green Mobility)	5.1. Promoting the travel without using engines	There are plans to develop (roads, pedestrians, bike lane) within the area.
	5.2.Vehicle sharing	Having plans/measures to promote the usage of vehicle sharing such as Carpool, Vehicle (Car / Bike / Motorcycle) Sharing, etc.
	5.3 Usage of energy-saving low emission vehicles	Having plans/measures to promoting the usage of economical and low emissions vehicles such as Electric vehicles (EV), hybrid, providing charging stations
6.Other innovative proposals for the Mobility	4.1 To support the innovation that can support the development of smart cities in the terms of Smart Mobility, concretely	Presenting innovations that can support the development of smart cities in terms of Smart Mobility

Source: Compiled by the Study Team based on Smart City Thailand website (<https://smartcitythailand.or.th/>)

Table 2.9 Smart Energy Criteria

framework	goal	Criteria for consideration
1. Specific Energy Consumption (Mandatory)	1.1. All buildings in Smart City must have must meet the specific energy consumption (SEC) according to the average reference criteria for each types of buildings or enterprises.	All buildings and enterprises within the smart city have to meet the energy consumption average reference criteria for each types of buildings and enterprises.
2. Energy generation	2.1 To focus on renewable energy production and to reduce the impact on the environment and society caused by the use of fossil fuel energy.	Renewable energy production (mandatory)
	2.2 To promote local power production by public, private and individual service providers and connect these source of power to Smart Micro grid network system effectively	Onsite power generation
	2.3 To increase the efficiency of local power production system. reduce the amount of wasting energy as well as to reserve energy for the smart city from the level of the business building to the household level in order to reduce the cost and increase energy self-sufficiency	Energy storage
3. Energy distribution	3.1 To optimize both heating and cooling energy distribution to various areas of smart city	District cooling or district heating system
	3.2 To promote the usage of environmental-friendly vehicles such as electric vehicles, CBG and fuel cell vehicles, etc.	Promoting the usage of environmental friendly vehicles (Eco-vehicle)
4. Greenhouse gas reduction	4.1 To allow the smart city to have greenhouse gas reduction goal that conforming to the country's goals and allow the energy usage of the smart city to be consistent with effective energy usage policy which is under Ministry of Energy's current energy conservation plan.	Greenhouse gas reduction target throughout the project period. Greenhouse gas reduction target within the first years of the project
5. SMART Grid system	5.1 To manage local energy production and usage as regarding the lowest cost by designing an energy management system (EMS) which is a part of the Smart Grid System as well as working with utilities systems in other categories such as Smart Mobility, Smart Living and Smart Environment.	Area energy management system (AEMS)
	5.2 To have basic equipment for Smart Grid System as well as the channel to communicate with the energy providers in order to manage the energy for the electricity users.	SMART Meters
	5.3 To generate electricity regarding of the balance between power production and energy usage within Micro-grid by using Main-grid in order to strengthen the energy security for the smart city.	Micro-grid system
	5.4 To manage local energy usage such as the electricity usage of building and household	Smart Home / Smart Building system
6. Other innovative proposal for Smart Energy (SMART Energy Innovation)	To support the innovation that can support development of smart City, and implementation of smart Energy concretely.	Presenting the innovations that can support the development of smart city in Smart Energy field.

Source: Compiled by the Study Team based on Smart City Thailand website (<https://smartcitythailand.or.th/>)

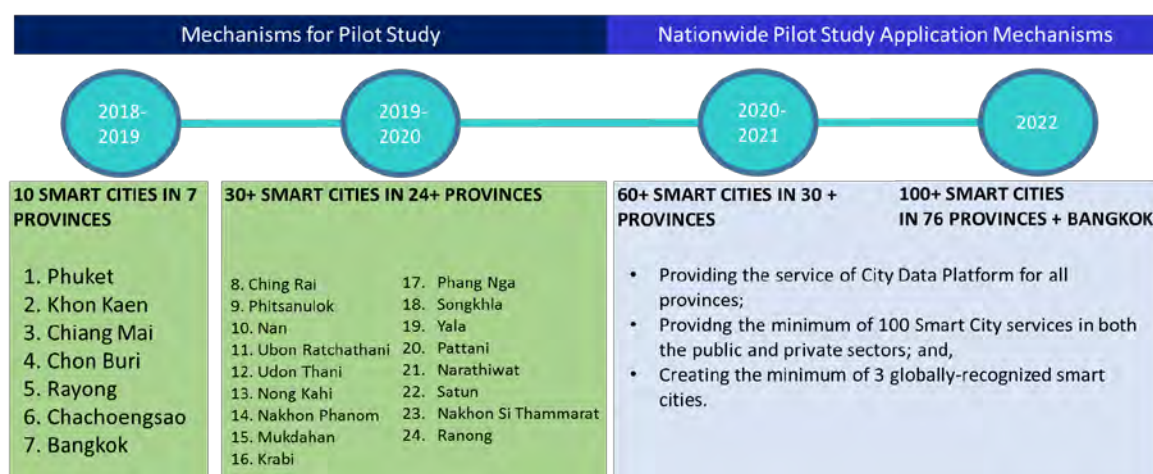
Table 2.10 Smart Environment Criteria

framework	goal	Criteria for consideration
1. Conserve the environment as the resources base that can be used for living and occupations in the way that do not affect the quality of life	1.1 Comprehensive waste management for the community according to academic principles	Increasing amount of waste that is utilized before handling
		No remaining waste
		Solid waste that has been properly managed according to regulations
	1.2 sufficient water for consumption	Access to clean water
		Clean water service area cover more than % of community area
		Basic standard for clean water used for consumption
	1.3 Urban/ community/ development projects manage wastewater efficiently	Basic wastewater treatment system
		Community level waste water treatment system
2. Maintaining the balance of nature which is suitable for living and occupation of people in the community	1.4 Air quality does not affect people in the community.	The area that provide wastewater treatment services should cover more than 50% of community.
		Handling the complaints related to air quality
	2.1 City/ community/ development project have sufficient green spaces meeting with the standards.	Environmental-friendly public transport management
		The proportion of public green areas in the city / community / development project is not less than 10 square meters / person.
	2.2 Appropriate land use	For land use, environment and ecology should be taking into account.
	2.3 Safe city	There are plans or systems to monitor the risks from weather changes.
	2.4 Beautiful and tidy city	Environmental landscape management
3. Management efficiency and monitoring of the environment	3.1 Urban Development Innovation	Having the technology and innovations improving environmental and pollution management
	3.2 Effective measure to cope with environmental problems	Methods, mechanisms to promote the management of urban environment through residences' participatory processes Efficiency in dealing with environmental problem complaints
	3.3 People have environmental friendly consumption and way of life	Production, service and consumption are environmentally friendly.
4. Other innovative proposals in environmental aspect (SMART Environment Innovation)	4.1 To support the innovation that can support development of smart City, and implementation of smart environment concretely.	Having the innovative proposal that can support the development of smart city in Smart Environment field.

Source: Compiled by the Study Team based on Smart City Thailand website (<https://smartcitythailand.or.th/>)

2.3.3 Smart City Projects in Thailand

In 2018 and 2019, a pilot study for Smart City was carried out in 10 cities in 7 provinces. From 2019 to 2020, 30 smart city projects are targetted to be implemented, while from 2020 to 2023, 100 smart city projects are targetted to be implemented.



Source: Compiled by the Study Team based on “Smart City Thailand Annual Report2018”

Figure 2.29 Smart City Development Plan in Thailand

According to the IDC, Phuket and Khon Kaen cities in Thailand are listed among the 19 out of 148 most outstanding smart city projects in Asia Pacific (excluding Japan) initiated by DEPA in 2018. Both the winning projects illustrated the best practices of urban innovation with ultimate focus on the use of technologies (cloud, platforms, analytics, IoT, mobile solutions) and data, unique partnerships, funding models and/or community involvement.



Source: IDC Web sites, <https://www.idc.com/getdoc.jsp?containerId=prAP44102018>

Figure 2.30 List of the most outstanding smart city projects in Asia Pacific

(1) Phuket

Phuket has been touted as Thailand’s first ever smart city. It has also been included as one of 26 cities within the ASCN which envisions a collaborative platform for selected cities to work

towards sustainable and smart development.

DEPA has proceeded with the Smart City Project which comprises the following:

1. City Data Platform: An information integration project in Phuket Province:
 - Data on behaviour of Phuket tourists.
 - Data on immovable property.
 - Data on environment.
2. Smart Safety: Marine safety based on a proposal for sandbox development for control of safety of marine tourism in 3 Andaman provinces (Phuket, Pang Nga, Krabi) by applying digital technology.
3. City Investment: Method and conditions of joint investment with the private sector for smart city development by proposing 3 formats, namely BOT, BLT, PPP.
4. Smart Safety, Smart Environment, Smart Governance: Increased CCTV installation points based on a survey of Phuket Provincial Police and local authorities, so as to safeguard the lives and property of citizens and tourists, including control when a disaster occurs. A smart data integration center is also set up which increases city management efficiency by applying digital technology mainly to promote a complete Phuket Smart City.



Source: The Asian post, <https://theaseanpost.com/article/smart-city-spotlight-phuket>

Figure 2.31 Outline of the Phuket's Smart City

(2) Khon Kaen

1) DEPA-initiated project

The purpose of this project is the development of an ecological system for the digital economy within the area in order to lay the guidelines on development of Khon Kaen Smart City. The details are as follows.

1. Summarize the urgent issues of Khon Kaen Province jointly by government agencies and private entities in the following areas:
 - Preparation of standards for linking of data recognized both domestically and abroad and division of data storage so that it is systematic and can be actually utilized at provincial level and national level (City Data Center or SCOPC).
 - Preparation of standards on storage of medical data and public health data within Khon Kaen first, so that it can be developed as an important model for linking of personal data.
 - Khon Kaen Smart Living Development Plan in respect of safety by using smart CCTV technology so as to create confidence and convenience for a MICE City.
 - Stimulate tourism and seminars by promoting tourist spots by applying digital technology.
 - Enhancing mobility so that it spreads all over the country, thus increasing efficiency in order that it can be exported using the skills of Thai people.
2. Prepare a digital business promotion plan for smart city operators, such as cooperation in setting up business, promotion of development and upgrading of business by support measures and assistance from the DEPA as well as enhancing awareness to create understanding when accessing capital sources and promoting DEPA measures, by emphasis on developing:
 - (1) Smart Living (public health and smart medical services)*.
 - (2) Smart Mobility (smart device for small taxi buses).
 - (3) Smart People (supporting E-sports industry and development of digital skills in labour force).
 - (4) Smart Government (management system for government meeting documents).
 - (5) Smart Environment (smart garbage collection system), etc.

Additionally, the DEPA is preparing a city data platform development plan for use as the basic structure of the city when gathering, analysing, and disclosing data, comprising:

- Data on population, economy, and society from the Provincial Statistical Office.
- Smart data integration and CCTV data processing system.

*Note: The Khon Kaen Smart Health project

The Khon Kaen Smart Health project is an initiative by DEPA with local healthcare service providers and universities that consists of 3 components:

1. A smart ambulance that utilizes teleconferencing, IoT, and robotics technology to increase emergency dispatch efficiency and allow healthcare professionals to perform initial diagnosis and emergency treatment before patients arrive at the hospital,
2. A preventive healthcare service that leverages smart wristbands and smart home solutions to monitor and collect citizens' health data and provide health guidance accordingly, and

(3) Chiang Mai

1) Chiang Mai University-initiated project

Chiang Mai University has prepared a business model for developing the CMU Smart City-Clean Energy Project. The policy underlying the projects is green energy management. Some projects have already been implemented and others are underway (e.g. clean energy from sunshine and biomass, project for reduction of use of private motor cars in the city, zero garbage project, and waste-to-energy public bus project). The projects which are being implemented include an absolute smart control network project which focuses on establishing a comprehensive control network system and city measurement system, be it an energy system, security system, travelling system, or public participation promotion system.

Also, projects such as the public transport network, smart business project, TREEs project, preparation for construction of new TREEs-Platinum certified buildings, and so on are increasing. CMU Smart City - Clean Energy Project is included in the Chiang Mai Development Project No. 12 (2017-2021).

Presently, Chiang Mai University has duly implemented the following projects according to the business model: electric bus and tram project, smart meter installation project to measure use of energy of all buildings within Chiang Mai University perimeter, and 500 kWh Energy Storage Installation Project.

2) DEPA-initiated project

The DEPA is preparing a City Data Platform Development Plan that will be the basic structure of the city in gathering, analyzing, and disclosing data. The plan comprises:

- Data on population, economy, and society from the Provincial Statistical Office.
- Agricultural production data such as rice, longan, and sweet corn, and data on management, production, transportation, marketing and circumstances of said agricultural produce.
- Linking of agricultural tourism and logistics, and linking of production places, chefs, and consumers.
- Data on elderly, and patients suffering from specific diseases (diabetes, kidney diseases, etc.)

Additionally, the DEPA is promoting the development and upgrading of businesses by applying digital technology, comprising:

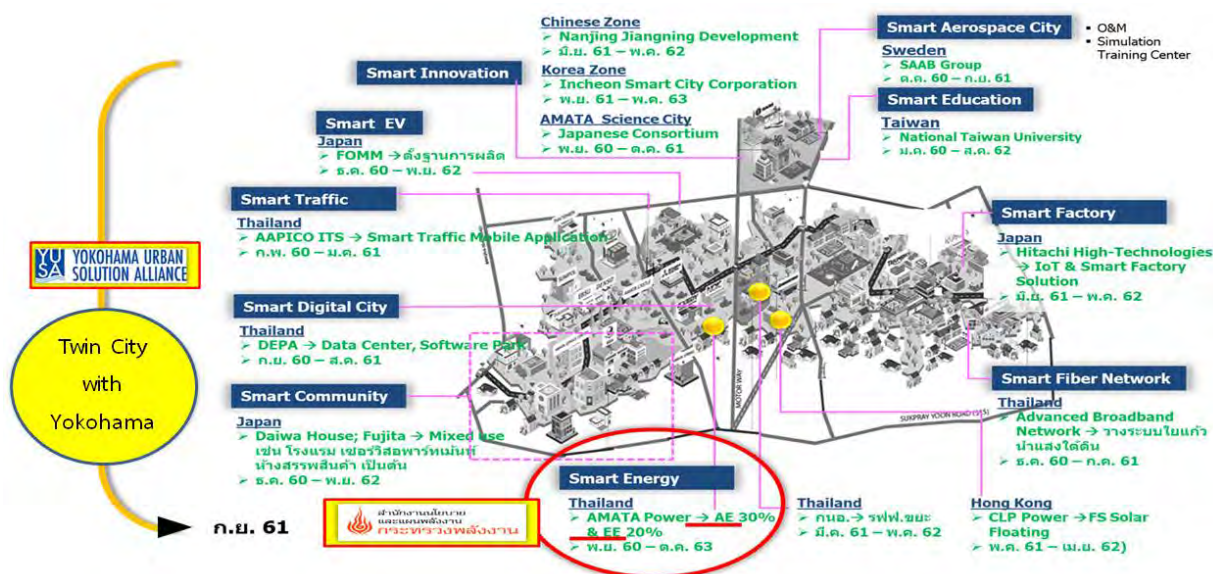
- Development of a smart agriculture model and selection of IoT equipment for agriculture so that it can be a model project, and analysis of investment worthiness of smart agriculture, with modern organic rice-growing as the starting project.
- Smart data integration system and CCTV data processing system.
- Prepare a digital business promotion plan for smart city operators, such as cooperation on setting up of business, promotion for development and upgrading of business by support measures and assistance from DEPA.

(4) AMATA Smart City

AMATA Smart City is one of the three cities that is nominated in ASCN framework. The project area includes 4,000 ha land in the existing industrial site and 1,000 ha land in the northern part of the owned land which would be newly developed as Smart City.

AMATA Smart City development is being planned under cooperative framework with Yokohama City in Japan. In January 2018, AMATA Corporation contracted Yokohama Urban Solution Alliance (YUSA) as a consultant. The term of the contract is to 1) provide technical recommendation for AMATA to promote Smart City development at AMATA's industrial area, and to 2) conduct technical study and make proposal on project formation to accelerate Smart City development in AMATA.

For Smart City development, AMATA has signed MOU with several other companies and cities in the world to realize Smart City development as is shown below.



Source: Material provided by OTP

Figure 2.33 AMATA Smart City

(5) EEC Area

The EEC area is designated as Smart City as a whole. The Smart City development is expected to create synergy effect with the development of Laem Chabang Port, U-Tapao Airport and the High Speed Rail.

Especially notable project in EEC area is the Digital Park Thailand project in Siracha, which is promoted by DEPA. The project focuses on research and development on “Smart Mobility”, “Smart Economy”, and “Smart People”. More specifically, the below facilities are to be developed and promoted to advance research and development of cutting edge technologies.

- Research facility for smart logistics
- Test Bed Area for 5G network
- Research facility for IoT
- Accumulation zone for start-ups and incubation



Source: Digital Park Thailand, <http://digitalparkthailand.org/witp-2/>

Figure 2.34 Overview of Digital Park Thailand development project

(6) Discussion

Smart City development has been planned and initiated in several cities under DEPA, such as Phuket, Khon Kaen, and EEC area. Moreover, according to 2018 annual report Smart City project is planned to be initiated at Ubonrachathani and Ubonthani region as well.

Table 2.11 Pilot Smart City projects in Thailand in 2019-2020

Areas	Smart Economy	Smart Mobility	Smart Energy	Smart Environment	Smart Living	Smart People	Smart Government
Chiang Mai	√ (Tourism)						√ (IOC*)
Khon Kaen					√ (Health)		√ (IOC*)
Ubonrat-chathani	√ (Tourism)						
Udonthani	√ (Trade)	√ (Border)			√ (Safety)	√ (Community)	
Phukhet		√ (Bus)		√ (Waste, Disaster)			√ (IOC*, Regulatory sandbox)
EEC	√ (Tourism, Startups)	√ (Port, Bus)	√ (Factory)	√ (Factory)	√ (Safety, Health)	√ (University)	√ (IOC*, Regulatory sandbox)

*IOC: Intelligent Operation Center

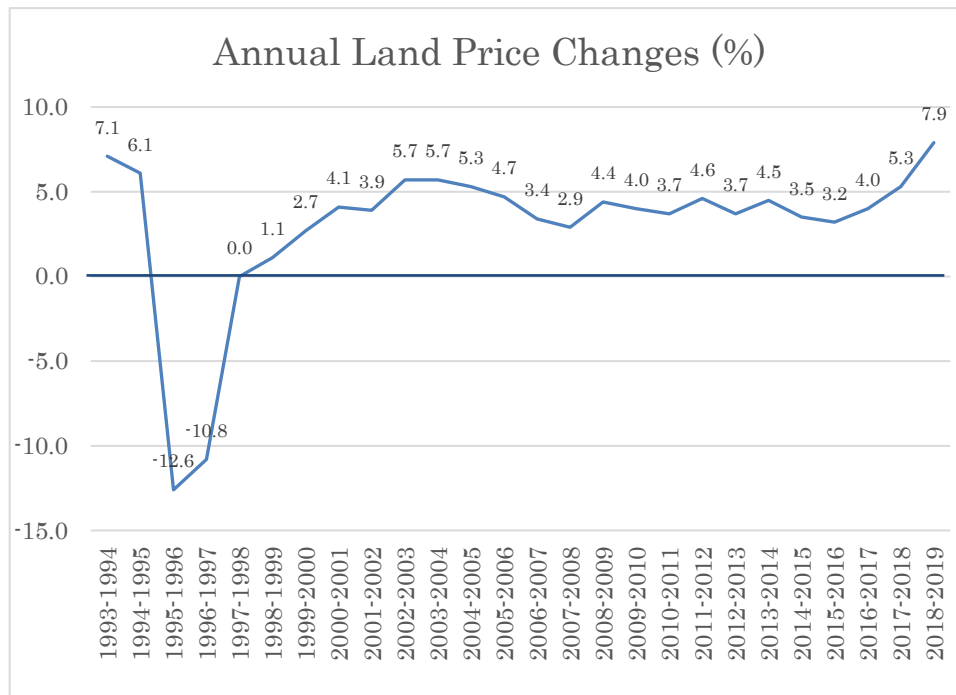
Source: Smart City Thailand Annual Report 2018

In shaping the Smart City project in Bang Sue, it is also important to consider the unique regional attributes that would not compete with other cities' initiatives.

2.4 Large-scale Development Projects in Bangkok

2.4.1 Property Development and Land Price Trend in Bangkok

The property market in Bangkok has been expanded, supported by a solid increase in land prices. Land prices have recorded continuous stable growth in the period except for the Asian Financial Crisis in the latter half of the 1990's. Figure 2.35 shows a land price trend from 1993 to 2019 in Bangkok. When taking a look at a five-year average, the change rates for land prices have risen annually at an average of a 4% range in the periods from 2004 to 2009, from 2009 to 2014 and from 2014 to 2019.

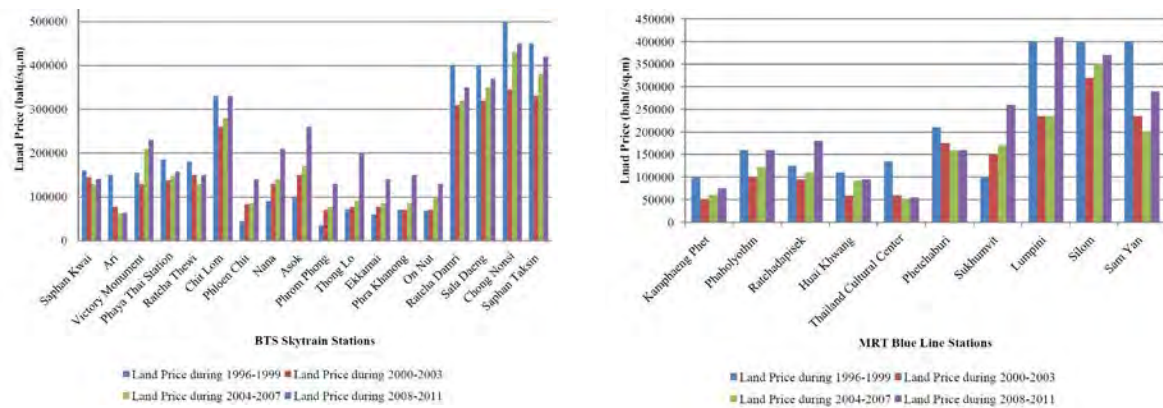


Source: Agency for Real Estate Affairs

Figure 2.35 Land Price Trend in Bangkok from 1993 to 2019

Land price growth in Bangkok is led by that in the Central Business District (CBD). According to Thai real-estate research firm AREA (Agency for Real Estate Affairs), growing land prices by the mid-2000's are attributable mainly to housing demand expansion coupled by income growth in the middle class and large-scale development in the CBD. In recent years, as BRT and other public transportations have been developed, the land price especially with high transportation convenience has risen remarkably. AREA reported that the land price has been increased by 11% in the area near the metro stations in 2018.

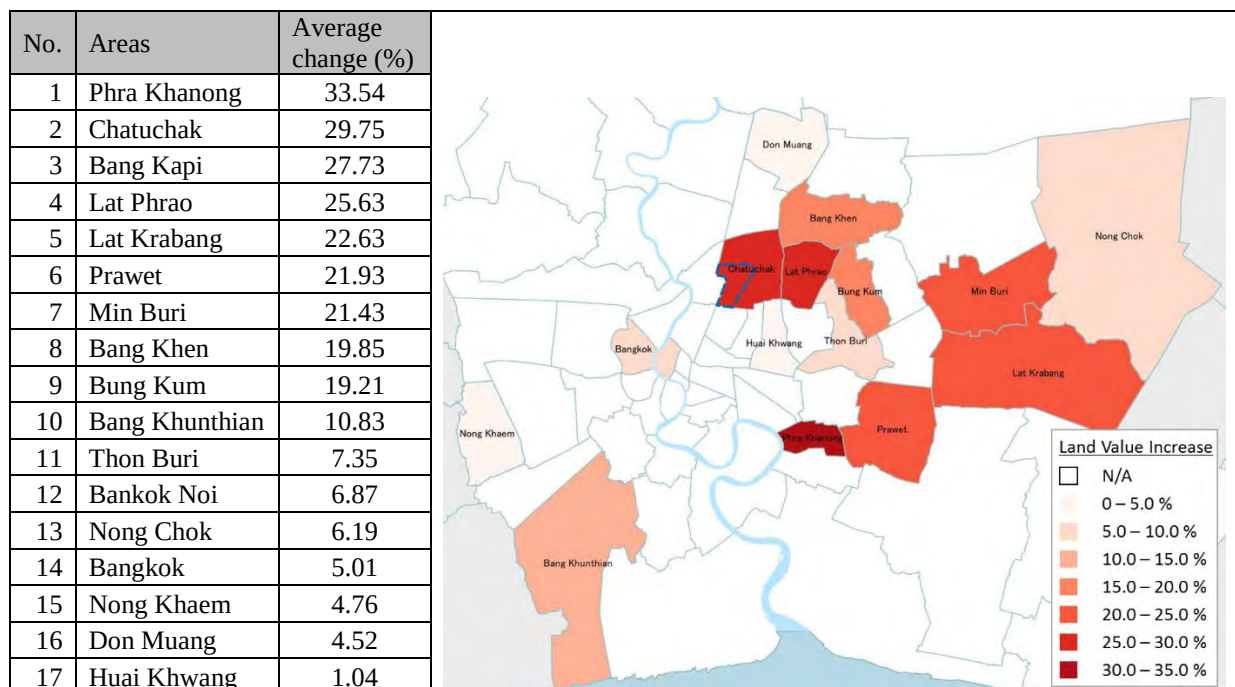
The following table, as related data, shows an appraised value trend of land by BTS and MRT stations, compiled by researchers from Kyoto University. The table finds a high growth rate trend for land prices in the 2000's onward and higher land prices in Bangkok CBD. As of 2011, especially, the appraised land value around Pahonyothin Station in the Bang Sue area is approximately half of that near Silom Station.



Appraised land value trend at BTS station
Appraised land value trend by MRT station
*The above land prices are different from market ones due to appraised values of land.
Source: Malaitham, Sathita, “A Study of Urban Rail Transit Development Effects in Bangkok Metropolitan Region” (2013), released by Kyoto University

Figure 2.36 Appraised Land Value Trend at BTS and MRT Stations

As Red Line and other metro or public transportation networks have been expanded or improved, land prices along the line or stations are expected to rise due to higher convenience. As the appraised values of land have been revised in some areas of Bangkok in 2019, land prices have grown by about 30% on average in the Chatuchak area of Bang Sue. After the opening of Bang Sue Grand Station, when it connects with Red Line and high speed railways with higher transportation convenience and Bang Sue is developed as a new CBD, land prices are likely to rise further. Figure 2.37 shows growth rates of revised appraised values of land from 2016.



Source: Produced by the Study Team, based on documents released by Thailand Treasury Department.

Figure 2.37 Growth Rate of Appraised Value of Land by Area from 2016 to 2019 (Area with Appraised Value of Land Revised in 2019)

In the Bang Sue area, as described earlier, land prices are expected to soar due to the development of the public transportation system. However, in the area with a 5-minute walk range from a

station in Bangkok especially, property values are said to be high and condominiums far away from a station provide residents with their own transportation services (such as Tuktuk) to the station. Therefore, in order to raise property values more, it is indispensable to “improve accessibility to the station.”

As the project area in Bang Sue is vast, the existence of Grand Station itself does not necessarily ensure accessibility. It is indispensable to secure smooth accessibility to the station and boost mobility for the entire area to enhance property values.

2.4.2 Development Projects in Bangkok

Real estate development in Bangkok has been accelerated since around 2010. As show in Figure 2.38, unit number of newly completed condominiums in Bangkok has increased since 2013 (left), and floor space of new office supply has increased since 2014 (right). However, new development of condominium units seems to be stipulated after marking its peak in 2016.

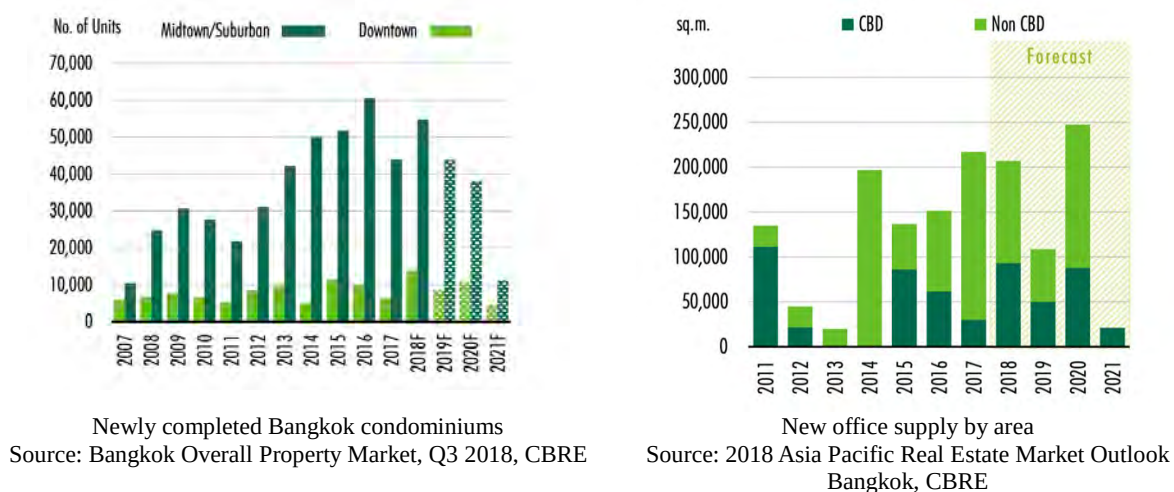


Figure 2.38 Evolution of new condominium/office supply in Bangkok

Table 2.12 New office supply at Bangkok from 2017 to 2024

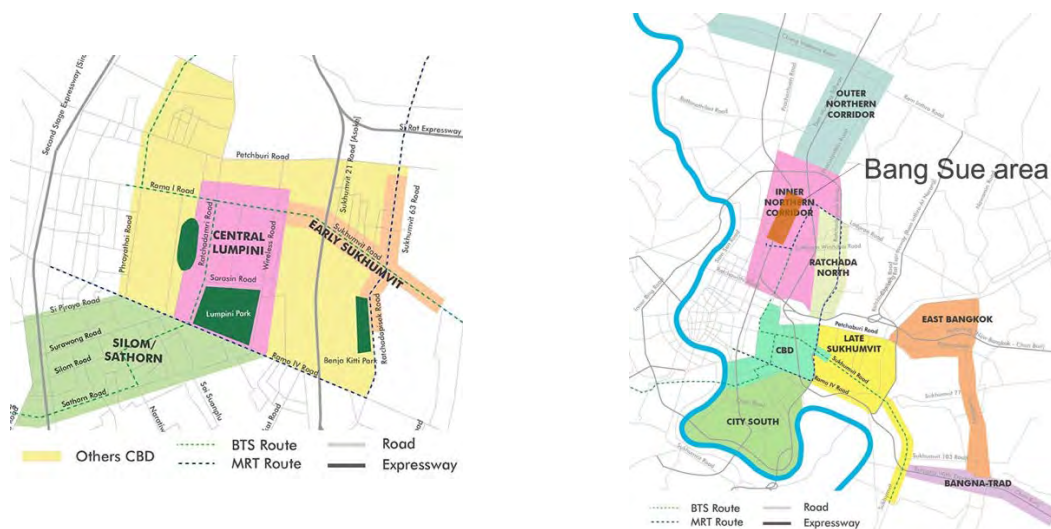
Year	location	No of buildings	Total of net rentable area (sqm)
2017	CBD	1	30,000
	Non-CBD	8	199,000
	Total	9	229,000
2018	CBD	3	88,500
	Non-CBD	5	83,400
	Total	8	171,900
2019	CBD	1	45,000
	Non-CBD	2	40,000
	Total	3	85,000
2020-24	CBD	11	891,439
	Non-CBD	5	252,110
	Total	16	1,143,549

Source: Compiled by JICA Study Team from “Thailand Industry Focus Property, Funds, REITs, and IFFs” by DBS Group Research, April 2018

Table 2.12 indicates new office supply (number of buildings and total net rentable area) at Bangkok from 2017 and 2024. Around 200,000 square meters’ office space was provided in both of 2017 and 2018. The figure will decrease to less than 100,000 square meters in 2019 but new

office supply will amount to 1.1 million square meters during the period from 2020 to 2024. In addition, 73% of the new office supply will be at CBD area and only one project, One Bangkok which will be developed at the center of the CBD will provide 500,000 square meters of office space during the period from 2021 and 2024. Therefore, “Thai banks are being conservative about new project lending to developers and so Thai developers are seeking funding from foreign partners,” according to CBRE³. Major foreign partners are Japan, Hong Kong, Singapore and China.

Figure 2.39 shows CDB and non-CDB areas of Bangkok. The CDB area seems to expand to the east direction, and a part of “Late Sukhumvit” (around Soi Thong Lo) could say a part of the CBD, and recent housing development is expanding along Airport Rail Link (individual houses) and MRT Purple Line (Condominiums). Pahonyothin Transport Center (Bang Sue Area) is a part of the “Inner Northern Corridor”. The Pahonyothin Transport Center would be a junction among SRT (Red Lines and High-Speed Railways, MRT, BTS and inter-city bus station but it is about 10 kilometers away from Bangkok's CBD.



Bangkok CBD area (defined as the area incorporating Silom, Sathorn, Rama IV Road, Ploenchit, Wireless Road, Asoke, and the early Sukhumvit area (Sukhumvit Road up to Soi 24).)

Non-CBD area (Late Sukhumvit, City South, Ratchada North, Inner Northern Corridor, Outer Northern Corridor, East Bangkok and Bangna-Trad)

Source: CBRE (Thailand) website (<https://www.cbre.co.th/en/SubServices/bangkokofficerentlease>)

Figure 2.39 CDB and Non-CBD areas of Bangkok

Currently, several large-scale real estate developments by private companies are planned or are under construction in Bangkok and the nearby areas. Six examples of large-scale projects including the Pahonyothin Transport Center are explained Table 2.1.

³ P.4 2018 Asia Pacific Real Estate market Outlook Bangkok, CBRE, 2018.

Table 2.13 Large Scale Projects in Bangkok

Name of project	One Bangkok 	The Grand Rama 9 	Iconsiam 
Location	CBD (near Lumpini Park)	MRT Rama 9 station	Chaoren Nakhon Road, Khlong Ton Sai
Year of project completion	2025	n/a	2018
Commencement of the project	2018	2015	-
Completion of Phase 1	2022	2016	-
Development body	SPC (Kasemsubvadhana)	G-Land (Central Group)	SPC
Composition of the development body	TCC Asset 80.1%, Frasers19.1%	-	Siam Piwat 50%, CP 25%, MQDC 25%
Land area (ha; rai)	16.7 (104)	11.7 (73)	8.8 (55)
Gross floor area (sqm)	1.83 million	1.2 million	750,000
Green area (ha; rai)	8 (50)	-	-
Arrangement of land	Leasehold	Own land	Own land
Land owner	Crown Property Bureau	G-Land	SPC
Total investment amount and financing	THB 120 billion The source of funds for the group's investment will be partly from its own cash flow. It may also raise funds from the capital market by issuing debentures, establish a real estate investment trust or borrow from commercial banks.	THB 60 billion 60% Bank Loan and 40% company's revenue from other projects	THB 50 billion Own fund and loan from commercial banks (Kasikorn Bank and Thanachart Bank)
Land use	Red Zone* (commercial land: Type 3 or Type 5)	Orange Zone (Residential zone with high density: Type 9)	Orange Zone (Residential zone with high density: Type 8)
Floor area ratio	Type 3 FAR 7:1, Type 5 FAR 10:1	FAR 7:1	FAR 6:1
Sublease scheme of land	- Kasemsubwattana (under TCC Group) lent land from CPB - Kasemsubwattana leases out to the SPC. SPC sub-lease to zone developers. - One Bangkok Holdings will manage the project after completion of the construction works.	-	-
Leasing period	30 years (option of 30 years-extension) Grace Period for construction and development: 9 years	-	-
Office	Applicable: five A ranked office tower	Applicable	Applicable
Hotel	Applicable: 5-star hotel	Applicable	Not applicable
Residence	Applicable: three Luxury condominium	Applicable	Applicable
Commercial facilities	Applicable: 4 zones shopping areas	Not applicable	Applicable
Others	- Art & Culture Space - 1ha of public plaza in the green area to organize events	-	Art&Culture space
Remarks	- Hitachi Consulting (Thailand) was selected to be in charge of designing and planning of smart service in ONE Bangkok - Plans to install regional cooling/heating. - Main contractors for construction are SEAFCO and Thai Bauer.	- G-Land also raised funds by issuing corporate bonds (around 4,000 mil THB). - GLAND had planned to build the Super Tower, the Asian tallest tower with 615-meter height, 125 floors. However, the building plan was postponed after Central Pattana takeover GLAND.	- Developing a giant composite facility with shopping malls, recreational facilities, conference halls, tourist attractions (museums etc.), and cultural facilities on Charoen Nakhon Road (along Chao Phraya river) - Japanese companies built the facilities, and a Japanese department store operates commercial business as a tenant. - Plans to invest 3.8 billion THB to construct the Gold line in order to secure connections with BTS Krung Thon Buri Station

Note: *According to the city plan map from Department of Public Works and Town & Country Planning, it is quite hard to identify whether the area of One Bangkok is located in the land for commercial use type 3 or type 5 which will affect the rate of FAR.

Source: Compiled by JICA Study Team

Table 2.14 Large-scale Projects in Bangkok (2)

Name of project	PARQ 	Samyan Mitrtown 	Pahonyothin Transport Center 
Location	CBD (MRT Queen Sirikit National Convention Centre Station)	CBD (MRT Sam Yan Station)	SRT & MRT Sang Sue Station; BTS
Year of project completion	2023	End of 2019	2032
Commencement of the project	2017	2016	2017
Completion of Phase 1	2020	-	2019
Development body	TCC Asset and Frasers Property	Golden Land	-
Composition of the development body	-	Kasemsubbhakdi: Golden Land (49%) and TCC (51%)	-
Land area (ha; rai)	3.8 (24)	2.1 (13)	232.5 (1,453.1) Zone A: 5.1 (32)
Gross floor area (sqm)	320,000	220,000	n/a
Green area (ha; rai)	7000 sqm. (Sky Park 3,400)	n/a	n/a
Arrangement of land	Leasehold	Leasehold	Leasehold
Land owner	Crown Property Bureau	Chulalongkorn University	SRT
Total investment amount and financing	THB20 billion	THB8.5billion	-
Land use	Red Zone (commercial land: type 3)	Red Zone (commercial land: Type 5)	Red Zone (commercial land: Type 8)
Floor area ratio	FAR 7:1	FAR 10:1	Zone A: FAR 8:1
Sublease scheme of land	-	PPP scheme	Bidding by zones; The process for Zone A will start January 2019
Leasing period	30 years (option of 30-year extension)	30 years (option of 4-year extension) under PPP scheme	30 years (waiting for TOR of Zone A that will indicate extension period)
Office	Applicable; 2 office towers; 2,300-5,000 each floor/ 13 floors; total 60,000 sqm.	Applicable; 35 floors, GFA: 65,000 sqm.	Applicable
Hotel	Not applicable	Not applicable	Applicable
Residence	Not applicable	Applicable; 35 floors; 36,000 sqm.; Condominium 554 rooms + SA 104 rooms	Applicable
Commercial facilities	Applicable; 12,000 sqm (1-3 rd floor)	6 floors, GFA: 65,000 sqm.	Applicable
Others	Not applicable	Applicable; Learning Center	Applicable
Remarks	- A Japanese construction company is the main contractor for this project.	- CBRE is the main realtors who is in charge of office rental space. - Anchor tenant in retail podium is Big C. - Planning to employ AI system to integrate the facilities within office tower. - MBK also extended their land leasing contract with Chula to another 20 years and paid around 20 billion THB (To extend the contract, the extension needed to be approved by Cabinet.).	

Source: Compiled by JICA Study Team

From interviews with four Japanese/Japanese-affiliated companies which are joint ventures with Thai companies, the following opinions are collected on the real estate development in Bangkok as of May 2019. Note that the opinions below are the ones that were commonly raised.

- Demand on residence is shifting from speculative purpose to real demand. For example, demand on individual houses is strong demand in Eastern Bangkok area including the area along Airport Rail Link, and demand on condominiums is strong areas near stations of MRT Purple line.
- In general, demand on offices are still strong in Bangkok. In terms of minimizing risks, mixed-development is the most favorable one.
- Location of Bang Sue area is good in particular for Thai people.
- It is rare for Thai companies in doing the same business to form a joint venture for real estate development. Large-scale real estate development conducted by a joint venture which is observed in Japan is not observed in Thailand.
- Due to limitation of investment portion of foreign companies, forming a joint venture within Japanese companies would not occur.
- With a fixed lease period of 30 years, it is difficult to make a condominium for sale or for a detached house (because the right to use land after 30 years is unclear). Residence lease could be possible if the land's lease period extends to 50 years.

2.5 Current Situation of the Bang Sue Area

2.5.1 Land Use

Zoning plan and functions that was set in the previous JICA Study is shown below.

Zone		Urban Functions to be Assigned	Bang Sue Area Zones
Zone A	1	Office/ commercial/ hotel	
	2	Commercial	
Zone B	1,2	Residential, commercial, office	
	3,4	Commercial	
Zone C		Super arena or MICE facilities of the same kind	
Zone D	1	Hotel/ residential/ office/hospital (high-end constructions in expectation of the increase of foreign guests)	
	2	Residential/ commercial/ hotel/ office	
	3	Residential/ commercial/ hotel/	
	4	Residential/ office	
Zone E (SRT Land)	1,2	Office/ commercial (including a high-rise which will be one of the main landmarks of Bang Sue Area, Knowledge center and incubation office space) Civic center (future headquarters of MOT)/ residential	
	3	Residential	
Zone F	1	Commercial (retail shops to be constructed under skydecks around Bang Sue Grand Station)	
	2	Office /commercial (including amusement facility) /residential/ hotel	
Zone G (KM 11)		High-end residential (garden city with abundant greenery space)/ commercial/ office/ hospital/ school	
Zone H	1	Office/commercial/residential	
	2	Office/commercial/residential/hotel	
Zone I		Residential (high-rise condominiums)/ commercial	

Source: JICA “Data Collection Survey on Urban Redevelopment in Bang Sue Area”

Figure 2.40 Zoning plan and functions for Bang Sue Area

Although Bang Sue Area development is widely regarded as a green field project on a large piece of land, currently there are some existing facilities and ongoing construction projects in the area. These should be monitored and taken into consideration, as they may potentially influence the development plan and its implementation. The Study Team has thus reviewed the current situation regarding usage of the land in the Bang Sue Area.

■ Zone A



Temporary huts



Zone A is adjacent to the elevated railroad

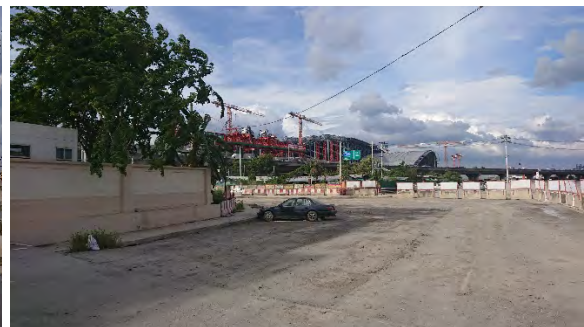
Zone A, located at the corner of the area boundary on the south side of Grand Station, will be the first zone to be developed in Bang Sue Area. The development of the zone will synchronize with the development of Grand Station which is planned to open in 2021. Divided by the elevated railroad which is under construction, Zone A is a relatively small and fragmented zone.

Zone A is planned to have a commercial facility, hotel, and office buildings, so as to meet the needs of users of Grand Station when it is opened. The tendering process was initiated in April 2019.

■ Zone B



Depot for railway vehicle is under construction



Zone B is located in front of Grand Station

Zone B, located in front of Grand Station, will be one of the last pieces of land to be developed in the Area. The zone, according to the master plan, will be developed in the third phase which is scheduled from 2028 to 2032.

Zone B is planned to be developed as mixed use land with residential, commercial, and office facilities. Due to the zone's strategic location and its land size, it is expected to be the key piece for the Bang Sue Area. Currently, the land is largely occupied by the railway depot which is still under construction.

■ Zone C



Mo Chit Bus terminal is one of the largest in Bangkok



The long distance buses mainly go north-ward and north-east-ward

Zone C, located in the center of the area, will be developed in the second phase which is scheduled from 2023 to 2027. The zone, according to the master plan, will accommodate an arena, or a MICE facility.

Currently, Zone C is used as a bus terminal operated by Transport Company Limited. The bus terminal serves as a hub for long distance buses going north and north-east as well as middle distance van-type buses. With more than 130 berths, respectively, for long distance and middle distance buses, the terminal is one of the largest in Bangkok.

■ Zone D



JJ outlet mall is a well-known market in the area



Low rise buildings currently occupy the land

Zone D, a long slice of land along Kamphaeng Phet 2 Road, will be developed step by step through the first phase to the third phase. The zone, according to the master plan, will be developed as a mixed use land with hotel, commercial, residential, office, and hospital functions.

Currently, the land is occupied by a commercial facility and low-rise shops. It is worth noting that JJ Outlet shopping mall, locally well known as a place where people can buy affordable daily products, is also located in the zone. The land is leased from SRT to the business owners but the status of the land in this zone is somewhat complicated due to land lease contracts each ending at a different timing, with one contracted until 2032. Also, some of the lease contracts are currently being negotiated, or a lawsuit is in process.

■ Zone E



Low-rise and dense residential area



Low-rise and dense residential area

Zone E, located at the back of Grand Station, will mostly be developed in the first phase by 2022, while the remaining portion will be completed in the second phase by 2027. Zone E, according to the master plan, will be developed for office, residential, and commercial facilities.

It is currently occupied by small low-rise houses. The streets are narrow in this densely built-up area. The zone is said to be home to the residences of relatives of SRT employees.

■ Zone F



Space behind Grand Station (Zone F-1)



Space behind Grand Station (Zone F-2)

Zone F, a thin slice of land between Grand Station and the existing railway station, according to the master plan will be developed throughout the first phase (Zone F-1) and the second phase (Zone F-2). Zone F-1 will be developed as a commercial zone with retail shops using the space under the skywalk, whereas Zone F-2 will be developed as an office, commercial, residential, and hotel area.

Currently, there is a railway station with tracks that are in operation.

■ KM 11 (Zone G)



Low –rise small shops and residences



Low –rise small shops and residences

KM 11 Zone (Zone G), located at the north end of the boundary, will be developed as a mixed

use area with offices, hospital, school, and high-end residences. According to the master plan, the area will be developed in the second phase, scheduled until 2027.

Currently, the zone is occupied by small low-rise houses, and the zone is a densely built-up area. Adjacent to KM 11, there is an area where the Ministry of Energy, PTT, the Energy Complex (ENCO) building is located. Several advanced energy-saving technologies are introduced in the area, such as district cooling, PV, and BAS (Building Automation System). These initiatives are highly compatible with Smart City concept that is pursued in Bang Sue. Therefore, the area may function as a satellite hub, or a backup center for energy management.

■ Zone H



There are some small buildings on the land



Zone H occupies vast area between the Grand Station and Chatuchak Park

Zone H, located in the center of Bang Sue Area in front of Grand Station, will be developed as a mixed use area with office, residential, commercial and hotel facilities. According to the master plan, the zone will be developed in the third phase which is scheduled until 2032.

The construction office for the Red Line and Bang Sue Grand Station currently occupies the zone.

■ Zone I



There are some existing facilities on the land



Construction machines for the railway at Zone I

Zone I will be developed as a high-rise residential area. According to the master plan, the area will be developed in the third phase, scheduled until 2032.

Currently there are some existing facilities and equipment in Zone I, mainly related to ongoing construction of the railway.

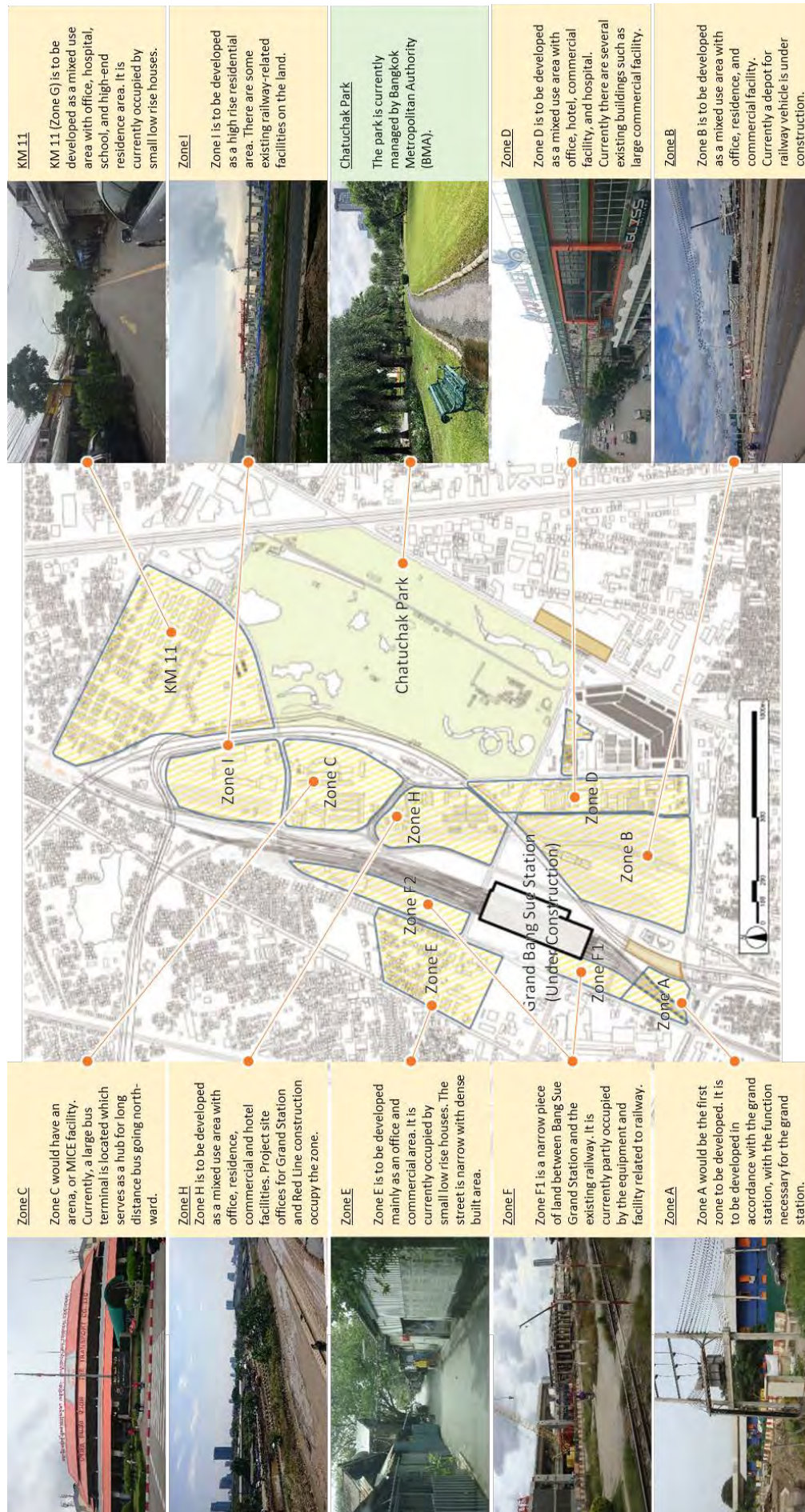


Figure 2.41 Current land use in Bang Sue Area

Source: Compiled by JICA Study Team

2.5.2 Infrastructure

Along with the land use, the conditions regarding the infrastructure and facilities around the area should also be taken into account so as to efficiently and effectively realize the Smart City development in Bang Sue Area. The Study Team has thus reviewed the current situation regarding usage of the land in Bang Sue Area.

■ **Bang Sue Station (SRT)**

Located around 8 km north of Hua Lamphong, the terminal station for the SRT railway line, the current Bang Sue SRT Station is a way station for trains connecting Bangkok and destinations in the northern region. The station platforms and the tracks will be transferred to Grand Station which is currently under construction.

■ **Bang Sue Station (MRT)**

Bang Sue MRT Station is an underground station, the roadside exit of which is located on the west side of Grand Station. The MRT Station will be connected directly to Grand Station when construction is completed via an underground passage.

■ **Chatuchak Park Station (MRT)/ Mo Chit Station (BTS)**

Chatuchak Park MRT Station is an underground station, the roadside exit of which is located on Phahon Yothin Road. Mo Chit Station is the last station for the BTS Skytrain, the station platform of which is an elevated structure over Phahon Yothin Road. On the east side of the station, there is a large flat parking area.

■ **Sirat Expressway**

Sirat Expressway is a dedicated motorway that runs in the longitudinal direction over Bang Sue Area on an elevated structure. According to SRT, there is a plan for off-ramp and on-ramp development in the area for access to the expressway.

■ **Kamphaeng Phet 2 Road**

Kamphaeng Phet 2 Road also runs across Bang Sue Area with some sections of the road running under Sirat Expressway. Since the bus terminal is located in the zone designated as Zone C, long distance buses and vans run along the road. The traffic volume of the road is relatively high.

■ **Flyover/ Access road**

A flyover and access road connecting Zone C to Grand Station are currently being constructed by SRT. Another access road connecting Zone H and Grand Station is also planned to be developed.

■ **Business district for energy-related industry**

Adjacent to KM 11 Zone, there is a small business district for energy-related industries where the PTT head office, Energy Complex building and Ministry of Energy are located.

■ **Gas pipeline**

The existence of a gas pipeline is a unique attribute of the area. The gas pipeline extends along the Red Line which is under construction.

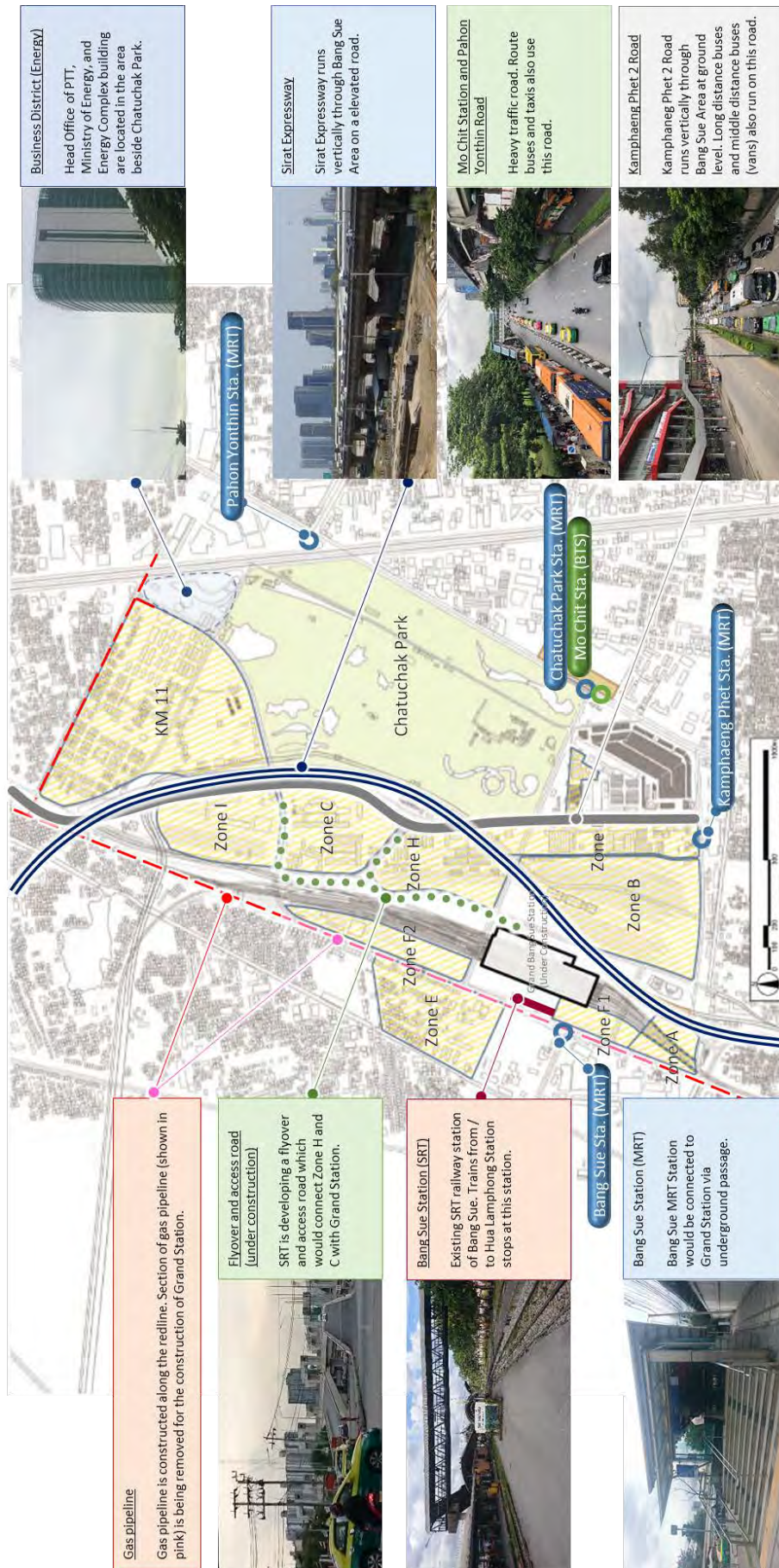


Figure 2.42 Current infrastructure and facilities in Bang Sue Area

Source: Compiled by JICA Study Team

2.5.3 Existing and Ongoing Facilities and Projects

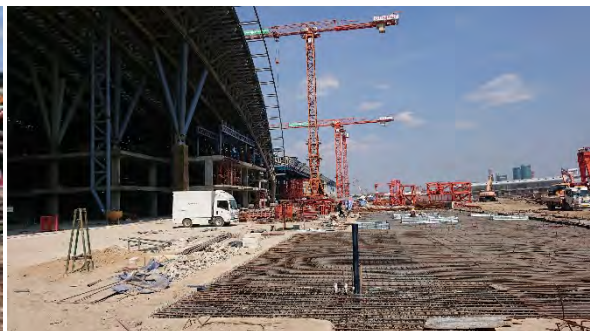
(1) Bang Sue Grand Station

Construction for the development of Bang Sue Grand Station is currently being implemented with completion planned in 2020. The station will cover 300,000 m² in the center of the designated area, with the total construction cost estimated at around 16 billion Thai Baht.

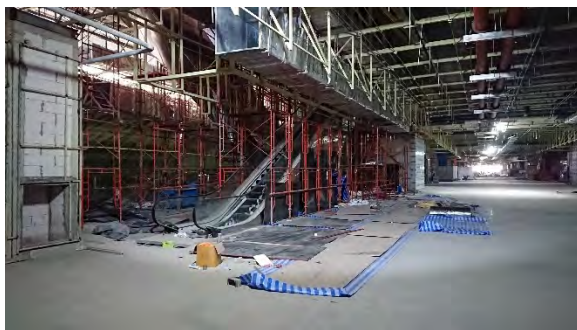
Grand Station shall be a four-storied structure. The ground floor shall be the concourse and the ticketing area, while also accommodating retail shops. The second floor shall accommodate the platforms for commuter trains and inter-city trains. There will be a mezzanine floor as a concourse and retail space. The third floor will accommodate the proposed high-speed railway and the three-airport rail link. The underground space will be used as a parking lot, while there will be an underground passageway connecting to Bang Sue MRT station.



Façade of the Grand Station



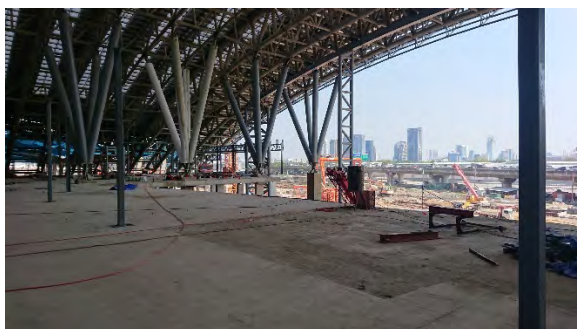
Construction at the station facade



Construction of First Floor : Concourse and retail space



Construction of Second Floor : Inter-city and commuter train platform



Construction of Mezzanine Floor: Concourse and retail space



Construction of Third Floor: High Speed Railway and Airport Link

(2) Red Line Project

It has been reported that SRT is indebted for about 100 billion THB (338 billion JPY) and has been requested by the State Enterprise Policy Office (SEPO) of the Ministry of Finance to formulate and execute a restructuring plan. It is expected that SRT will have a certain amount of returns from the development of Bang Sue area. Therefore, it is necessary to examine the financial status and capability of the SRT when considering the project implementation structure and finance scheme for the Bang Sue development project.

It should also be noted that the Red Line, which is planned to start operating in 2021, may have some delay in its completion, and thus attention must be paid when considering short-term project plans.

(3) Other railway projects

As stated above, currently, BTS Sukhumvit line and MRT Blue line is in operation. The Red Line is to be opened by 2021 and would be extended in sequence. The Airport Link line is targeted to be opened by 2023, while the High Speed Rail is currently being planned.

(4) Road construction projects around Bang Sue Area (Ramp and U-turn road)

Construction of ramps are planned around Bang Sue Area for connection to Sirat Expressway that runs over the area.



Source: Material provided by SRT

Figure 2.43 Plan of ramps and U-turn road around Bang Sue Area

In addition, elevated roads which enable access to Sirat Expressway from the Grand Station, and a U-turn road which enable access to the expressway.



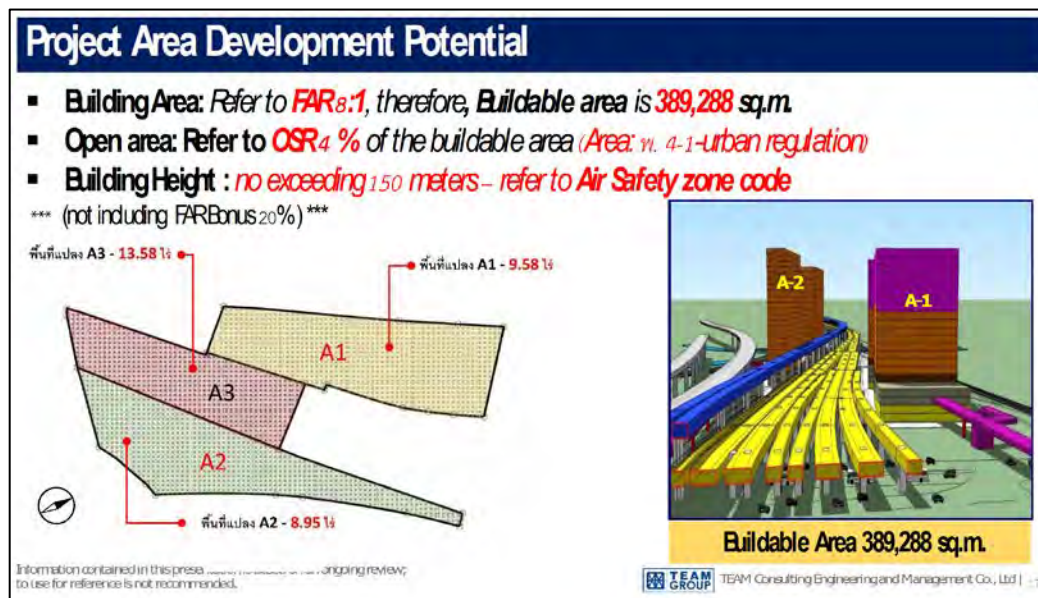
Source: Material provided by SRT

Figure 2.44 Plan of ramps and U-turn road to access Sirat Expressway

(5) Zone A Development

■ General information on Zone A development

Zone A covers 32 rai (5.1 ha) for a Smart Business Complex. The zone will be the first zone to be tendered. The development of Zone A will precede the development of other zones so its completion will coincide with the opening of Bang Sue Grand Station and the Red Line. Zone A is planned to have a commercial facility, hotel, and office buildings, the functions required to meet the needs of users of Grand Station when it is opened.



Source: Market Sounding Land Development Project for Commercial Area Development at Pahonyothin Transport Center, Zone A Wednesday 17, October 2018

Figure 2.45 Zone A Project Area

The general terms for the tender for Zone A are as follows:

- The project comes under the “DBFOT (Design, Build, Finance, Operate, and Transfer)” PPP scheme, and SRT shall provide the land only.
- The construction period is 4 years, and the design concept shall follow the TOD Principles. The zone would have function of retail shopping area, hotels, and office tower.
- The concession period is 30 years and investors have to pay a rental fee and share revenue with SRT.
- Investors shall transfer buildings and project assets in good working order after the concession period by technological transfer (management).

(6) Zone E Development

■ Outline of Zone E Development

Zone E, also known as the “Red Building Area” in the zonal development plan, will be developed on a land of 120 rai (19.2 ha) just to the west of Bang Sue Central Station. It is to have multiple functions where office facilities such as the SRT headquarters and homes will be built in the lush atmosphere with pedestrian decks and open spaces.

The site plan of Zone E is shown in figure below.



Source: Pahon Yothin Zone E Market Sounding material

Figure 2.48 Site Plan of Zone E

An office tower is planned to be built in Zone E-A, the 20.4 rai (3.3 ha) section within Zone E denoted as A1~A3 in the figure. Meanwhile, SRT’s headquarters is to be built in Zone E-S, the 15.6 rai (2.5 ha) section denoted as S, and shall become a building that embodies energy saving as a building representing the area. Zone E-B, the 55.8 rai (8.9 ha) section denoted as B1~B3, will be developed as a residential area with green open spaces and small commercial facilities. In Zone E-C, the 28.2 rai (4.5 ha) section denoted as C1~C4, there will be housing built for SRT staff.



Source: Pahon Yothin Zone E Market Sounding material

Upper Left: Sky walk and walkways, Upper Right: Bicycles/Busses, Lower Left: Bus Routes, Lower Right: Vehicle Roads flow

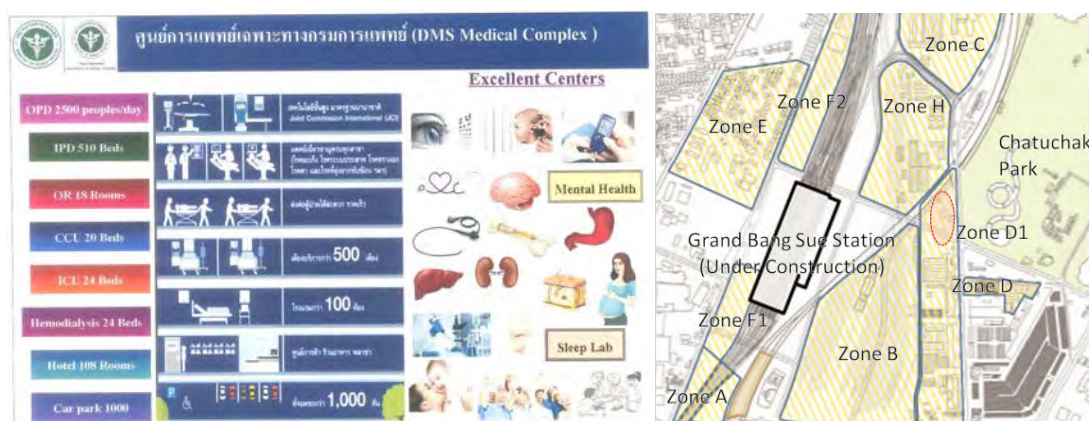
Figure 2.49 Traffic Line Planning Within/Around Zone E

The traffic line planning within and around Zone E is shown in Figure 2.49. Buses have been proposed as a public transportation to connect the inner and outer area of the section while the Skywalk and Bicycle paths are being planned as a means to travel within the zone.

(7) Zone D1 Development

Preceding the other block of Zone D, the Department of Medical Services under the Ministry of Public Health is planning to build a Medical Complex in Zone D1 based on a PPP system. A memorandum of understanding has been signed between the Ministry of health and the SRT regarding the project.

Detailed plans for the Medical Complex are yet to be decided. The facility is expected, however, to have around 510 beds installed, serve about 2500 outpatients per day, and function would include: an intensive care unit; operating theater; and a treatment room for patients with acute diseases.



Source (Left): "DMS Medical Complex" Concept Paper (From OTP), (Right): Compiled by the Study Team
Left: The Functions of the Medical Complex, Right: The Location of Zone D1

Figure 2.50 Plans for the Medical Complex in Zone D1

2.5.4 Organizational Change

(1) Establishment of SRT Asset Management Company

While SRT has an accumulated debt of over 100 billion THB (as of 2015), it owns about 6,300 ha of land which is not used in the railway business. When converted with the rate of 4700THB/m², the land value exceeds 300 billion THB. Nevertheless, the land is not appropriately managed by SRT, making only about 240 million THB per year from the land. Due to such circumstances, SRT has decided to establish an asset management company with a 100% SRT subsidiary, in order make more effective use of these lands to increase profits. The income from effectively using such assets is expected to help eliminate the accumulated debt of the SRT.

The main business activities are as follows:

- Management of lease contracts for the lands owned by the SRT
- Allocation and negotiation of development areas
- Land development business (Lease/purchase land from the SRT and conduct land development businesses)

The scheme is approved by the Superboard of the Thai government, and the asset management company is officially underway.

(2) Plans for Smart city development by the PTT/SRT

PTT has made contributions such as conducting their own surveys in their efforts to realize a smart city in Bang Sue. In November 2018, a memorandum of understanding has been signed between SRT and PTT towards the cooperation for realizing a smart city in the Bang Sue area.

Thereafter, PTT, EGAT, MEA, and SRT have been examining the energy service businesses in the Bang Sue area, and are planning to examine the provision of other infrastructure services and business models. A joint action plan, including plans such as the establishment of new entities, is expected to be formulated by 2019.

(3) Absence of a Steering Body to Promote the Bang Sue Smart City Development

The development of the smart city in Bang Sue will be led by Ministry of Transport, with Office of Transport and Traffic Policy and Planning (OTP) as the department in charge.

On the other hand, coordination between the relevant ministries and agencies is necessary in order to realize the smart city development. As of June 2019, however, a steering body to bring relevant agencies together has yet to be established.

Taking the case of Japan for example, committees have played an important role in bringing relevant agencies together, formulating basic policies, and facilitating coordination amongst related organizations, in promoting such large-scale redevelopment and smart city development.

Similarly, the coordination among the many related organizations is essential in the Bang Sue area development as well, in order to realize integrated development/smart city development. An early establishment of such steering body is desirable.

(4) (Reference) Establishment of “Department of Railway Transport”

The management of rail transport in Thailand had been conducted by the Rail Project Development Office attached to the Office of Transport and Traffic Policy and Planning in the Ministry of Transport

As there had been no government agency that oversees the railway project, the Thai government decided to upgrade the Rail Project Development Office attached to the Office of Transport and Traffic Policy and Planning in the Ministry of Transport to the extent that it is established as the Department of Rail Transport within the Ministry of Transport, so that management of rail transport is more efficient.

All businesses, property, budgets, rights, debts, obligations, civil servants, staff, employees, and manpower of the Office of Transport and Traffic Policy and Planning in the Ministry of Transport shall be transferred to the Department of Rail Transport in the Ministry of Transport.

There will be no changes regarding the Bang Sue Project which comes under the Office of Transport and Traffic Policy and Planning in the Ministry of Transport. However, railway projects such as the Red Line Project will come under the Department of Railway Transport. When considering the Bang Sue Project, coordination with the Department of Railway Transport might be needed for some of the issues.

2.6 Review of the Existing Master Plan and Relevant Studies

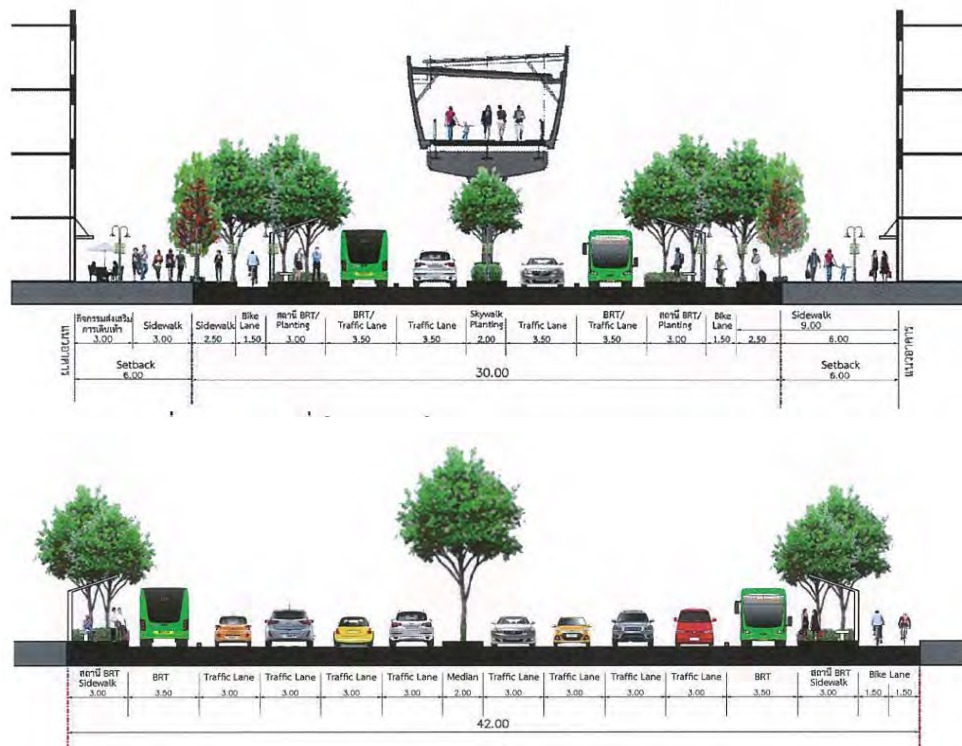
2.6.1 Development Plan by SRT and OTP

SRT and OTP implemented studies for the development plan of the Bang Sue Area in 2016. In the study by SRT, the development concept and direction were considered for Zones A, B, C and KM11 in order to realize the ASEAN HUB. The study proposed the concepts for each zone, such as Zone A as a Smart Business Complex; Zone B as the ASEAN Commercial and Business Hub; and Zone C as a Smart Healthy and Vibrant Town. Besides that, the financial plan for the development was also investigated on the basis of the concepts.

In the OTP study in 2016, the development plan for Zone D and the regional traffic plan based on the concept of TOD were compiled. Using the results of the traffic survey and demand forecast, the road development plan, pedestrian and cycling road plan and Bus Rapid Transit (BRT) plan were formulated.



Figure 2.51 Regional development plan and BRT network by OTP study



Source: OTP (2016)

Figure 2.52 Sectional view of the road by OTP Study

2.6.2 Urban Development Plan for Bang Sue Area

In the previous JICA study, ‘Data collection survey on urban redevelopment in Bang Sue Area in the Kingdom of Thailand’, the development concept and the development plan for the Bang Sue Area were formulated considering the results of these studies. The basic policies proposed for the Bang Sue Area development were summarized as follows: 1) to grow up to a centripetal urban core in Bangkok Metropolitan Area which plays important roles in the international community, 2) to create an eternally beloved new central district full of various attractiveness, 3) to create a visitor-friendly traffic terminal area comfortable for everyone. In addition, the future demand of railway passengers and properties based on the Bang Sue development plan was forecasted in the study. For example, the number of passengers using Bang Sue Grand Station was estimated at more than one million in 2032. In this study, two types of development scenarios were compared from different perspectives. Scenario 1 was ‘Individual Development’ and Scenario 2 was ‘Integrated Development’ as shown in Figure 2.53. In the result, Scenario 2 is recommended in terms of effectiveness and sustainability. Figure 2.54 shows the phased development plan for the Bang Sue Area that is proposed based on the scenario in the study.

Development Framework/ Investment Condition		Scenario 1: Individual Development	Scenario 2: Integrated Development
Development Framework	M/P Positioning	M/P approved by SRT Board	M/P approved by Cabinet, designated as special development district
	M/P Contents	Primarily private development of office/retail/residential area, wherever feasible	Model case of TOD/Smart City with both public infrastructure and private development, orchestrated to maximize land value
	Implementation Structure	Implementation between SRT and Private	Implementation between Gov't, SRT and Private
	Coordination Process	Coordinate separately with each related agency	Establish "One Stop" window for accelerated coordination within special district
	Development Steps	Develop primarily based on availability of land	Step-wise development to maximize land value
Investment Condition	PPP Tender Process	Tender conditions and documents are developed top-down	Tender conditions and documents are developed interactively with inputs from private, so as to ensure bankability
	Leasehold Period	30 years	50 years (based on BMA special zone regulation)
	Government Support	Nothing specific	Tax incentives and longer grace period as part of special development district support

Expected Results

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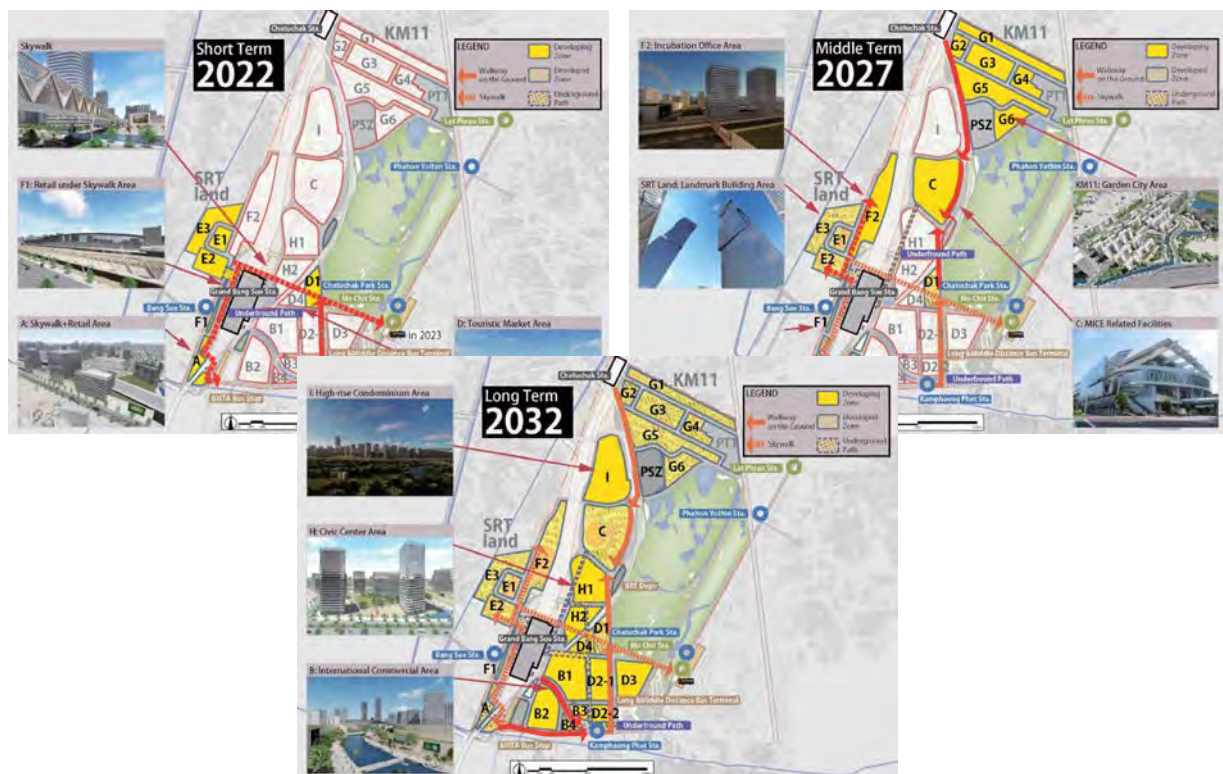
Usual private development. Profitability and economic effects are changed depending on developer's tendency.

→

Many bidders, A grade development, high profitability, significant economic benefit

Source: Data collection survey on urban redevelopment in Bang Sue Area in the Kingdom of Thailand, (2017). JICA

Figure 2.53 Comparison between Integrated Development and Individual Development



Source: Data collection survey on urban redevelopment in Bang Sue Area in the Kingdom of Thailand, (2017). JICA

Figure 2.54 Stepwise development plan

In terms of the smart city, several potential aspects and technologies related to a smart city were briefly argued in the study, namely the district cooling system and cogeneration, the energy management system by communication infrastructure and smart grid, energy infrastructure including common ducts, and smart transportation such as traffic information provision and

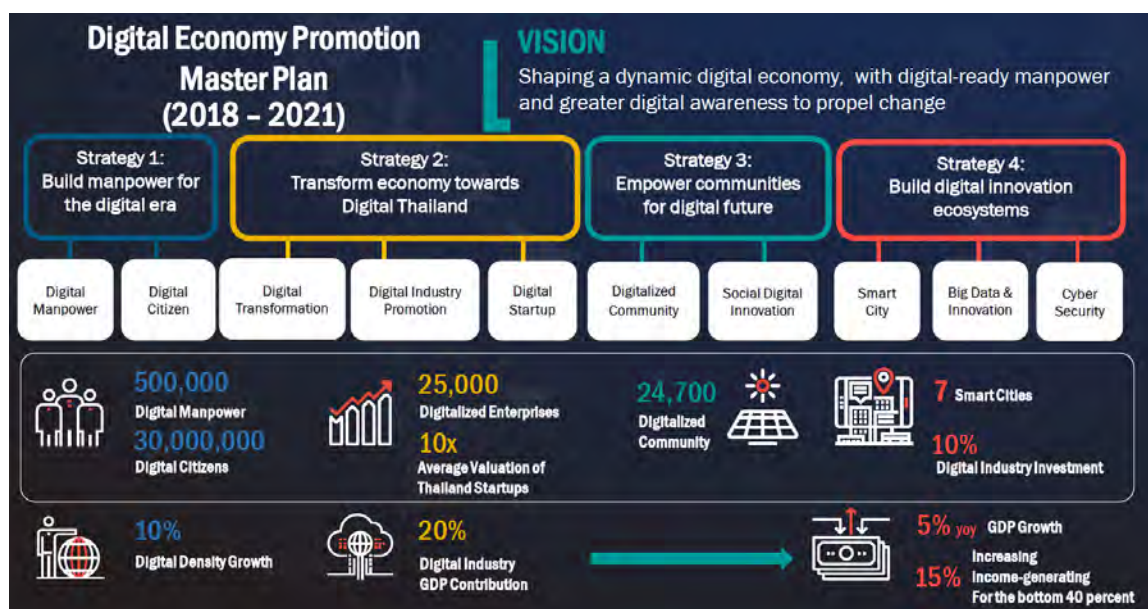
public transportation priority system (PTPS). However, the detailed concepts and implementation methodologies to make the Bang Sue Area into a smart city were not deeply explored in the study.

According to SRT, the plan was approved by the board committee of SRT and submitted to NESDC in 2018. The plan is expected to be endorsed by the Cabinet of Thailand in the near future.

2.6.3 Smart City Promotion by Government of Thailand

Thailand Government is supporting smart city development projects that are led by local authorities and private sector through support for basic infrastructure development and institutions. The government aims to make 70 smart cities in Thailand within the next five years, according to interviews with DEPA. As described before, the government established the Smart City Steering Committee, and appointed DEPA, OTP and EPPO as the secretariat. In addition, local governments, local and global companies, the academic sector and city development companies are expected to be key players in the planning and development of actual smart cities. Smart city development is promoted on the basis of five strategic pillars, which are; 1) master plan, 2) legal system, 3) PPP mechanism, 4) city data and security, and 5) R&D innovation.

In terms of digital economy promotion, DEPA formulated the Digital Economy Promotion Master Plan (2018 - 2021) as shown in Figure 2.55. DEPA established a funding mechanism not only for digital industries but also for the development of smart cities, which supports smart services and infrastructure development by the private sector. Moreover, there is a soft-loan scheme for local governments and the private sector which provides smart technologies and services. Recently these schemes have been frequently updated.



Source: DEPA (2016)

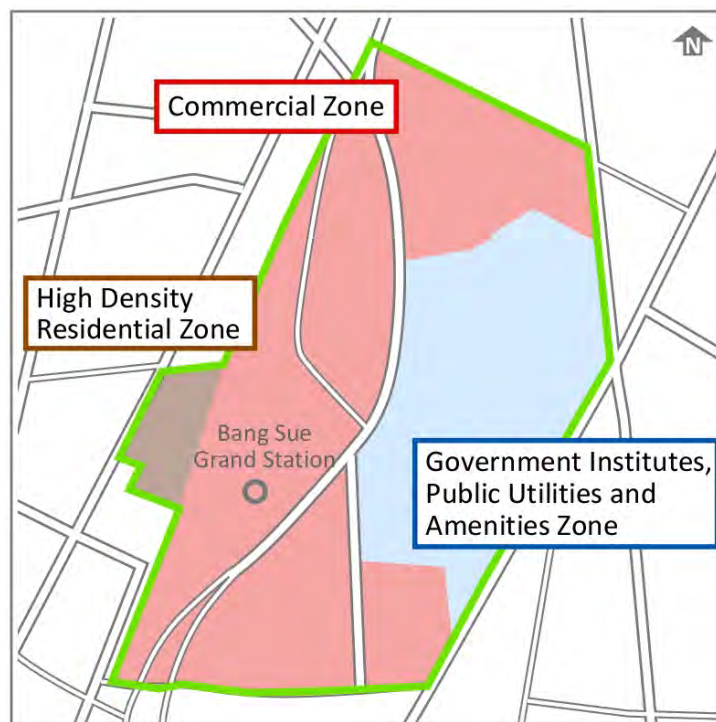
Figure 2.55 Digital Economy Promotion Master Plan (2018-2021)

2.7 Outline of the issues of laws and regulations on the urban development, real estate development and Smart City development

As mentioned in the previous study by JICA, two major regulations should be strongly related for the Bang Sue development: “Bangkok Comprehensive Plan 2013” and “Bangkok Building Control Regulation 2001”. In this study, detailed information of these two regulations was further examined.

2.7.1 Comprehensive Plan 2013 (3rd Edition)

According to “The Bangkok Comprehensive Plan 2013 the 3rd Edition”, the land use zoning of Bang Sue area consists of three types: commercial, residential and public utilities zones. The west side of Bang Sue Grand Station, same as Zone E, consists of “high density residential zone”. The east side of the study area, contains three parks Wachirabenchat Park, Rod Fai Park and H.M.Queen Sirikit Park, and is defined as “government institutes, public utilities and amenities zone”. The rest of the study area, which accounts for majority of the development area, is covered by “commercial zone”.



Source: JICA Study Team based on “The Bangkok Comprehensive Plan 2013 3rd Edition” by BMA

Figure 2.56 Zoning by Comprehensive Plan 2013 in the Study Area

The summary of these three zones are described as following table.

Table 2.15 Summary of the Zoning in the Study Area

Zoning Category	Sub Category	Floor Area Ratio (FAR)	Maximum FAR	Open Space Ratio (OSR)*	Major Land Use
Commercial Zone	C.4	8 times (800%)	9.6 times (960%)	5 %	Large sized commercial usage
High Density Residential Zone	R.8	6 times (600%)	7.2 times (720%)	4 %	Residential and commercial usage

Government Agencies, Public Utilities and Amenities Zone	G.22	n.a.		n.a.	Government agencies, public utilities, parks and so on
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Note: OSR=uncovered area is divided by the total floor area

Source: “The Bangkok Comprehensive Plan 2013” by BMA

(1) Floor Area Ratio in the Study Area

As the Bangkok Comprehensive Plan 2013 shows, floor area ratio (FAR) ranges from 600% to 800% in the study area. The current plan has a system of FAR bonus which obtains 20% extra privilege at maximum if the development considers the following cases.

- Case 1: The development includes low income houses
- Case 2: The development provides green open space
- Case 3: The development provides the public parking space
- Case 4: The development provides natural green open space and rain water storage
- Case 5: The development encourages green building construction concept approved by Thai Green Building Institute (TGBI)

Since the capacity of basic infrastructure in Bangkok such as water supply and sewage system is not enough to accommodate a large population, the 20% of extra FAR is considered as the maximum by BMA. Accordingly the policy of maximum FAR will be meant to stay the same in the next comprehensive plan under preparation unless there is a drastic change of infrastructure capacity in Bangkok.

(2) Development under Current Zoning System

1) Installation of Cogeneration Power Plant

Installation of a cogeneration power plant in the Bang Sue area is one important measure to develop as a smart city with advanced technologies. However the expected installation areas, both high density residential and commercial zones, are not allowed to build any power plant according to the comprehensive plan 2013. The system of “minority use” which allows a small area, less than 10% of the plot, incompatible with the zoning is no longer able to adopt in current and further comprehensive plans. Therefore installation of a cogeneration power plant requires permission from BMA. According to BMA, SRT needs to submit the proposal with formal decision of the relevant government ministry for obtaining the approval as mentioned in the previous study⁴.

2) Development in the Parks

Existing parks should be kept as open spaces in order to maintain the living and social environment. On the other hand, small developments, construction of a pedestrian deck (skywalk) or monorail, passing through the existing three parks could be planned in consideration with the convenience of access inside the study area. As mentioned above, the three parks are categorized as the government agencies, public utilities and amenities zone. Therefore development activities needs a permission from BMA even the parks belong to the land of SRT. Besides all sizes of rail systems including monorail require EIA according to the Ministry of

⁴ “Data Collection Survey on Urban Redevelopment in Bang Sue Area in the Kingdom of Thailand” by JICA

Natural Resources and Environment (MONRE)⁵. However skywalk development is exempt from it⁶.

2.7.2 New Comprehensive Plan (4th Edition)

Comprehensive Plan 2013 will expire, and the new Comprehensive Plan is currently under revision by the Department of City Planning in BMA. According to them, the new plan is already drafted and is going to take public hearings in 2019. The plan is supposed to be finalized and published around the end of 2019 or the beginning of 2020⁷. The concept of compact city will continue to be employed in the new comprehensive plan. The zoning shall keep the green belt in the fringe to avoid urban sprawl and define some urban centers inside Bangkok. The Bang Sue area is considered to be an “intermodal transport hub” in the comprehensive plan which takes a role of the major gateway of Bangkok in likewise other two areas with Makkasan station and Wongwian Yai station in Thon Buri.

The new comprehensive plan adds further conditions for applying FAR bonus in following cases. Thus in total eight cases would enjoy the bonus system. However the amount of additional bonus will stay at 20% same as the current regulation.

- Case 6: The development includes mass transit facilities
- Case 7: The development improves the water front area
- Case 8: The development provides the facilities for the elderly in consideration with aging society

Besides, two new measures will be taken into the comprehensive plan.

- Transfer Development Right (TDR):
TDR could allow to transfer FAR from agricultural land, historical and cultural areas to promotional areas such as commercial area and high-density areas. This measure is aimed at protecting the potential agricultural land and heritages and making urban developments to be concentrated.
- Planning Unit Development (PUD):
PUD could allow to transfer FAR with flexibility inside the designated district. This measures is aimed at securing open spaces and improving urban environment by increasing flexibility of building design⁸.

The Bang Sue area could apply to both systems of FAR bonus and PUD however the maximum extra FAR will be 20% only due to limited capacity of basic infrastructure as mentioned above.

2.7.3 Building Act

In the study area, following consideration could be necessary by BMA Building Control Regulation 2001 when the development plan will be designed.

⁵ Enhancement and Conservation of National Environment Quality Act (1992)

⁶ Notification of the Ministry of Natural Resources and Environment regarding the type and size of the project or business which must prepare an environmental impact analysis report

⁷ As of December 2018

⁸ Similar idea to “Comprehensive Building Design System” in Japan

Table 2.16 Summary of the Requirement by BMA Building Act 2001

Category	By Type	Regulation
Required Open Space	Residence	30% at minimum
	Commercial and Public Building	10% at minimum
Required Setback	Road width < 10m	setback form the center of road is 6 m at minimum
	Road width between 10 and 20m	setback form the center of road is 10% of the road width at minimum
	Road width > 20 m	setback form the center of road is 2 m at minimum
Required parking spot	Theater	1 spot per 10 seats
	Hotel	10 spots for the first 30 rooms, 1 spot per 5 rooms (the 31st room to 100th room), 1 spot per 10 rooms (from the 101st room)
	Condominium	1 spot per room unit
	Restaurant	10 spots for the first 150 sqm., then 1 spot per 20 sqm
	Department store, and exhibition hall	1 spot per 20 sqm
	Office	1 spot per 60 sqm
	Market and Hospital	1 spot per 120sqm
	School	1 spot per 240 sqm

Source: BMA Building Control Regulation 2001

With regard to installation of rooftop solar power in order to encourage renewable energy in the Bang Sue development, the other regulation shall be adopted. According to “Ministerial Regulations No.65 (2005)”, the rooftop panel must not exceed 160 sqm with the maximum weight of 20 kg/sqm. The installation must be checked and certified by an engineer for safety, and must be informed to the local government office in advance.

2.7.4 Scheme of BOI

The Board of Investment (BOI) provides incentive schemes for a variety of development in Thailand so as to enhance both domestic and foreign investments. Recently BOI announced to establish a new scheme for “smart city development”. According to the investment review in March 2019⁹, the scheme supports a project categorized as any one of following three categories: 1) Smart City Development, 2) Smart City System Development, or 3) Smart Industrial Estate or Smart Industrial Zones Business. In order to apply this scheme and obtain the incentive, the development needs to at least provide a “Smart Environment” and one or all out of six smart city platforms defined by Smart City Committee. The incentive supposes to provide 8-year of corporate income tax exemption in case the project could cover all seven platforms, while other case could be adopted 5-year of exemption. In addition to the corporate income tax exemption, customs and VAT for importing machines shall be applied. The development of Bang Sue area could claim this scheme, however it could apply to other schemes such as “activity-based incentives” and “technology-based incentives”. Selection of a scheme should be considered in the implementation.

For the time being, the scheme for the Eastern Economic Corridor (EEC) seems to have the most attractive incentives for investors and project owners however the Bang Sue area is not selected as a part according to the criteria by BOI.

⁹ Thailand Investment Review (TIR) Vol.29, No.3, March 2019, Smart City a Solution to a more livable future, BOI

2.7.5 Regulatory Sandbox

Regulatory sandbox is usually used as a deregulation system for enhancement of development projects. In case of Thailand, regulatory sandbox was launched for the financial sector such as fintech by the Bank of Thailand (BOT) in end of 2016. The applicants include financial institutes, financial business groups, fintech firms and technology companies. The main benefit is that BOT allows the applicants to test their innovate financial products or/and services in a limited environment. This scheme seems to not adopt urban redevelopment but to encourage innovation of financial services.

2.7.6 Others

The period of real estate leasehold for commercial and industrial properties is raised as one of the issues for the Bang Sue development in the previous study. The lease period is still 30 years according to “the Lease of Immovable Property for Commercial and Industrial Purposes Act 1999”. Although the current lease period is limited to 30 years, two 10-year extensions are allowed. The increase to a 50-year granted period is expected by amendment of the law by the ministry of finance, however a tangible schedule of the amendment has not decided yet.

According to the interviews with real estate developers, the 30-year lease period seems to not be enough for housing developments. The developers consider that 50-years would be necessary at least. Some contracts therefore have been made with conditions of extension. In the case of ONE BANGKOK which is developing a new urban agglomeration next to Lumpini Park and Rama IV road with 16.7 ha of total land will be accomplished by 2025. The project owner, TCC, won a 30-year extension for this commercial area. Therefore this example shows that the negotiation to win a longer year lease period could be possible.

In the Bang Sue development, the zone including housing developments will need a 50-year lease period. Discussions need to be continued with The State Enterprise Policy Office (SEPO) who is concerned with the lease condition for each zone.

2.8 Issues for Development in the Bang Sue Area

2.8.1 Zoning Change

Zoning change for installation of the cogeneration system is critical for the Bang Sue development. Thailand had a previous precedent to give the approval for installation of a power plant in an unqualified zone by the government order. In practice the Order 4/2559, Article 44 of interim constitution, “the Order of the National Council for Peace and Order (NCPO)” facilitates necessary development of a power plant by decreasing legal limitations such as zonings and city plans. By this Order, Electricity Generating Authority of Thailand (EGAT) has been permitted to develop Krabi Coal-fired Power Plant and Thepa Coal-fired Power Plant (unit 1 & 2) proposed in the power development plan¹⁰. These power plants are located in partly restricted areas, however the NCPO provided the approval in order to cope with power shortages in the southern part of Thailand. In addition, the Energy Regulatory Commission (ERC) has carried out the feed-in-tariff (TiF) program¹¹ on ground-mounted solar power generation in 2015. This program was

¹⁰ Thailand Power Development Plan 2015-35, Ministry of Energy

¹¹ Program on Ground-mounted Solar PV Generation for Government Agencies and Agricultural Cooperatives 2015

also adopted by the NPCO in order to enhance the solar power generation by utilizing the fallow lands¹². Thus the procedure for zoning modification in order for installation of cogeneration power plant seems to not be complicated by referring to the Order 4/2559.

In addition, BMA agreed with the importance of the Bang Sue area as a gateway of Bangkok. In fact the study for making a development master plan was conducted a decade ago by BMA itself however the plan was not accomplished. Making the plan of the Bang Sue area consulting with BMA is important and could be expected to obtain efficient guides including the zoning change of the comprehensive plan.

2.8.2 FAR

Although obtaining 20% of extra bonus, the FARs in the study area are relatively low compared to other international cities. For example, central Tokyo, in front of Tokyo Grand Station, obtained roughly between 1,200% and 1,700% of FAR¹³. However according to BMA the capacity of basic infrastructure does not allow to accommodate extremely high density. Thus higher FAR than 960% is not expected due to this physical barrier at this moment. The new Comprehensive Plan will be unveiled after being published within one year.

2.9 Findings and Recommendation

With regards to the study area, in terms of law and regulation for urban development, there are no serious issues to jeopardize the Bang Sue development. As mentioned above, the challenges could be dealt with respectively by taking appropriate procedures along the relevant laws and regulations such as changing the zoning system and taking FAR bonus. However the procedures to take time to resolve them since Thailand does not have comprehensive measures to encourage urban redevelopment smoothly and quickly at this moment. In order to reduce the process time, to obtain consensus of the stakeholder is necessary by explanation and opinion exchange with them in the early stages. In particular BMA is a principal organization for obtaining the permission of project development, installing cogeneration system and applying FAR bonus. From the planning stage, involvement of BMA is essential for smooth implementation.

Table 2.17 Major Required Procedure for the Development in Bang Sue Area

Item	Current regulation	Required procedure	Relevant Organization
Installation of Cogeneration Power Plant	Comprehensive Plan	To attain the approval for change the zoning based on “NCPO Order 4/2559, Article 44”	BMA
FAR Bonus	Comprehensive Plan	To apply the FAR Bonus (20% maximum) by meeting the requirement of Case defined in Comprehensive Plan	BMA
Buildings and facility - General - Solar Panel	BMA Building Control Regulation 2001 Ministerial Regulations No.65	To follow the existing regulation and to obtain the approval To follow the regulation and obtain the permission of installation by local authority	BMA Local Authority Bang Sue District Office

Source: JICA Study Team

¹² Annual Report 2016, Energy Regulatory Commission and Office of the Energy Regulatory Commission

¹³ Bureau of Urban Development, Tokyo Metropolitan Government

Long-Term Recommendation

Cities tend to have an increased need for renovation or redevelopment in response to social requirements and changes such as renewal of infrastructure, improvement of disaster prevention, introduction of advanced technologies, and alteration of the social structure including aging society, and strengthening of international competitiveness. Therefore not only the Bang Sue area but also other area might need redevelopment in Bangkok and other cities. Notably the improvement of law and regulation for the new technologies and services is sometime difficult to catch up due to the innovation of technologies are constantly improving day by day. The idea of “regulatory sand box” is one of the solutions for adopting such rapid changes.

In the case of Japan, urban redevelopment is considered to be important for providing more comfortable living environment taking into account the aging society and strengthening the urban competitiveness to stimulate the economy. For this, some area-based measures for urban redevelopment are implemented in Japan. For example the following three measures namely “Urgent Urban Renewal Area”, “International Strategic Zone” and “National Strategic Zone” could designate the area as “special zone” where it could be designed with a basis of unique proposals from project owners and investors.

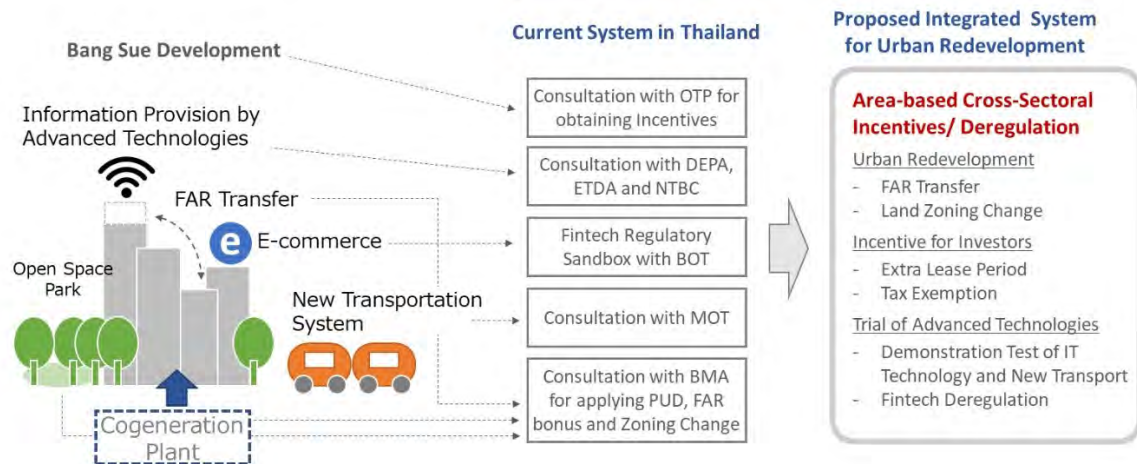
Once the area is defined as a “special zone”, it could benefit from advantages such as simplified procedure and quick implementation, deregulation of zoning and FAR, and financial incentives including financial supports and tax exemption. Such regulatory circumstances could contribute to create smart cities in Japan.



Source: JICA Study Team based on Office for Promotion of Regional Revitalization, Cabinet Office, Japan

Figure 2.57 Area-based Cross Sectorial Incentives and Deregulation System in Japan

Since Thailand has been preparing the master plans of smart city development in 40 cities by 2021, the following proposed system could contribute to efficient and quick implementation. This system is area-based cross sectorial regulatory sandbox based on the examples in Japan.



Source: JICA Study Team

Figure 2.58 Proposed Area-based Cross Sectorial Incentives and Deregulation System

3. Analysis of the Potential and Challenges of the Bang Sue Area

3.1 Problem-solving Approach

“Smart City” has become a common term and it can be said that there is general recognition of the key values and norms it relates to, such as liveability, sustainability, and balanced development. However, from a practical point of view, its focus area and approach are wide ranging and extensive, and thus defining or evaluating Smart City is not a straightforward task. Nonetheless, as long as Smart City development is interpreted within the context of urban development, it should strive to satisfy the needs of the people in the area, and solve actual issues that the region faces. One definition of Smart City, given by the Ministry of Land, Infrastructure, Transport and Tourism of Japan (MLIT) is: *“a sustainable city or region which aims for overall optimization through the application of technologies (ICT etc.) to solve urban issues, as well as management (planning, maintenance, management/administration etc.)”* (cited from the Ministry of Land, Infrastructure, Transport and Tourism, City Department “Towards realizing a smart city <Interim Report>”. August 2018.).

When revisiting Smart City development from the viewpoint of a solution-oriented approach to the urban issues Bangkok city faces, as well as the context of the functionalities necessary for Bang Sue area, the specific image of a Smart City in Bang Sue can be summarized as below;

Table 3.1 The Challenges for Bangkok city and outline of measures for Bang Sue area

Challenges	Measures for the Bang Sue area (example)
Smooth transit between the lines/ public transportations (busses to railways etc.)	➤ Physically seamless and efficient transit with comprehensible transit information ➤ Platforming of public transportation related data integration and analysis. ➤ Transportation service for the first/ last mile
Chronic traffic jam	➤ Optimum management of the traffic flow /introduction of advanced traffic countermeasure technologies ➤ Smooth parking in the urban areas
Deterioration of urban environment including air, water, and noise pollution	➤ Reduction of NO_x, CO₂ through electric cars, self-driving, and efficient distribution etc. ➤ Public space planting management with the application of smart agriculture technologies ➤ Smooth transport of logistics trucks
Unstable electricity supply (e.g. Momentary power failure)	➤ Stable electricity supply through energy management
Lack of walking space Barrier-free as a city	➤ Securing sufficient space specially for pedestrians, separation of sidewalks with roads ➤ Supplying a road for bicycles ➤ Developing a barrier-free city
Waste/garbage disposal issues	➤ Building a regional logistics system using a multi-functional utility tunnel ➤ Waste management (the promotion of the 3R's etc.)
Steps towards a low-carbon society (SDGs)	➤ Total management of CO₂ emission in Bang Sue area
Innovations in information technology (installation of 5G etc.)	➤ Acquisition and application of <i>all</i> data ➤ Data platforms, data center ➤ High-speed internet (Free Wi-Fi) ➤ Inducing innovation based on sharing big data
Chronic floods	➤ Securing retention basins, enhancing drainage capacity
Lack of housing for the low-income	➤ Institutional improvement to enhance accessibility for the low-

Challenges	Measures for the Bang Sue area (example)
population	income population

Source: Study Team

While adopting the problem-solving approach as an underlying proposition for the Bang Sue Smart City, it is also worthwhile to consider its advantages and potential taking into account the contemporary situation and ASEAN context when outlining the general direction for Bang Sue Smart City development.

In Bang Sue's case, SRT solely owns the vast 300ha of land that it covers, and thus the development of the area could be managed as a whole. Hence, the area has a great potential in taking advantage of the policies for Thailand 4.0, as well as the incentives, while also actually implementing the cutting edge technologies in advance to other cities.

To analyze Bang Sue Area's advantages and its potential, it is beneficial to take into account the urban development situations regarding other ASEAN cities, Thai cities, and in Bangkok. In the following sections, Bang Sue Area development project and its Smart City concept is redefined through analyzing the attributes from the context of three distinct levels of: ASEAN, Bangkok metropolitan area, and Bang Sue district.

3.2 Outline of Bang Sue Area Development

3.2.1 Outline of Bang Sue Area development in context of ASCN

(1) Relative position of Bangkok within ASEAN cities

Quantitative data and literature were collected and reviewed to understand the current standing of Thailand's economy and business climate, as well as the competitiveness of Bangkok as a city.

The table below shows the score for ease of doing business provided by the World Bank.

Table 3.2 Doing Business Index (2019) for ASEAN and other Asian Countries

Economy	Ease of doing business score global (DB17-19 methodology)	Score-Starting a business	Score-Dealing with construction permits (DB16-19 methodology)	Score-Getting electricity (DB16-19 methodology)	Score-Registering property (DB17-19 methodology)	Score-Getting credit (DB15-19 methodology)	Score-Protecting minority investors (DB15-19 methodology)	Score-Paying taxes (DB17-19 methodology)	Score-Trading across borders (DB16-19 methodology)	Score-Enforcing contract (DB17-19 methodology)	Score-Resolving insolvency (DB15-19 methodology)
Singapore	85.2	98.2	84.7	91.3	83.1	75.0	80.0	91.6	89.6	84.5	74.3
Hong Kong SAR, China	84.2	98.2	88.2	99.3	73.6	75.0	78.3	99.7	95.0	69.1	65.7
Taiwan	80.9	94.4	87.1	96.3	83.9	50.0	75.0	85.1	84.9	75.1	77.1
Malaysia	80.6	82.8	87.0	99.3	80.4	75.0	81.7	76.1	88.5	68.2	67.2
Thailand	78.5	92.7	71.9	98.6	69.5	70.0	75.0	77.7	84.7	67.9	76.6
Shanghai (China)	73.7	93.4	67.7	92.0	79.7	60.0	60.0	66.3	83.1	78.9	55.8
China	73.6	93.5	65.2	92.0	80.8	60.0	60.0	67.5	82.6	79.0	55.8
Beijing (China)	73.6	93.7	62.1	92.0	82.2	60.0	60.0	69.0	82.0	79.1	55.8
Brunei Darussalam	72.0	94.9	73.5	86.6	51.5	100.0	65.0	74.0	58.7	61.0	55.1
Vietnam	68.4	84.8	79.1	87.9	71.1	75.0	55.0	62.9	70.8	62.1	34.9
Indonesia	68.0	81.2	66.6	86.4	61.7	70.0	63.3	68.0	67.3	47.2	67.9
Mongolia	67.7	86.9	78.2	54.9	74.1	80.0	68.3	77.3	66.9	61.4	29.4
ASEAN average	66.1	79.8	71.4	80.3	64.7	62.0	57.0	70.2	72.2	53.5	50.0
Philippines	57.7	72.0	68.6	87.5	57.6	5.0	43.3	71.8	69.9	46.0	55.2
Cambodia	54.8	52.8	44.2	57.0	55.2	80.0	50.0	61.3	67.3	31.8	48.4
Lao PDR	51.3	60.9	67.9	52.8	64.9	60.0	31.7	54.2	78.1	42.0	0.0
Myanmar	44.7	77.3	70.4	55.7	52.3	10.0	25.0	63.9	47.7	24.5	20.4

Source: World Bank "Doing Business Index 2019"

The criteria mostly relate to issues at national level, such as laws or business customs. However, as the data is mostly collected from businesses in the capital city, the scores are, to some extent, a reflection of the easiness of conducting business in the capital city.

According to the data, Thailand ranks third among ASEAN countries in overall score, behind Singapore and Malaysia. While Thailand outscores the ASEAN average in all the criteria, Thailand is perceived to be relatively low in "Permission for construction", "Registering properties", and "Enforcing contracts" when compared to fellow competitors such as Singapore and Malaysia.

The table below shows the liveability of cities in Asia provided by the Economist Intelligence Unit.

Table 3.3 Cities Liveability Index 2012

rank	Country	Spatial Adjusted Liveability Index	Stability (18.75%)	Healthcare (15%)	Culture and Environment (18.75%)	Education (7.5%)	Infrastructure (15%)	Spatial Characteristics (25%)
1	Hong Kong	87.8	95	87.5	85.9	100	96.4	75
10	Tokyo	84.3	90	100	94.4	100	92.9	53.3
20	Seoul	79.1	80	83.3	85.6	100	89.3	58.8
22	Singapore	78.2	95	87.5	76.6	83.3	100	46.7
30	Beijing	70.5	80	66.7	72.2	83.3	85.7	51.5
33	Shanghai	66.8	80	62.5	75	75	75	46.1
34	Shenzhen	66.7	85	62.5	63.7	66.7	82.1	48.5
37	Kuala Lumpur	64.6	80	62.5	67.8	91.7	76.8	36.6
39	Guangzhou	63.1	80	62.5	61.1	66.7	76.8	42.9
46	New Delhi	58.6	55	58.3	55.6	75	58.9	58.6
48	Manila	58	60	58.3	63.2	66.7	64.3	46.1
49	Bangkok	57.8	50	62.5	64.4	100	69.6	36.3
52	Mumbai	55.7	60	54.2	56.3	66.7	51.8	52.1
56	Jakarta	51.5	50	45.8	59.3	66.7	57.1	42.3
57	Hanoi	50.2	55	54.2	53.7	58.3	51.8	38.4
60	Ho Chi Minh City	48.1	55	50	49.5	66.7	48.2	35.1
64	Phnom Penh	44.6	60	37.5	49.3	58.3	53.6	24.1
68	Dhaka	37.9	50	29.2	43.3	41.7	26.8	35.7

Source: Economist Intelligence Unit

According to the data, Bangkok ranks 49th in the global ranking, and 4th among ASEAN cities behind Singapore, Kuala Lumpur, and Manila. When compared to these rival cities, Bangkok appears to have lower scores in Stability - consisting of indicators related to crime and civil conflict - and in Spatial Characteristics - consisting of indicators related to urban form (sprawl, green area), geographic attributes (natural assets, connectivity), and pollution.

Looking at both Doing Business Index and Liveability Index, it could be said that Bangkok ranks relatively high in business aspect and living environment aspect. However, when compared to rival cities such as Singapore and Kuala Lumpur, Bangkok is inferior in areas related to law and contract enforcement in business domain, whereas it also falls behind in areas related to urban form and geographic attributes in living environment domain.

(2) Relative position of Bang Sue Area within ASCN

Combining these statistical data and the Smart City projects in ASCN which is mentioned in the previous section, the distinctive characteristics of Bangkok's approach to Smart City projects are outlined. Table below shows the business environment index, liveability, and the priority projects registered in ASCN.

Table 3.4 Attributes of other main cities in ASEAN Smart City Network

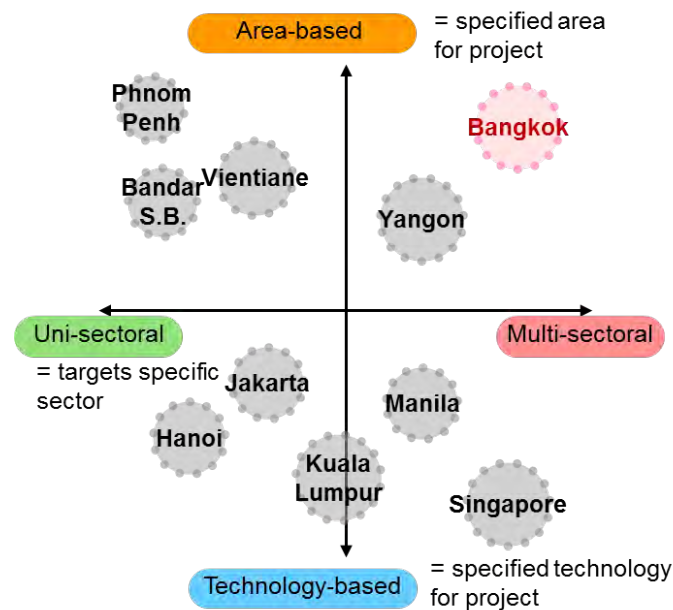
City	Business Environment	Liveability Index	Priority Projects
Singapore	85.24	78.2	E-Payments National Digital Identity (NDI)
Kuala Lumpur (Malaysia)	80.6	64.6	Kuala Lumpur Urban Observatory Kuala Lumpur Pedestrian and Bicycle Lane
Bangkok (Thailand)	78.45	57.8	Transport Hub Development at Bang Sue Area Smart City Plan
Bandar S.B. (Brunei)	72.03	N/A	Revitalization of Kampong Ayer (Water Village) Clean River Management Project
Hanoi (Vietnam)	68.36	50.2	Intelligent Operation Centre (IOC) Development of Intelligent Transportation
Jakarta (Indonesia)	67.96	51.5	Job Creation Linking Research Institutes and Entrepreneurs OK OTrip Integrated Transit Cashless System
Manila (Philippines)	57.68	58	Command Centre Upgrade (Transport/Disaster Prevention/Security) E-Education
Phnom Penh (Cambodia)	54.8	44.6	11 Sidewalks Rejuvenation Project Improving Efficiency of Phnom Penh Public Transit
Vientiane (Lao PDR)	51.26	N/A	Establishment of Drainage System Sustainable Transport Plan
Yangon (Myanmar)	44.72	N/A	Conservation of Yangon City Downtown Area Low Cost Rental Housing and Transit Oriented Development

Source: Compiled by the Study Team based on Economist Intelligence Unit, World Bank, ASCN

Overviewing the Smart City projects in other ASEAN cities, it could be pointed out that Bangkok's approach for Smart City development is unique in two ways. Firstly, it is area-based, that is specific area (Bang Sue Area) is designated as an area to be developed as Smart City. The other cities such as Singapore or Kuala Lumpur does not necessarily specify an area to implement Smart City development, but rather specify a smart technology which is to be implemented (technology-based approach). Secondly, it is multi-sectoral, meaning that the project is targeted to solve various urban issues by linking with urban and spatial planning. The other cities such as Phnom Penh or Hanoi targets specific issue to be targeted (uni-sectoral approach).

The approaches of Bangkok and the other ASEAN cities could be summarized as shown in the below figure.

Bang Sue could become a model city which demonstrates the solution-oriented Smart City by combining urban planning method and Smart City concept.



Source: Compiled by the JICA Study Team

Figure 3.1 Comparison of approaches to Smart City development among ASEAN cities

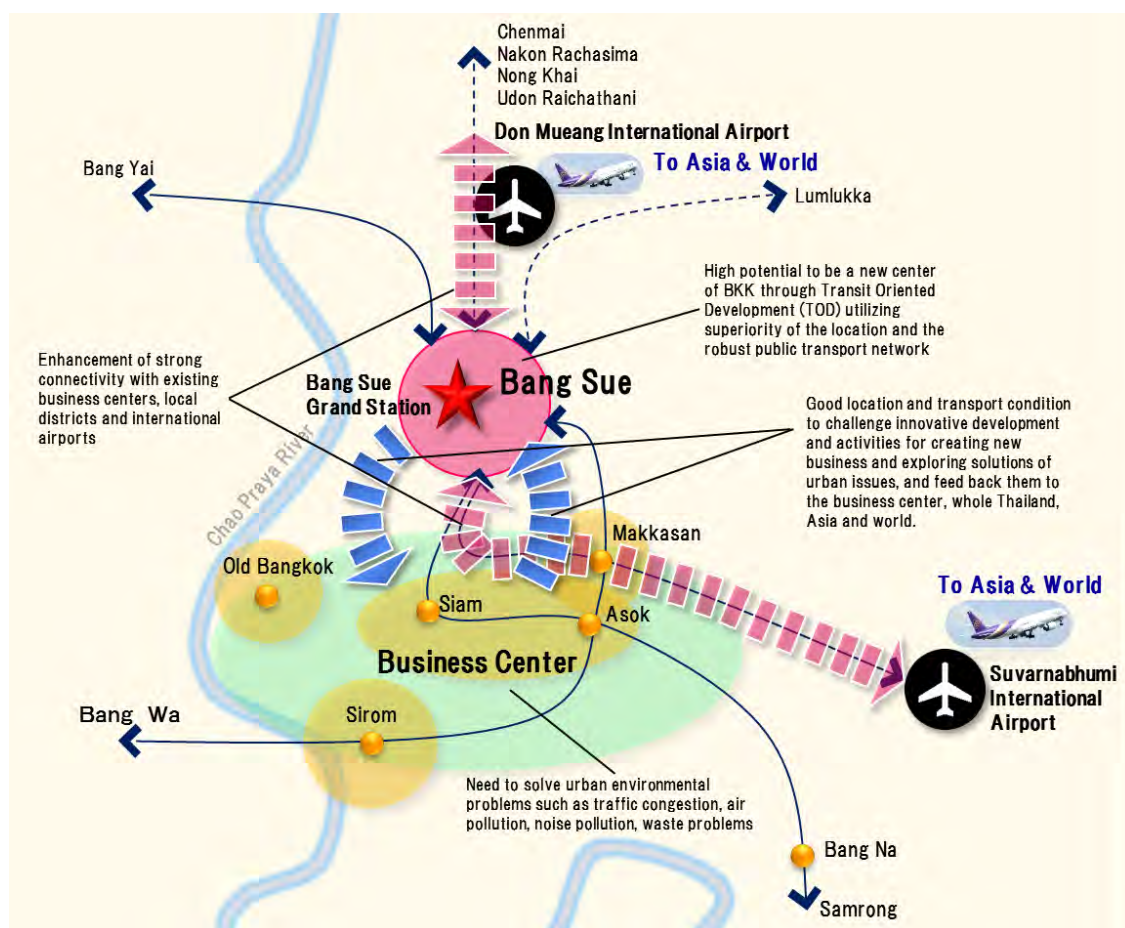
3.2.2 Outline of the current situation in context of regional level

(1) Bang Sue from viewpoint of spatial position attributes

Looking at the urban development of Bangkok, one may notice that Siam, the outskirts of Silom, and the area along Chao Phraya near the royal palace are the center of commerce; and that the north side of Siam is developing into a commuter town.

Bang Sue Area, which is about 10 km away from the center of Bangkok, is slightly distant from the center of commerce. On the other hand, the area is also at about 10 km from Don Mueang International Airport, which means that it is midway between central Bangkok and the airport.

Commercial facilities in the suburbs of Bangkok have mainly developed along arterial roads, yet such development has been quite limited around train stations. The distinctive characteristic of Bang Sue, however, is that it is a place where various railways/roads intersect and that it is highly convenient when using public transportations. By taking full advantage of this characteristic, Bang Sue Area has a great potential in becoming a new central city area of Bangkok. The key to this would be in creating a city in which its society does not rely on automobiles, but instead on public transportations – a Transit Oriented Development (TOD) and Walkable City.



Source: JICA Study Team

Figure 3.2 Potential of Bang Sue development regarding urban development in Bangkok

(2) Bang Sue from viewpoint of historical development attributes

Referring to the “Histories of Urban Development in Bangkok” in the previous chapter, if one were to picture the scale of the Bang Sue Area and draw an analogy with historical development projects such as Ratchamnoen or Suan Dusit, the Bang Sue smart city development could be regarded as a flagship project which symbolizes transformation of the urban form. Bang Sue development could be a pilot project that accelerates “Thailand 4.0” or “The Fourth Industrial Revolution”.

In doing so, it is imperative to adopt measures and technologies for the improvement of Bangkok’s urban issues such as traffic congestions and urban environments, for example: next generation traffic systems, traffic management measures, energy saving technologies, and provision of environmental friendly urban space. On the other hand, in order to strengthen Bangkok’s competitiveness as a city, establishing new industries and global standard business environments are critical aspects as well.

3.2.3 Outline of Bang Sue Area development in context of local level

Looking at the current state of Bang Sue Area, there are several facilities which already attracts people into the area: the offices, hotels, and commercial buildings around Mochit station; Chatuchak park (museums, sport facilities, bikeways, etc.); Chatuchak Weekend Market; Energy Complex building (where the PTT has its main office) on the north side of the park; and MRT

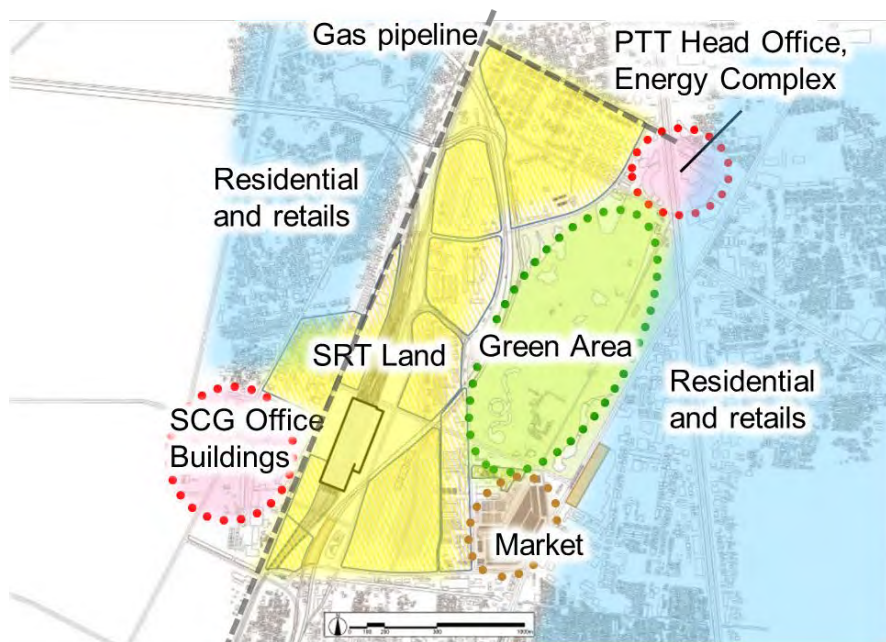
Bang Sue Station where the SCG headquarters is at.

In the same area, however, elevated highways/interchanges runs over the area, and railway depot occupies wide space which separates the area.

On the other hand, Bang Sue Area, especially to the west and south of the station, is a residential area with many houses, which are home to many low/middle-income people.

By connecting these facilities in an organically coordinated manner, we can unlock the entire area's potential, and establish a vast commercial area that puts homes and workplaces in close proximity to each other.

Bang Sue already seems to attract various people but is expected to experience a greater diversity with the development of the transportation network and urbanization. People of diverse backgrounds, including foreign people, may come to meet, work, and live in the area. The interaction of diverse people in Bang Sue Area would lead to creating new values. This would be a distinctive feature for the Area.



Source: JICA Study Team

Figure 3.3 Bang Sue Area and vicinities

3.2.4 Outline of Bang Sue Area development in context of residents and people

As mentioned, various kinds of people will come and go at the Bang Sue area. Some characteristics of each user category is elaborated as followings.

(Expected users of Bang Sue area)

Railway Passengers ; Users of Railways (SRT, Red line, MRT, BTS, Airport Rail Link, in future: High Speed Railway (Bangkok-Chenmai), Dark Redline, Light Red Line)

Users of Long and Middle Distance Bus Service ; From/to rural areas

Leisure use ; Shopping, By Train, By Private Car

Residents ; SRT Housing for employees (SRT Land, KM 11), Condominium, Rental Mansions

Workers ; Office workers in office buildings

Labours

Tourist ; Foreigners

Table 3.5 Types of Users of Bang Sue Area

Type	Transportation Mode	Volume	Generation	Income Level	Activities	Note
Railway Passengers (Transit)	Rail	High	Various	Middle ~ Upper-Lower	Travelling, Visiting	Red Line-MRT/BTS
Bus Passengers	Bus/Taxi/Bike	Middle	Various incl. aged and children	Upper-lower ~ Lower	Travelling, Visiting	
Leisure Use	Rail /Private Car	Middle	Young ~ Family	Middle ~High	Shopping, Entertainment	
Residents	Rail /Private Car	Middle	Young ~ Family	Middle ~High	Living	
SRT Staff Houses	Bike	Middle ~ Low	Various	Upper-lower ~ Lower	Living	
Office Workers	Rail /Private Car	Middle	Young ~ Middle age	Middle ~High	Working	
Labours	Bike	Middle	Young ~ Middle age	Upper-lower ~ Lower	Working	
Tourist	Rail	Middle ~ Low	Young ~ Family	Middle ~High	Travelling, Visiting	

Source: JICA Study Team

The functions and potential of the Bang Sue area have been organized from the three aspects of livelihood, business environment, and visitor attraction in shopping, tourism, and leisure.

(1) Livelihood

The residents in the Bang Sue Area is expected to consist of workers commuting to offices in central Bangkok, as well as those who live close to work and commute to companies within the area. The parks in the Area contributes to environmentally friendly atmosphere. With the development of visitor attractions such as commercial or MICE facilities, not only would the area be a place in which one can feel the nature from the Chatuchak Park and the greenways but also a place which would offer convenient and exciting urban life.

Meanwhile, the Ministry of Public Health plans to have their medical complex built in the Bang Sue area during the initial phase. Healthy lifestyles are expected to be promoted by collaborating with Chatuchak Park and its bike paths/sport venues.

(2) Business Environment

Dominant firms of Thailand are accumulated in the Bang Sue area — Energy Complex Building (PTT's headquarters) and the Ministry of Energy's office to the north, and SCG's headquarters near the MRT Bang Sue station. There are plans to build the SRT's headquarters and a building for the Ministry of Transport to the west of the station, and it is assumed that the Bang Sue area would become a new business district for Bangkok.

It is also worth noting that Thailand is working for the creation of new industries and the promotion of innovation as part of their policy. By realizing a serene urban space while making most of the district's diversity through integrated development with the Grand Station, the area is expected to provide a business environment that is attractive for knowledge-intensive industries (IT and R&D related fields etc.) and start-up companies.

(3) Visitor Attraction in Shopping, Tourism and Leisure

The Bang Sue area has unique location characteristics as it is to the north of Bangkok and is easily accessible by public transportation such as railways. The area is already a distinguished visitors' destination with the Chatuchak weekend market and the park. However, with the upcoming opening of the Bang Sue Grand Station and highways including the airport rail link line, further increase in the visiting population can be assumed.

Various facilities with myriad functions such as commercial facilities, cultural facilities, and MICE facilities are to be located in the Bang Sue Area. By securing the area's spatial continuity through integrated development, Bang Sue can establish connectivity between the various functions. Such connectivity can bring prosperity in town and act as a catalyst that attracts people.

3.2.5 Bang Sue Development from the Viewpoint of Real Estate/Urban Development Investment

(1) Responsibility for Sustainable Development Goals (SDGs) and ESG

In recent years, there has been a global trend for investors – mainly institutional investors – to select investment from the perspective of ESG (Environment, Society, Governance), and also to require commitments to the SDGs for the invested companies. This trend is strong in Europe and the United States, and in investments for long-term asset management. ESG investments generally incorporate E: Environment, S: Social, and G: Governance perspectives into long-term investment decision-making, aim to improve risk management, and increase sustainable and long-term returns. Guidelines on ESG investments have been set out in the Principles for Responsible Investment (PRI) proposed by the United Nations in 2006.

The Sustainable Development Goals (SDGs) are 17 global goals for sustainability, including actions for poverty reduction and climate change, set by the United Nations in 2015 for the year 2030. The spread of actions for the SDGs into private businesses, especially after 2015, has encouraged the expansion of ESG.

In the actual management of ESG investments, major equity evaluation organizations, such as S&P Dow Jones Indices, are evaluating companies in the light of ESG based on company disclosure information. These organizations provide stock price indicators comprised of companies that have acquired excellent ESG evaluations, and also operate investment trusts linked to them. Such indexes will become more and more important in real estate investment as

well.

Smart city development in the Bang Sue area is consistent with the goals set out in the SDGs. If its contributions to the SDGs as well as positive impacts are evaluated highly from the ESG aspect, the project could attract investment funds from a wider variety of source, which could be an incentive for companies doing smart service businesses in the Bang Sue Area. .

Table 3.6 The SDGs and the possible contributions by the Bang Sue Development

SDGs	SDGs Target (abstract)	Bang Sue Area's Commitment for the SDGs (example)
 3. Good health and well-being	3.6 Halve the number of death/injuries from road traffic accidents 3.8 Universal Health Coverage	▪ Pedestrian oriented, walkable city ▪ Providing health services linked to the medical complex facilities (planned to be built in Zone D1)
 4. Quality education	4.4 Improvement of technical/vocational skills, nurturing entrepreneurship 4.7 Global citizenship, and appreciation of cultural diversity	▪ Creation of learning opportunities through impetuses such as satellite campuses ▪ Creating an international atmosphere and promoting cultural exchange as a gateway to Bangkok
 7. Affordable and clean energy	7.2 Increase the share of renewable energy 7.3 Improve energy efficiency	▪ Promote the installation of renewable energy, such as the PV ▪ Introduction of cogeneration technology, district cooling system, and energy management
 8. Decent work and economic growth	8.2 Promote high-value added and labour-intensive sectors 8.3 Support job creation, entrepreneurship, and innovation	▪ Promote location of high-value added industries such as knowledge-intensive industries ▪ Development as a new business district of Bangkok
 9. Industry promotion and infrastructure	9.1 Sustainable and resilient infrastructure 9.5 Promoting innovation	▪ Installing high quality and flexible infrastructure as a smart city ▪ Supporting start-up companies and implementation of new technologies
 11. Sustainable cities and communities	11.2 Expanding public transport and sustainable transport systems 11.3 Enhance participatory, inclusive, and sustainable planning/management	▪ Development of an environmentally-friendly public transportation system ▪ Development as a walkable city that does not depend on automobiles ▪ Realization of participatory city planning and management
 12. Responsible consumption and production	12.2 Sustainable management/efficient use of natural resources 12.6 Encourage companies to adopt sustainable practices	▪ Promoting local production and local consumption (including energy) ▪ Encouraging companies to make sustainable efforts ▪ Ensuring transparency by disclosing information on corporate initiatives

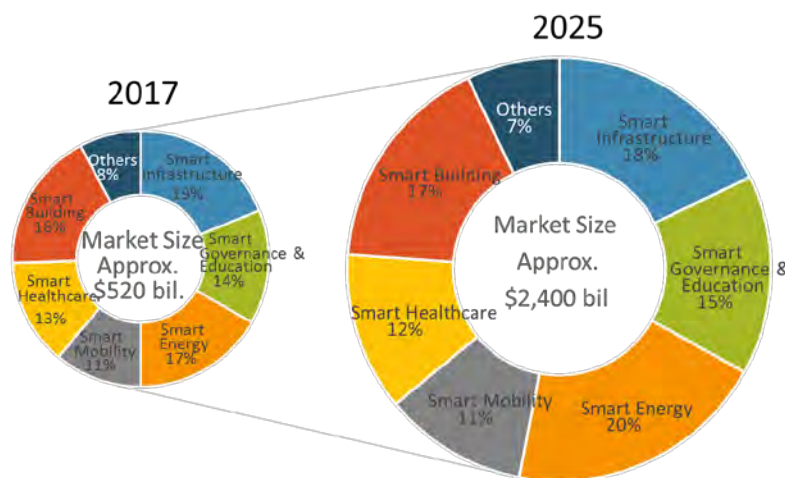
Source: Compiled by the JICA Study Team

(2) Market Potential for Smart City Technologies/Services

Through the spread of smartphones and the rapid progress of IoT technology, new technologies such as 5G communication and automatic driving technology have formed a large market worldwide, starting in Europe and the US, and are still in the research and development stage. Markets related to smart cities are expected to further expand as these new technologies are put

into practical use.

According to market research firm estimates, Smart City's market size is expected to grow to approximately \$ 2.4 trillion by 2025, compared to \$ 520 billion in the global market as of 2017. The market segments in this estimate are defined by 7 sectors: Smart Infrastructure (transport infrastructure, water infrastructure, stadiums, safety and security infrastructure, lighting, etc.); Smart Governance and Smart Education; Smart Energy (power generation, storage, smart grid, etc.); Smart Mobility (ticketing systems, parking systems, etc.); Smart Healthcare (telemedicine, connected healthcare, etc.); and Smart Buildings (building management systems, building safety and security equipment, etc.). According to the same survey, the Asian region is the number one market expected to grow in the future. The current situation and future estimates for the smart city market are as shown below.



Source: Allied Market Research “Smart Cities Market by Functional Area”, compiled from the Study Team

Figure 3.4 Market Size Estimation Related to Smart Cities

(3) The Potential of bang Sue Smart City as an Investment Destination

Global attention for smart city development, social demands for SDGs, and capturing the current trends of the international community such as the expansion of ESG investment are essential in realizing the potential of Bang Sue district as a smart city. In this regard, the following three factors can be the key to competitiveness of the Bang Sue area within ASEAN's competing smart cities;

- Public Awareness of “Bang Sue”, Established Reputation:

The Bang Sue area will become a smart city with Bang Sue Grand Station, the largest station in Southeast Asia, at its core. Once the Central Station is completed, the airport connection line is connected, and the transboundary high-speed railway concept has been realized, *Bang Sue* will be widely recognized not only in Thailand but also internationally.

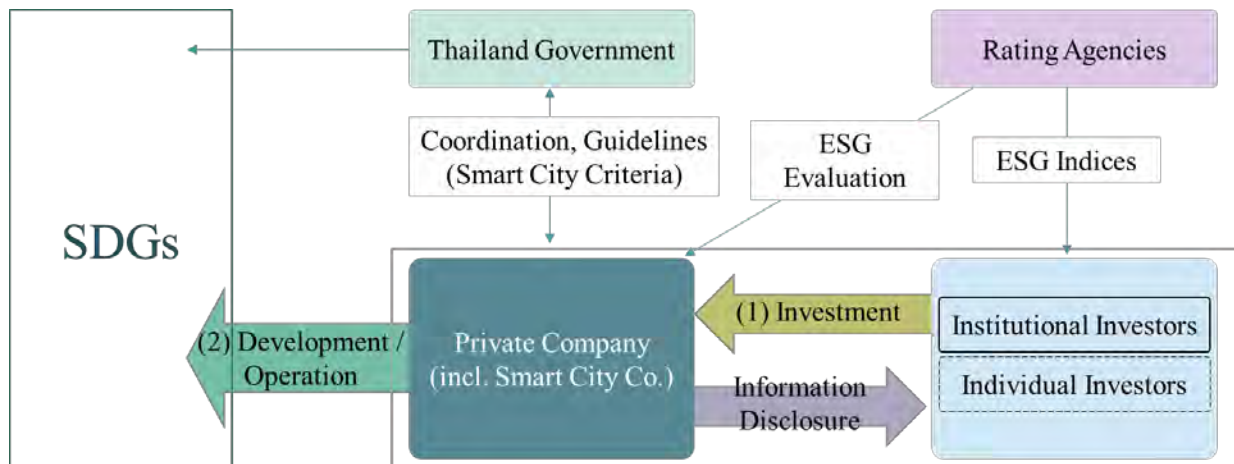
- Integrated Development with Inclusive Approaches at the District Level:

As mentioned in the section, comparison of smart city development in ASEAN cities, Bang Sue Smart City is unique for being designated a relatively large land area, and for being defined a direction to comprehensively address urban issues. As shown in the following figure, the Bang Sue area has the potential to introduce smart technology and services in various ways. In addition, promoting integrated development is an important point in making the most of the *established reputation* as mentioned in the above.

- The Smart City Criteria as an Evaluation/Monitoring Indicator:

The Smart City Criteria, which is set by the Thai government for the purpose of examining the adequacy of tax exemptions from BOI, can be an indicator for securing the suitability as an ESG investment as well.

The figure below shows an example of an application of ESG investment in the Bang Sue area;



Source: MLIT “Interim Report on directions for ESG investment for real estate”, Compiled by the Study Team

Figure 3.5 Examples of ESG Investment in the Bang Sue Area

3.3 SWOT Analysis

Based on the above-mentioned information and the ASEAN Smart City Network projects outlined earlier, a SWOT analysis was conducted to identify the potential and challenges of Bang Sue Area development especially as a development project in Bangkok. Also, SWOT analysis for the 7 Smart component is done from the viewpoint of necessary function as Smart City.

3.3.1 SWOT Analysis: comparison with ASEAN Smart City Projects

SWOT analysis was conducted based on case study on ASCN projects, to identify the potential and challenges of Bang Sue Area development especially as a development project in Bangkok.

(1) Strengths

- *Linkage with the national development strategy - Thailand 4.0*

Thailand has set up an extensive national development strategy in Thailand 4.0 which aims to shift its industry to enhance added value, while realizing sustainability and balanced growth. The Smart City development is in line with this strategy.

- *Robust government commitment to Smart City projects*

A steering committee is set up within the government to coordinate and promote Smart Cities, indicating the degree of commitment by the government.

- *Incentive scheme for Smart City businesses*

Under the current scheme, the Board of Investment of Thailand permits special tax exemption treatment for approved Smart City businesses. Such kind of incentive measures are expected to contribute to promoting investment.

- *Designated area for Smart City*

While typical cities that are listed for ASCN are registered as technology-based (such as e-payment system introduction in Singapore, or the Command Center upgrade project in Manila), Bangkok's plan is an area-based project (Bang Sue area). This ensures that the smart technologies or services to be embedded in the area then bring benefits to the local residents.

- *Relatively high education level*

The education level in Bangkok is regarded as being of the highest level according to the Economist Intelligence Unit data. Businesses can benefit from the highly educated work force.

- *Relatively easy to start up a business*

According to Doing Business data, starting up a business in Thailand is regarded to be relatively easy, as the hurdle for administrative procedure and required capital when starting up a business is relatively low.

The ease of starting up a business contributes to opening up business opportunities and laying the foundation for an environment geared to innovation.

(2) Opportunities

- *International attention towards Smart City development in Thailand*

As Thailand will host the ASEAN Smart City Summit in 2019, it can be said that Smart City development is an important policy agenda in Thailand.

- *Support from international communities*

International cooperation agencies including JICA support the Smart City development.

- *Stable growth of real estate market*

There are many large-scale developments in Thailand, and a number of domestic and international companies are engaged in real estate development projects. The land price in Bangkok is growing at a rate of around 5-7% annually.

(3) Weaknesses

- *Uncertainty and complexity for business*

As implied in the doing business indicator, there is some uncertainty and complexity in the procedures and customs, which hampers business.

- *Difficulty of business for foreign companies*

There are some stumbling blocks for foreign companies to enter urban development project, or Smart City development project, as it is stipulated in the Thai law that the company should form a JV with a Thai company. Also, the short land lease period of 30 years means it is difficult to ensure financial feasibility. The foreign companies need to adapt to Thai business culture and customs.

- *Uneven urban form*

Urban sprawl, lack of green space and pollution are significant issues in Bangkok.

(4) Threats

- *Social and political instability*

As implied in the doing business indicator, there is some instability in the political climate which may affect business.

- *Vulnerability to natural disasters and other contingencies*

Bangkok is considered to be vulnerable to natural disasters such as floods.

(5) Strategies for Smart City project in Bangkok

Given the above-mentioned attributes regarding Smart City projects in Bangkok, the implications for preferable strategies are drawn up as shown below:

[Strengths – Opportunities Strategy]

To shift towards knowledge-intensive industry (high-value-added industry) through utilization of abundant and high standard human capital and industrial technology.

[Strengths – Threats Strategy]

To realize a city which could flexibly adapt to needs and challenges by introducing a regulatory sandbox.

[Weaknesses - Opportunities Strategy]

To set a clear policy for Smart City development which will assure private business activities

[Weaknesses - Threats Strategy]

To adopt a problem-solving approach and to address urban issues.

The SWOT analysis results can be summarized as shown below.

Table 3.7 SWOT analysis for Smart City project in Bangkok – in comparison with ASEAN cities

External Factors	Opportunities - International attention towards Smart City in Thailand - Support from international communities - Stable growth of real estate market	Threats - Social and political instability - Vulnerability for natural disasters and other contingencies - Competition with other ASEAN smart cities
Internal factors		
Strengths - Linkage with the national development strategy - Government commitment - Incentive scheme for Smart City businesses - Designated area for Smart City	S-O strategies - To shift towards knowledge-intensive industry (high-value-added industry) through utilization of abundant and high standard human capital and industrial technology.	S-T strategies - To realize a city which could flexibly adapt to needs and challenges by introducing a regulatory sandbox.
Weakness - Uncertainty and complexity for business - Difficulty of business for foreign companies. - Uneven urban form	W-O strategies - To set a clear policy in Smart City development which would assure private business activities	W-T strategies - To adopt problem-solving approach and to address urban issues

Source: JICA Study Team

3.3.2 SWOT Analysis: comparison with Smart City Projects and Urban development projects in Thailand

The SWOT analysis was conducted to identify the potential and challenges of Bang Sue Area development especially in comparison with other Smart City projects in Thailand.

(1) Strengths

- *Plan for the biggest terminal station in South East Asia - Grand Station, Red Line, Three-Airport Rail Link, and High Speed Railway*

Bang Sue Area will incorporate the Red Line, Three-Airport Rail Link, as well as the High Speed Railway while at the same time incorporating a terminal for long and middle distance buses. When fully developed, it will be a transport hub used by a wide variety of people ranging from locals to tourists and from the young to the elderly.

- *Existence of unique infrastructure and operator*

The land is owned by SRT, and will host Grand Station which will be developed as a new transport hub for Bang Sue Area. In the adjacent area, there is the energy complex building and

PTT head office, to which the gas pipeline extends. Moreover, there is a large bus terminal in the area from which long distance and middle distance buses depart.

- *Existence of prominent company in Thailand*

Besides the energy complex and PTT head office, SRT plans to have their head office in one of the zones in Bang Sue. Also, Siam Cement Group has located their office in the adjacent area. Thus, Bang Sue is expected to function as a new business district.

- *Availability of large expanse of land for development*

A large expanse of SRT land – 360ha– is available for development. This is another unique attribute which differentiates Bang Sue from other Asian cities in which the land for development is often segmented and involves long and costly negotiations and coordination with many landowners. With comprehensive and integrated planning, the Area can become a harmonized and liveable city.

(2) Opportunities

- *Potential as a new business district with an innovation-enabling environment*

Bang Sue Area will be an area that promotes and incorporates Smart technologies and services. Various new businesses related to smart technologies such as the information and communication industry can be promoted in the Area.

- *Connection with Eastern Economic Corridor (EEC)*

With the railway connecting Bang Sue with the Eastern Economic Corridor, there is potential for a linked economy creating synergy.

(3) Weaknesses

- *Long development period until completion*

The development of Bang Sue Area will not be completed until 2032. The developer must be able to commit to the project for a long time.

- *Costly investment and difficulty for projection of return*

Since the Bang Sue project is a green field project, the investment amount is significant, while the profitability of the project is difficult to judge. A legitimate and coherent plan for the development will be needed to convince the investors and business operators.

(4) Threat

- *Lack of integrated and coherent plan and strategy, and disjointed implementation of the project*

The TOR for the first zone to be developed is currently being discussed and will be finalized soon without an integrated plan that oversees the whole development, or a coherent set of specifications and requirements for the designs, functions, and conditions. This may lead to disjointed and incomplete implementation.

- *Lack of government budget*

Various investment sources should be explored, due to the budget constraint for the government for infrastructure development.

(5) Strategies for Smart City projects in Bangkok

Given the above-mentioned attributes regarding Smart City projects in Bang Sue, the

implications for preferable strategies are drawn up as shown below:

[Strengths – Opportunities Strategy]

To develop the area as a transit-oriented Smart-City, enabling seamless mobility inside the area while attracting a wide range of people

[Strengths – Threats Strategy]

To establish project implementation structure incorporating Thai leading companies in Bang Sue Area.

[Weaknesses - Opportunities Strategy]

To promote the area as a field for demonstration, where new smart technologies are demonstrated for commercialization.

To promote and attract start-up companies to Bang Sue Area as innovation promotion district.

[Weaknesses - Threats Strategy]

Realization of harmonized development through an area management approach

The SWOT analysis results are summarized as shown below.

Table 3.8 SWOT analysis for Smart City project in Bang Sue

External Factors	<u>Opportunities</u> - Potential as a new business district with innovation enabling environment - Connection with Eastern Economic Corridor (EEC)	<u>Threats</u> - Lack of integrated and coherent plan and strategy, disjointed implementation of the project - Lack of government budget
Internal factors		
<u>Strengths</u> - Plan for the biggest terminal station in South East Asia - Existence of unique infrastructure and operator - Existence of prominent company in Thailand - Availability of large bulk of land for development	<u>S-O strategies</u> - To develop the area as Transit-Oriented-Smart-City, enabling seamless mobility inside the area while attracting wide range of people	<u>S-T strategies</u> - To establish project implementation structure incorporating Thai leading companies in Bang Sue Area.
<u>Weakness</u> - Long development period until completion - Costly investment and difficulty for projection of return	<u>W-O strategies</u> - To promote the area as a field for demonstration, where new smart technologies are demonstrated for commercialization - To promote and attract start-up companies to Bang Sue Area as innovation promotion district.	<u>W-T strategies</u> - Realization of harmonized development through an area management approach

Source: JICA Study Team

3.3.3 SWOT Analysis for 7 Smart Components

When considering the Smart elements which can be incorporated into Bang Sue, the ideas were aligned along 7 Smart Components - Environment, Energy, Mobility, Economy, Governance, Living, and People – set up by the Thailand Government. SWOT analysis was conducted for each Smart Component to determine the respective direction and strategy.

(1) Smart Mobility

SWOT analysis on Smart Mobility is as shown below.

Table 3.9 SWOT analysis for Smart Mobility viewpoint

External Factors Internal factors	Opportunities - Global trend for low carbon society, rise in environmental awareness - New ideas and technology is being promoted (eg. MaaS, Autonomous Cars)	Threats - High demand density, which could potentially cause heavy traffic in the area - Disjointed planning for transport and land use
Strengths - Bang Sue to become a new Transportation hub for Bangkok - Existing transportation infrastructures such as BTS, MRT, and bus terminal - Large bulk of land for development owned by SRT – transport service operator	S-O strategies - To establish a Smart Mobility system which enable seamless mobility inside Bang Sue Area - Collaboration with key stakeholders from public and private sectors	S-T strategies - Realization of TOD through integrated transport measures, introducing parking policy and transport management policy.
Weakness - Heavy traffic on the existing road - The area not walkable for transit - Existing infrastructure spatially dividing the area (elevated roads)	W-O strategies - To introduce and demonstrate new transport technology and service embodying the MaaS concept. - To enhance spatial connectivity through integrated design.	W-T strategies - Formation of a valid transportation plan and land use plan for the area.

Source: JICA Study Team

(2) Smart Energy

SWOT analysis for Smart Energy is as shown below.

Table 3.10 SWOT analysis for Smart Energy viewpoint

External Factors Internal factors	Opportunities - Thai gov. policies for sustainability - Global trend for low carbon society, rise in environmental awareness - No current infrastructure – opportunity for an alternative system	Threats - Long term for development phase - Zone A opening at very early stage
Strengths - Existence of energy complex and dominant player in the energy sector in Bang Sue - Availability of oil / gas pipeline	S-O strategies - Establishment of Smart City network consisting of gas cogeneration system and renewable energy, which is controlled by ICT.	S-T strategies - Establish a network system which allows flexibility for phased development. - Establishment of a decentralized energy network with ICT-controlled gas cogeneration and renewable energy.
Weakness - The current Smart City incentive scheme supports only PV - The current regulatory framework do not allow co-generation plants in the city	W-O strategies - Establishing a regulatory framework and incentive system which allow more flexibility for alternative energy system.	W-T strategies - Formation of a plan which defines the energy supply system requirement, which also takes into account the phased development.

Source: JICA Study Team

(3) Smart Environment

SWOT analysis on Smart Environment is as shown below.

Table 3.11 SWOT analysis for Smart Environment viewpoint

External Factors	Opportunities - Thai gov. policies for sustainability - Global trend for low carbon society, rise in environmental awareness - Bangkok Climate Change Master Plan to be revised (JICA)	Threats - Preference for economic profitability over environmental value - Weak enforcement of environmental regulations
Internal factors		
Strengths - Huge green area with notable parks - Almost no current built area (green field project) - Existence of energy complex nearby	S-O strategies - To develop to be a model district for “Ecologically and Environmentally Friendly City” - Urban design & building design for eco-friendly city (eg. green area networking, wind trail)	S-T strategies - To develop as a district for show-casing advanced eco-friendly technologies by private companies.
Weakness - Developed to be a busy transport hub - Disjointed development, lack of development principle	W-O strategies - Collaborative initiative among public, private companies, and local community.	W-T strategies - To establish institutional and regulatory framework towards sustainable urban development (eg. Area Management Concept)

Source: JICA Study Team

(4) Smart Economy

SWOT analysis on Smart Economy is as shown below.

Table 3.12 SWOT analysis for Smart Economy viewpoint

External Factors	Opportunities - Thailand 4.0 Policy - Government support for Smart City (Incentives)	Threats - Competition among cities in Asia - Competition with other commercial development in BKK
Internal factors		
Strengths - To be a transportation hub - To be a new commercial center (New CBD : Central Business District) - Huge plot of land	S-O strategies - To attract high-value-added industries and start-up companies - To attract tourism - To be a new urban development area	S-T strategies - To attract knowledge intensive industry by promoting the area as innovation promotion district.
Weakness - Distance from Bangkok downtown (around 10 km) - Currently low interaction in the area	W-O strategies - To aspire globalization by leveraging connection with the airport and EEC.	W-T strategies - To enhance interaction among existing facilities (eg. Chatuchak market, Park) and newly developed area.

Source: JICA Study Team

(5) Smart Governance

SWOT analysis for Smart Governance is as shown below.

Table 3.13 SWOT analysis for Smart Governance viewpoint

External Factors	Opportunities - Government support for digital technology	Threats - Low citizen participation - Low transparency in the governmental procedure
Internal factors		
Strengths - The place where people coming and going - Different kinds of people living and working (diversity)	S-O strategies - Provision of various governmental services for people coming to Bang Sue	S-T strategies - Establishment of a city management committee in which citizen could discuss issue regarding city management.
Weakness - Complex administrative procedures for private businesses in the area	W-O strategies - Introduction of on-line public utility management/ administration communication tool	W-T strategies - Introduction of One Stop Service Center which handles various kind of permission and contracts management.

Source: JICA Study Team

(6) Smart People

SWOT analysis for Smart People is as shown below.

Table 3.14 SWOT analysis for Smart People viewpoint

External Factors	Opportunities - Thailand 4.0 Policy; Social Well-being, Raising Human Values - Government support for Smart City (Incentives)	Threats - Social disparity - Weak Social welfare system - Aging society
Internal factors		
Strengths - To be developed as place where lots of people come and go - Rich in diversity, with various people living and working - Big companies (e.g. PTT, SCG) - Green area with cultural facilities	S-O strategies - To enhance cultural interactions making use of existing facilities and new facilities.	S-T strategies - To introduce universal design through barrier-free design and digital infrastructure - To enhance interaction of people through events
Weakness - Few educational facilities	W-O strategies - Life-long educational facilities - E-learning with ICT infrastructure	W-T strategies - Education-research-exchange activities.

Source: JICA Study Team

(7) Smart Living

SWOT analysis for Smart Living is as shown below.

Table 3.15 SWOT analysis for Smart Living viewpoint

External Factors	Opportunities - Rise in health awareness - Rise in environmental awareness - Thai gov. policies to promote health and environment	Threats - Aging society - Social disparity - Weak Social welfare system - Various safety issues
Internal factors		
Strengths - Huge green area with sports and other facilities (Cycling road, etc.) - Plan for Medical Complex facility at Zone D1 - Not far from Chao Phraya river and surrounded by small canals	S-O strategies - To become “health care hub” applying digital tools or attracting a health center in Bang Sue	S-T strategies - New (or unique) concept for people attraction from the viewpoint of health and safety
Weakness - Less connection between green area and Bang Sue area (divided by elevated express way)	W-O strategies - Networking green, walkable spaces, cycling roads as a place to promote healthy lifestyle. - To establish a network with hospitals and health care facilities.	W-T strategies - Introducing universal design policy - Introducing city management policy

Source: JICA Study Team

(8) Directions for Smart Factors in Bang Sue Area

Overviewing the major strategies for the above seven smart components, the directions for approaches regarding smart city development in Bang Sue are set as follows.

Table 3.16 Direction for Smart City Development in Bang Sue

Smart components	Basic strategy, based on attributes	Basic direction
Smart Mobility	- Introduce advanced mobility system and achieve seamless transfer within the Bang Sue Area. - Realize TOD through comprehensive transport policy such as parking/traffic management.	- Secure more comfortable, convenient transportation systems for residents, workers and visitors that enable smooth mobility and create a lively atmosphere. - Introduce ever advancing mobility technologies at its early stage to realize a new traffic hub for Bangkok.
Smart Energy	- Demonstrate global standard business environment with sophisticated energy technologies, etc. - Establish decentralized energy network, consisting of ICT-controlled gas cogeneration system and renewable energy.	- Set the Area as a field to introduce energy system friendly both to the environment and to society, in order to shift to low carbon and ecological society. - Establish sustainable, resilient energy system suitable for a new business district for Bangkok.
Smart Environment	- Develop the Area as a model area for “environmentally friendly city.”	- Realize Area development that harmonize with natural environment. - Raise awareness on the environment issues among companies located in Bang Sue and

Smart components	Basic strategy, based on attributes	Basic direction
		people to encourage environmentally friendly activities.
Smart Economy	- Attract high-value-added industries and new enterprises. - Enhance interaction among the existing resources (eg. Chatuchak Park market and parks) and new development to vitalize the area.	- Realize diverse and connected area which would be a foundation for new industries and innovation. - Create lively atmosphere.
Smart Governance	- Achieve effective administrative management with the introductions of online public utility management and communication tools.	- Enhance effectiveness of urban operation, utilizing data through digital infrastructure and IT devices.
Smart People	- Encourage integration of the existing resources (eg. Chatuchak Park market and parks) with new culture facilities (MICE facility or exhibition facility, etc.)	- Encourage learning and inspiration experiences through interactions with diverse people, goods and information.
Smart Living	- Develop, the Area as health promotion district, by developing green network connecting with parks and surrounding facilities, walking space and cycling road.	- Promote area development and lifestyle that aims to realize healthy life and symbiosis with the nature.

Source: JICA Study Team