

Data Collection Survey on the Application of Smart City Approach

FINAL REPORT

March 2022

Japan International Cooperation Agency (JICA)

Pacific Consultants Co., Ltd. (PCKK)
Mitsubishi UFJ Research and Consulting Co., Ltd. (MURC)

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APPENDIX: Promotion Leaflet for Smart City Approach

List of Abbreviations

Abbreviations	Explanation
AEB	Amsterdam Economic Board
AI	Artificial Intelligence
AIM	Amsterdam Innovation Motor
AMS Institute	Amsterdam Institute for Advance Metroipoitan Solutions
AoT	The Array of Things
ASC	Amsterdam Smart City
ASCN	ASEAN Smart City Network
ASEAN	Association of Southeast Asian Nations
BCN	Barcelona
BEMS	Building and Energy Management System
BOI	Thai Board of Investment
CCTV	Closed circuit television
CDO	Chief Data Officer
CIO	Chief Information Officer
CITIXL	City Innovation Exchange Lab
Covid-19	Infectious disease caused by the SARS-CoV-2 virus
CPH	Copenhagen
CTO	Chief Technology Officer
DECIDEM	Digital platform for citizen participation
DEPA	Digital Economy Partnership Agreement
DOE	Department of Energy
DoIt	Department of Innovation and Technology
DOTC	Department of Technology and Communications
EEC	East-west Economic Corridor
EEOC	Equal Employment Opportunity Commission
ERDF	European Regional Development Fund
ESF	European Social Fund
ETS	Emission Trading System
EU	European Union
Fujisawa SST	Fujisawa Sustainable Smart Town
FVH	Forum Virium Helsinki
GDP	Gross domestic product
IBM	International Business Machines Corporation
ICT	Information and communications technology
IMI	Instituto Municipal de Informática de Barcelona
IoT	Internet of Things
ITS	Intelligent Transportation System
JICA	Japan International Cooperation Agency
LED	Light emitting diode
LEZ	Low Emission Zone
MaaS	Mobility as a Service
MCDCB	Metro Cebu Development and Coordinating Board
MDDA	Metro Davao Development Agency
MDDCC	Metro Davao Development Coordinating Committee
MDES	Ministry of Digital Economy and Society

MDSUMP	Metro Davao Sustainable Urban Master Plan
MDUP	Metro Davao Urban Master Plan
MICT	Ministry of Information and Communication Technology
MLCP	Makassar Livable City Plan
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MMDA	Metropolitan Manila Development Authority
MOU	Memorandum of Understanding
MPWT	Ministry of Public Works and Transport
MSCF	Malaysia Smart City Framework
NDXP	National Data Exchange Platform
NEDA	The National Economic and Development Authority
NSEDP	National Socio-economic Economic Development Plan
NSTDA	National Science and Technology
NUDHF	National Urban Development and Housing Framework
OIS	Overnight Index Swap
PDP	Philippine Development Plan
PMC	Project management contract
QoL	Quality of Life
SCC	Smart Chicago Collaborative
SDGs	Sustainable Development Goals
SEGA	Software-Defined Sensor Network
SIPA	Software Industry Promotion Agency
SRP	South Road Property
SRT	State Railway of Thailand
STEM	Science, Technology, Engineering and Mathematics
TOD	Transit oriented development
UDCK	Kashiwa-no-Ha Urban Design Center
UK	United Kingdom
UN	United Nations
Urban CCD	Urban Centre for Computation and Data

1. Introduction: Overview of the Study

1-1. Background and Objective of the Study

1-1-1 Background of the Study

In the New Urban Agenda (2016) adopted at the Third United Nations Conference on Housing and Sustainable Urban Development (Habitat III), the global urban population is projected to double in number by 2050, while UN World Urbanization Prospects (2018) speculates that the urban population is to reach 68% of the total global population by 2050. In the face of such rapid urbanization, the development of housing and basic urban infrastructures has not kept pace with the rate of population inflow into cities, resulting in overloading of existing infrastructure and overall decline in the quality of life in many cities. The chronic traffic congestion, deterioration of the urban environment and sanitation, and reduced level of urban infrastructure services are just few of the instances of the consequences.

Since around 2010, various smart city initiatives – introduction of technologies or solutions using ICT, digital technologies and data science – have been promoted as a solution to these urban problems. Many advancements have been made in individual technological fields such as energy management and urban transportation to tackle the severest of problems. These early smart city attempts were often limited in their aim to focus on a given sector or technological field. These early attempts could be classified as a “technology-oriented” approach for their characteristics to focus on “how a given technology can be adopted and applied into the existing cities” rather than “how an ongoing urban problem can be solved by the adaptation of technology.” In recent years, however, the advancement of smart cities, both in conceptual and technological terms, has enabled the transition into a more “cross-disciplined” and “problem-oriented” approach, better suited to solving complex urban problems from the residents’ perspective in a bottom-up direction. The latter approach entails placing emphasis on the urban problems as a starting point, rather than wrapping a project around a given system(s) that companies want to push. Furthermore, importance of cooperation among the stakeholders across multiple disciplines and organizational layers has been emphasized even more.

As the urban challenges become more urgent and intense due to the accelerated urbanization, the demand for improvement of efficiency and performance in urban management and services becomes more pressing. In this context, the potential for smart city approach that utilize technologies to adequately and efficiently manage urban conditions is becoming increasingly significant in pursuing sustainable urban development. However, it needs to be noted that the topic regarding smart city is still new, and though numerous empirical cases provide useful implications on how to facilitate smart city approach, much of the discussions regarding theoretical framework and its applications are still in progress.

There is no one-size-fits-all approach for implementing smart cities. Formulation of the best-suited approach in each case shall take into account the unique history, context, conditions and trajectory of each city and district. Even though cities share some common developmental challenges and urban problems, a solution suited for a certain city does not necessarily fit to other cities. However, it does not mean that all tools and solutions must be reinvented from scratch; it is important to identify practical and effective knowledges and technologies that could be applicable to developing countries.

In developing countries where the resources for dealing with the insufficient supply of

infrastructure and services are severely limited, there is often an unrealistic expectation that the smart city approach will offer a low-cost and quick fix-all toolbox for solving urban challenges. It is, therefore, necessary to take a pragmatic view of the level of infrastructures, as well as the conditions and dynamics of the challenges, for each of the target cities to measure what is realistically achievable through the means now available.

Smart cities should not be taken as a goal to be achieved for cities, nor should it be viewed as a one-shot development project that assembles all kinds of state-of-art technologies in a package. Rather, the emphasis should be placed on the process or the mechanism to solve various urban problems in a collaborative and evidence-based manner. The objective of such problem-solving mechanisms should ultimately lead to an overall enhancement of the residents' quality of life, sense of fulfillment, and pride and love for one's town and city. While the use of technology is an indispensable part of any smart city project, a technology-driven approach in itself is unlikely to yield a lasting success in achieving such comprehensive goals. Thus, it is important that the careful formulation and alignment of the urban issues, development vision, goals, and strategies precede the selection of suitable technology and systems, and never vice versa. Additionally, it is essential to ensure that the adopted strategy and technology sufficiently address the complex and multifaced problems they are trying to solve. The technology, therefore, must be seamlessly integrated into the urban activities and services, and lead to the creation of added value for the stakeholders. For this, it is important to enhance the collaboration among the residents, public sector, private enterprises, research institutions, and others so that each party can contribute more effectively based on their respective strengths, roles, and responsibilities.

Lastly, the recent global situation regarding the COVID-19 pandemic has necessitated the implementation of new social norms and solutions such as social distancing, contactless transaction, remote working, and other infection-prevention measures. The present-day discussion on smart cities should also incorporate these perspectives.

1-1-2 Objectives of the Study

The objectives of this study are to understand the conditions and challenges in cities in the developing countries, to analyze the cases of the smart city early adopters in the developed countries for their best practices and lessons learned, and to assess the opportunities and challenges in applying those smart city approaches in developing cities. The study will also examine the desirable scope and implementation framework for international cooperation in this field based on the unique needs and constraints of the developing countries and cities. Thus, the study aims to contribute to formulating an overarching reference for JICA's future cooperation toward smart city approach in developing countries.

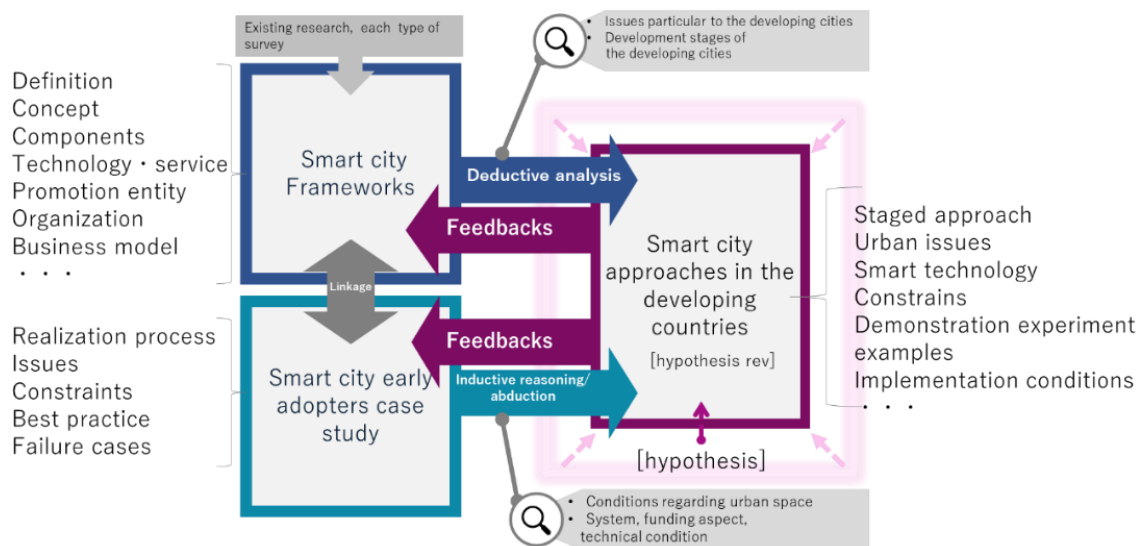
1-2. Approach for the Study

1-2-1 Hypothesis-Making and Verification Approaches

The hypothesis on the smart city approach in developing countries will be constructed in twofold: by deductive analysis based on the review of the past studies and articles by donor organizations, relevant institutions, and researchers in the related fields; and by inductive reasoning based on leading cases of smart cities in the developed countries.

In doing so, the study also analyzes the issues and constraints specific to cities in developing countries (e.g., socio-economic characteristics, historic and cultural backgrounds, level of available infrastructures, and competency in terms of fiscal, technical, and administrative capacity) as well as factors related to urban policy agenda (e.g., population growth, urban environment, SDGs, etc.).

As such, the first half of the study focuses on formulation of hypothesis and the second half focuses on identification of challenges in developing countries and the verification of the hypothesis. The two sections - hypothesis formulation section and the verification section - are mutually referenced during the study process to ensure the practicality and validity.



Source: JICA Study Team

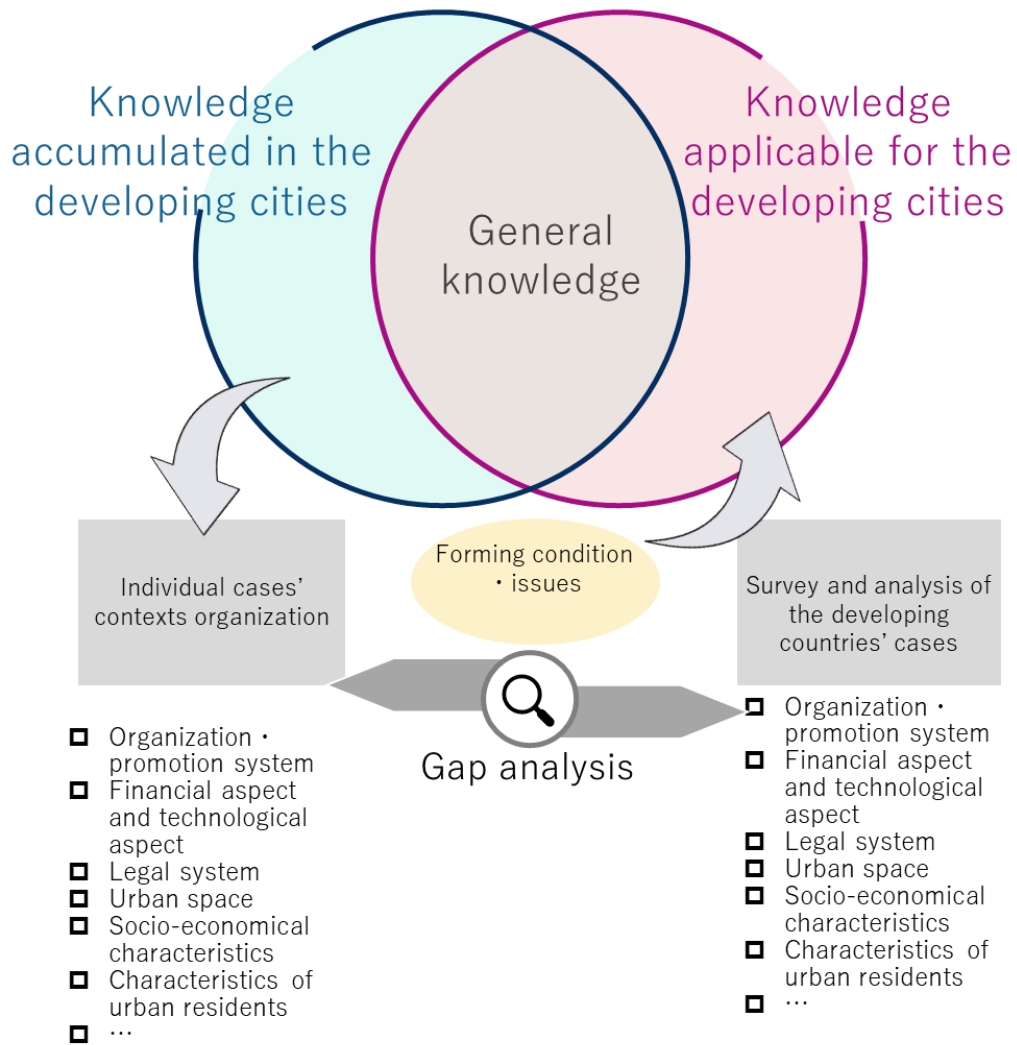
Figure 1-1 Image of the analytical framework

1-2-2 Case Study with Holistic View Focusing on Local Contexts

While there are some common principles to urban development using smart city approach in both developed and developing countries, the unique social and cultural contexts, as well as the availability of technical and financial resources in the target country and city must be taken into careful consideration in formulating the framework. In examining the applicability of knowledge gained in the developed countries – often complied as “best practices” – to projects in the developing countries, it is necessary to carefully understand the overall project environment and to identify the unique circumstances in which such approach becomes valid, and to assess the conditions and challenges for the knowledge and technology to be transferable in other countries and cities.

Thus, in conducting the case study for developed countries, attention needs to be paid to the process in which the smart city initiatives were implemented. It is assumed that multi-layered analyses focusing on the process will yield effective and practical implications for

the developing cities undertaking the smart city project.

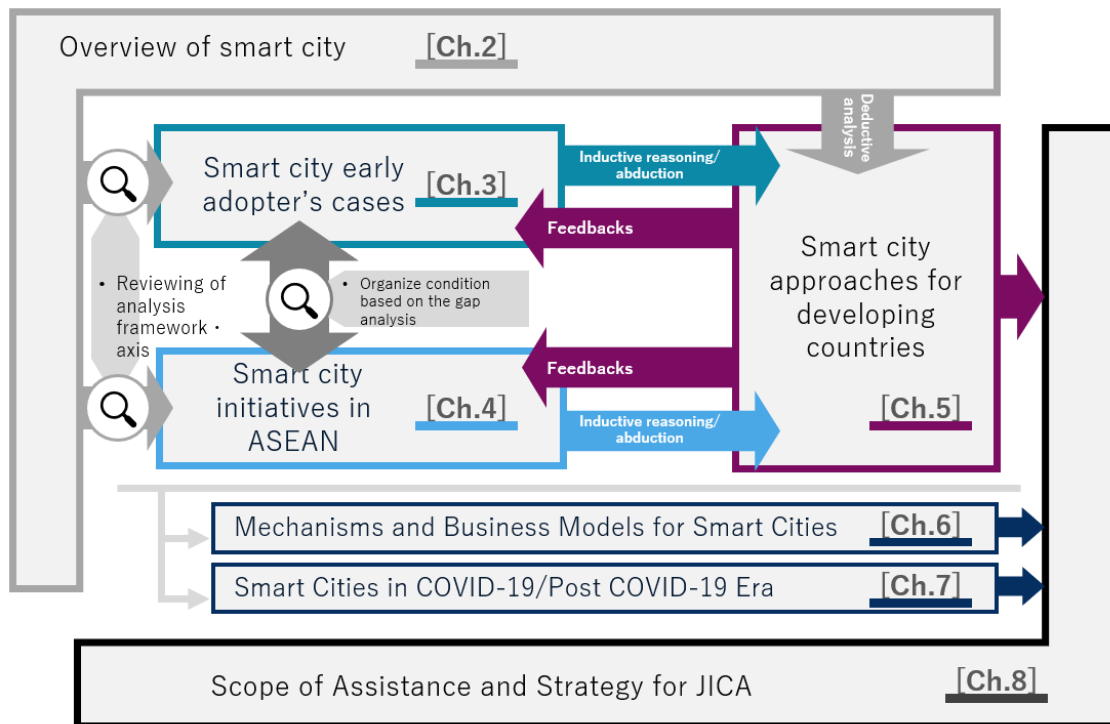


Source: JICA Study Team

Figure 1-2 Process for Forming Knowledge Applicable to Cities in Developing Countries

1-3. Structure of the Report

The structure of this report is as shown in Figure 1-3 below.



Source: JICA Study Team

Figure 1-3 Image of the structure of the report

In Chapter 2, an overview of the smart city concepts and practices across the globe is summarized. In particular, the concept and the increased significance of data integration platforms in smart cities projects is discussed. Furthermore, the general definitions of “smart city“ in the developed countries are reviewed, as well as the effects and benefits.

In Chapter 3, six cases of smart city projects in Europe, the U.S., and Japan are reviewed from the perspective of concept and vision, organization, policies and systems, technologies and tools. The key success factors are then identified and analyzed in detail, to be organized into a smart city framework consisting of 5 domains of “vision and policy,” “organizational structure,” “system,” “technology,” and “operation.”

In Chapter 4, the smart city initiatives in the ASEAN countries are reviewed and analyzed at the national and city levels. The chapter then provides an overview of the general conditions and urban challenges in each of the target ASEAN cities. The cities are analyzed in terms of economic size, development status and urban environments to examine the constraints and opportunities as well as the suitable direction for smart city development.

In Chapter 5, the key perspectives for the successful promotion of smart city initiatives in developing countries are proposed while also taking into account the key differences between the developed and developing countries. Phased approach for promoting smart city initiatives in developing countries and the assessment framework for evaluating the readiness for smart cities for each ASEAN country is presented.

In Chapter 6, the directions for formulating a business model for smart cities in the context of developing countries are outlined.

In Chapter 7, an overview of the impact of COVID-19 pandemic on the society and the cities is provided, especially focusing on the collection and utilization of data amid the pandemic period, while referring to the types of accumulated data, the data collection methods, and how the data is to be utilized.

In Chapter 8, JICA's basic policy on the smart city initiatives is proposed based on the findings of the analysis in the previous sections, and a menu for JICA's technical support is aligned along the narratives of the 5 smart city components: "vision and policy," "organizational structure," "system," "technology," and "operation." This chapter also proposes the concept and methodology for the JICA's support for phased development of smart city. In addition, an overview of smart city support by other donors and the international community is provided as reference.

2. Overview of Smart City and Principles

2-1. Smart City Overview

In Chapter 2, an overview of the smart city concepts and practices across the globe are summarized. In particular, the concept and the general progress toward the use of data platform in smart cities are provided.

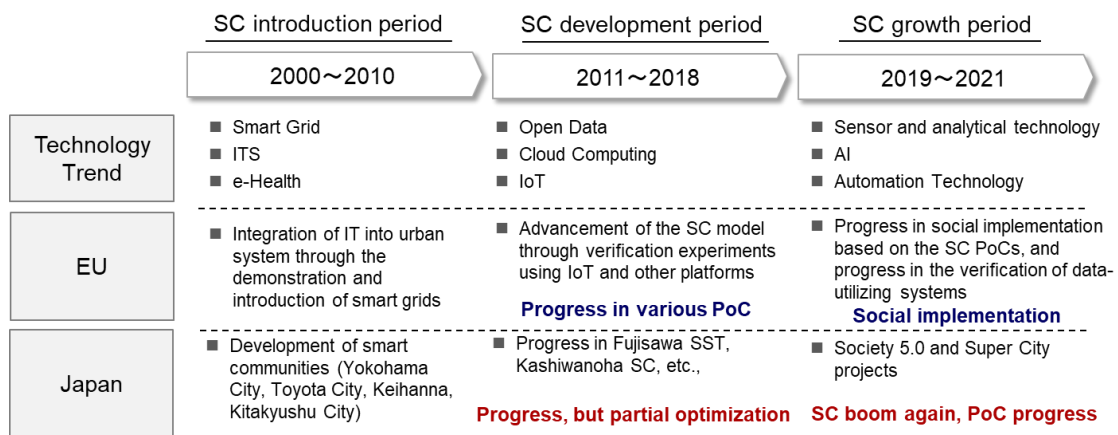
Furthermore, the general definitions of “smart city“ in the developed countries, and its effects and benefits are discussed.

2-1-1 Background and History of Smart Cities

Looking at the history and progress of smart cities in developed countries such as Europe, U.S, and Japan, the earlier projects were originally associated with energy management. From 2000 onward, particularly in Japan, attempts were made to create sustainable cities aimed to reduce environmental footprints, such as Kashiwa-no-ha and Fujisawa SST. These are the “ad hoc” type smart cities, which focused on specific technology with relatively narrow project scope such as energy conservation with energy management system (EMS).

Subsequently, in Barcelona and other leading European and American cities, the datasets that were yielded from urban services and activities (e.g., transportation, human flow, environment, refuse, etc.) began to be captured via ICT-enabled infrastructure, and were used to improve the efficiency and functions of the relevant urban services. This was the “technology-oriented“ prototype of smart cities that heavily depended on the technological advancements in IoT, big data, and AI. In this approach, Europe and the United States took the lead in formulating and operationalizing business-feasible smart city models through effective technical demonstrations and social experiments.

In recent years, the shift in focus from technological to “human-centered“ approach in urban development has led to formation of cities with enhanced ecosystems for sustained pursuit of new values such as collaboration, creativity and fulfillment in life. Such examples include the use of digital technologies to improve the quality of administrative services in Estonia and Aizu-Wakamatsu city in Japan, as well as implementation of “cross-disciplinary“ smart city prototype that is centered on an open innovation platform as in Copenhagen. In Japan, the “Society 5.0” initiative is an example in this category of smart city.



*SC: Smart City | PoC: Proof of Concept

Source: JICA Study Team

Figure 2-1. History of Smart City Development

2-1-2 Previous Research and Study on Smart Cities

(1) Development of Concept and Practice on Smart Cities in Japan

In Japan, where natural resources are scarce and natural disasters frequently occur, the priority in technological advancement was placed on relevant fields such as energy conservation and urban disaster prevention by necessity, thus, system improvements in achieving higher energy efficiency and urban resiliency have been eagerly pursued. Integrating these individual technological advancements under an overarching smart city concept, the earlier prototype of “ad hoc” style smart city was focused on field-testing and operationalizing systems such as energy management system (EMS) and disaster information system.

Under such government-led smart city policy, the local municipalities, universities, research institutions, and enterprises have joined forces to establish pilot projects across the nation, using large-scale, research-academic campuses as greenfield platforms for social experiments.

On the other hand, the private sector has been providing ICT-based area management services and attempting to commercialize next generation facilities such as smart homes and smart buildings and various smart services using GPS sensors and sharing service apps in the urban redevelopment projects. Thus, as sufficient quantity of data began to be collected from diversified smart systems within a specific project area, those datasets can now be integrally analyzed to enable creation of new methodologies of urban management and new forms of urban services, leading to development of data platform described later. This is the “technology-oriented” prototype of smart city that heavily rely on IoT sensors, data centers and other ICT infrastructure.

In recent years, as traditional societal norms have transformed in the context of low birthrate and aging population, diversification of family form and increase in foreign-born permanent residents in Japan, the needs, values, and lifestyle of the citizens have also diversified. Taking some hints from the leading examples in Europe and the US, several initiatives are underway to provide citizen-oriented services which are not limited to infrastructure development, but also including creation of convenient and comfortable life spaces, and establishment of a social structure taking into account flexibility and individual freedom.

Thus, the history and progress in the conceptual and technological development of Japanese smart city has been guided, and at times constrained, by the country’s unique natural, cultural and socio-economic characteristics, while being influenced by the relevant developments in other leading nations. The initiatives have been largely government-led but at the same time segmented, with each of the various ministries issuing its own policy within the jurisdiction. Next, to understand the characteristics of the Japanese smart city, a brief overview of the philosophy, policy, and guidelines to promote smart cities led by the main ministries and agencies is provided.

1) Cabinet Office

Relevant documents¹ from the Cabinet Office Council for Science, Technology and

¹ Cabinet Office (see 2021.12.24)
<https://www5.cao.go.jp/keizai-shimon/kaigi/special/reform/wg6/20210423/pdf/shiryou1-1.pdf>

Innovation define a smart city as follows.

“A sustainable city or region that solves various problems faced by cities and regions through improved management (planning, maintenance, management, operations, etc.) utilizing new technologies such as ICT, and continues to create new values, or a place for promoting the realization of Society 5.0“

Furthermore, a city furnished with a package of smart city services that are interconnected with open API are defined as “Super City.“

2) Ministry of Land, Infrastructure, Transport and Tourism, Japan

In the “Interim Report on the Realization of Smart Cities” (August 2018)² by the City Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, the inception of Japanese smart cities is described as follows: “Around 2010, many initiatives were established using individual field-specific methods targeting specific fields, including energy.”

It also defines smart cities as follows:

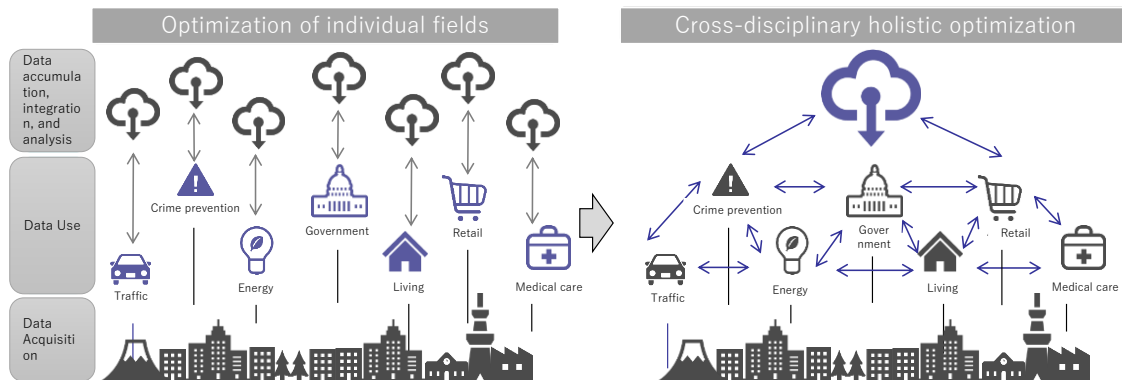
(Note: the following is an excerpt from the 2018 interim report and is subject to change.)

“Sustainable cities or districts where management (planning, maintenance, management and operations, etc.) is carried out, and overall optimization is achieved while utilizing new technologies such as ICT to address the issues faced by cities.”

The report also states that the five keywords of “transportation, coexistence with nature, energy saving, safety and security, and resource recycling” are given as examples of various challenges.

In addition, the following three points are given as policies for bolstering such initiatives.

- (1) Shift from a technology-oriented stance to a problem-oriented stance
- (2) Shift from individual optimization to overall optimization
- (3) Shift from public entity to public-private partnership



Source: Ministry of Land, Infrastructure, Transport and Tourism City Bureau “Interim Report on the Realization of Smart Cities” (August 2018)

Figure 2-2 Shift from Individual Optimization to Overall Optimization

² Ministry of Land, Infrastructure, Transport and Tourism (see 2021.12.24)
<https://www.mlit.go.jp/common/001249774.pdf>

(2) Definition of Smart City Concept in US and European Countries

The development history of the smart cities in US and European countries has varied depending on their adopted policies and the respective business environments; however, the major trend points to a cross-disciplinary approach and public-private collaboration, as mentioned earlier. In recent years, the emphasis is on responding to the diversified life need and values of the users, thus seamless service provision at appropriate time and place in a desired manner is the ultimate goal of higher functionality and integration between physical and ICT infrastructure. The effective data utilization will be the driving force in optimization of these services, thus using open data platform as a foundation, public and private sector actors will share data and collaborate to pursue mutual benefits in this model. The following is an overview of the definitions of smart city by leading European governments and institutions.

1) European Commission

A smart city is a place where traditional networks and services are made more efficiently with the use of digital solutions for the benefit of its inhabitants and business.

A smart city goes beyond the use of digital technologies for better resource use and less emissions. It means smarter urban transport networks, upgraded water supply and waste disposal facilities and more efficient ways to light and heat buildings. It also means a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population³.

2) Latvian Ministry of Environmental Protection and Regional Development

A smart city is defined as “a city which implements a strategic package of measures to address the most pressing challenges and boost the competitiveness of the area. This entails: i) not requiring substantial maintenance in the long term (save resources); ii) providing more efficient public services (faster, more comfortable, cheaper, e-services, one stop shop principle); iii) improve overall well-being of society, security and public order; iv) providing timely anticipation and prevention of potential challenges (flood hazards, energy shortages, heat losses, sewer leaks, etc.); iv) not affecting, while reducing or eliminating impact on environment; and v) smart development planning, which responds flexibly to the most pressing challenges and development opportunities in the area, identifying existing and potential competitive sectors and promoting their development, as well as providing cooperation between different stakeholders (public administration, entrepreneurs, academics, NGOs, citizens).”⁴

3) Spain

The Spanish government works with the concept defined by the Spanish Association for Standardization and Certification: “the Smart City concept is a holistic approach to cities that uses ICT to improve inhabitants’ quality of life and accessibility and ensures consistently improving sustainable economic, social and environmental development. It enables cross-cutting interaction between citizens and cities, and real-time, quality-efficient and cost-effective adaptation to their needs, providing open data and solutions and services geared

³ European Commission HP (Viewed Feb. 2022): https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en

⁴ *Enhancing the Contribution of Digitalization to the Smart Cities of the Future*, OECD, 2019

towards citizens.”⁵

(3) History of the Development of the Smart City Concept in Developing Countries

In developing countries, a rapid urbanization has resulted in accelerated population inflow from rural to urban parts. Particularly in megacities where excessive urban concentration occurs, the adverse effects in the management of urban traffic, sanitation, and disaster prevention measures have significantly worsened the residents’ quality of life and safety. The alleviation of these excessive concentration in population, economic activities and urban functions will be fundamental to sustainable urban development. For this reason, strengthening infrastructure provision by service improvement and diversification in communication is essential⁶. On the other hand, for demand-side, initiatives such as introduction of demand management policy are effective.⁷

On the other hand, the lack of systematic tools and open data platform at the national and local governments has resulted in incapacity to collect and analyze data for policymaking, leading to delayed response to demand for intervention. In the 9th Asia Smart City Conference, hosted by the City of Yokohama in 2021, the importance of Evidence-Based Policy Making (EBPM) utilizing actual city data was reiterated by the officials and other stakeholders from participating countries and cities.⁸

The lack of such data platform has also adversely affected the effective coordination and collaboration among the national and local governments, preventing integrated data management. In addition, insufficient database to serve as a basis for policy decisions on integrated policies and resource allocation has prevented officials and stakeholders from formulating effective city plans and business implementation which is undermining the urban management practice.⁹

Furthermore, the funding constraints are common theme in developing countries, and the implementation of expensive physical infrastructure projects has not caught up with the rapid pace of the ongoing urban expansion. On the other hand, the potential is higher than ever to gain significant positive outputs from limited resource inputs with the strategic use of ICT systems. In particular, the use of location data to match demand and supply distribution has enabled on-demand mobility services, as well as car sharing, car park sharing and other surplus assets sharing in a resource-efficient manner. This can be a new opportunity to curb peak demand, which in turn allows planners to avoid developing an large sized infrastructure designed to accommodate the uttermost demand, and instead it gives a chance to aim for flexible urban development approach better suited for a smooth transition to maturity.¹⁰

On the other hand, the chronic shortage of funds in each country appears to be predicted on the promotion of urban development utilizing private capital through the formation of public-private partnership projects; therefore, the monetization model for smart city services will be severely challenged by private partners. Securing various business revenue sources, such as collection of area management fees from tenant companies and user fees through the

⁵ Same as Footnote 4

⁶ *Urbanization in Developing Countries* by Vernon Henderson, The World Bank Research Observer, vol. 17, no. 1 (Spring 2002)

⁷ *Transport Demand Management* by Andrea Broaddus, et al., Federal Ministry for Economic Cooperation and Development, Germany, 2009

⁸ *Harnessing Smart Technology for Sustainable Development in Developing Countries*, World Bank, 2021

⁹ *The Path to Becoming a Data-Driven Public Sector*, Chapter 2: Data Governance in the Public Sector, OECD, 2019

¹⁰ *Private Sector Participation in Public Sector Financing: An Introduction*, Deloitte, 2018

creation of convenience, comfort, and desired value, will have a significance in the feasibility of smart city projects. Thus, ideas that take advantage of ICT characteristics will be important¹¹.

As described above, in pursuing higher functionality and sustainability in the context of urban development in developing countries, the approach that accurately captures the diverse and multidisciplinary urban activity data, which is analyzed cross-disciplinarily, and shared and collaborated across the sectors and organizations to seek new values, will become the mainstream.

2-1-3 Consideration for Data Platform

(1) Data Platform

As described previously, for the overview of the global progress in smart city concepts and practices, a people-centered perspective, integrated approach to cross-disciplinary field, and increased public-private partnerships are seen as major directions. A prerequisite for realizing this cross-disciplinary approach to urban management is the construction and operation of a data platform that enables the seamless collection and analysis of the vast and diverse data generated by urban activities, and the creation of new urban management innovations and improvements in efficiency.

This section first examines concept of the data platform that enables the utilization of data, which is the greatest common denominator under the definition of a smart city in the future.

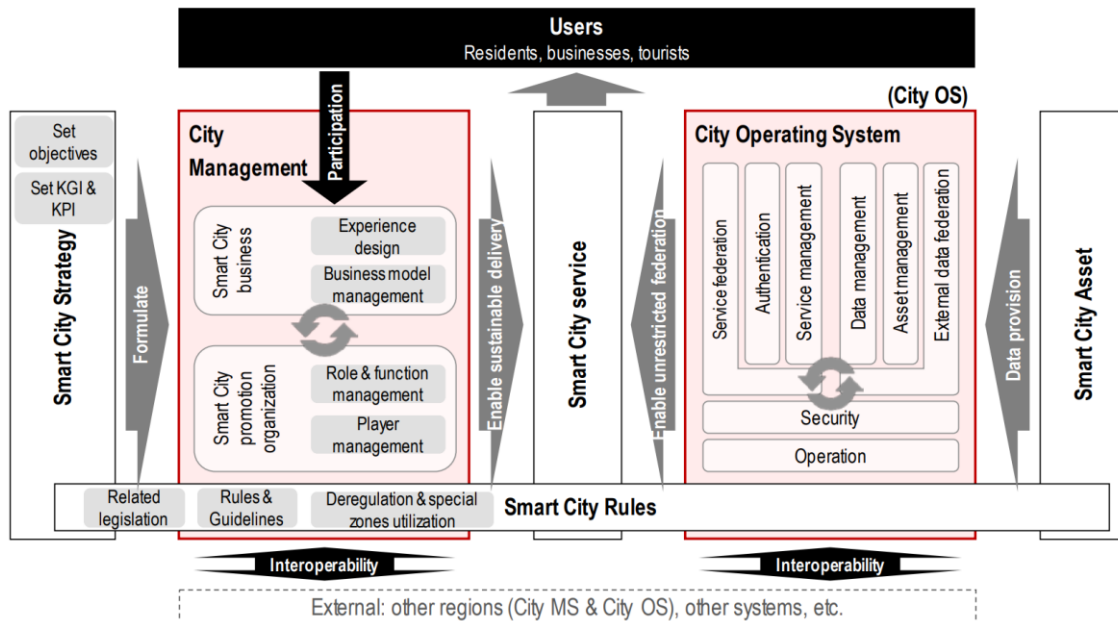
According to the Cabinet Office, a data platform is a platform that collects, organizes, and provides a variety of data in a cross-disciplinary manner. In addition to smart cities, studies for building platform technologies, are underway in areas such as agriculture, manufacturing, and automated driving.

On the other hand, in the context of smart cities, “Common Reference Architecture” (Smart City Reference Architecture), which was formulated as a standard design concept for smart cities, mentions City OS as a necessary component for data and services to work together freely and efficiently when discussing data platform in a smart city, the City OS can be considered an equivalent concept.

Taking a closer look at the definition of City OS, the Smart City Reference Architecture states that it is “a general term for IT systems that facilitates the introduction of services in various fields to be introduced in a smart city, by integrating functions that are commonly utilized by regions trying to realize a smart city” and can be taken as a common systematic foundation to achieve service integration and inter-city collaboration.

Hereafter, the term “Data Platform” will be used.

¹¹ *Smart City Benefits: How Smart Cities Can Save Governments and Citizens Money* by Alexandar Gelsin, bee smart city, 2018



Source: Cited from Cabinet Office “Smart City Reference Architecture White Paper”

Figure 2-3 Smart City Reference Architecture Overview

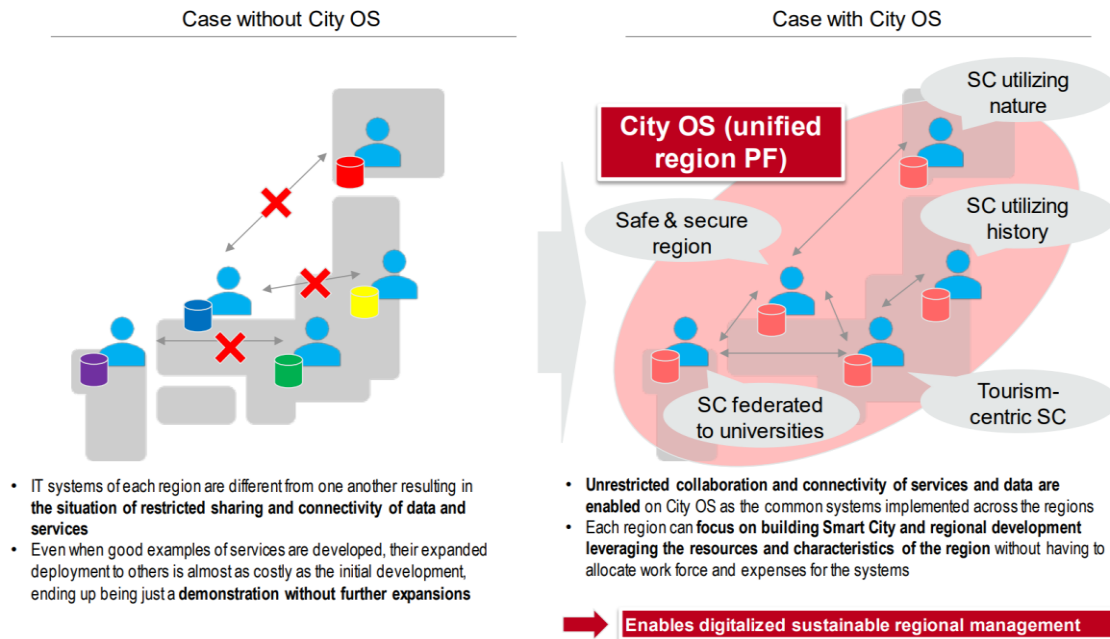
(2) Necessity of Data Platform from Issues related to Smart Cities

There have been two major problems with initiatives in smart city to date. The need for a data platform has been advocated as a system to deal with these problems.

The first problem is that the individual development of smart city services in each field and region has resulted in a lack of service integration between the fields, and difficulties for improving convenience for the residents (users). By introducing the data platform, systems that have been built closed to individual fields can now utilize data and services in different fields. This is expected to accelerate the creation of new services and businesses with higher added value in inter-industry and unexplored areas that span different domains.

The second problem is that once developed, smart city services cannot be reused, and costs are incurred each time a smart city is developed in each region. On the other hand, the data platform built under a unified design concept based on the Smart City Reference Architecture enables free services, data integration and distribution under the system commonly implemented in each city. Each region can efficiently use services that have already become effective in other regions or services in other regions with similar characteristics. It can promote smart cities by making use of regional assets and characteristics without further labor or system costs.

Under this background, the Digital Agency plans to develop the core components of the Data Platform within FY2021 and provide them to the cities and regions free of charge thereafter.



Source: Cited from Cabinet Office “Smart City Reference Architecture White Paper”

Figure 2-4 Distribution of Data Services Between Cities/Regions

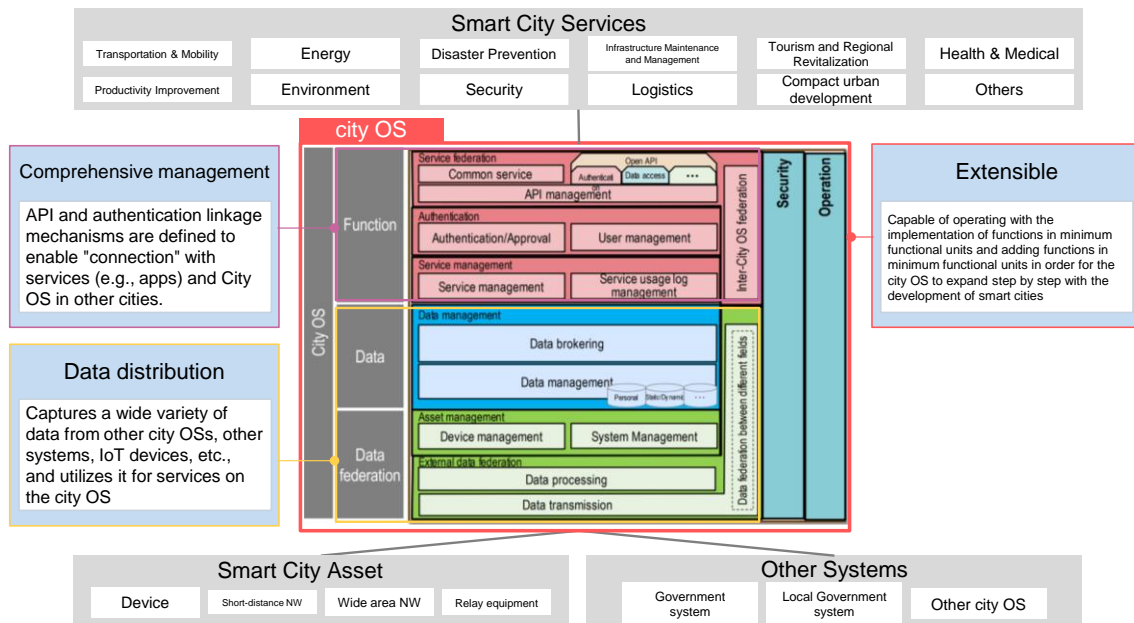
(3) Data Platform Features

There are three major features of the data platform.

The first is “promotion and activation of data distribution” that enables the acquisition of a wide variety of data from other data platforms, systems, IoT devices, etc., and the utilization of services on the data platform.

The second is “easy interoperability” that stipulates the API coordination and authentication mechanism, and enables coordination with service applications and other data platforms.

The third is “easy expansion,” which enables function implementation and addition in the smallest functional unit as the data platform gradually expands with the development of smart cities.



Source: Created by JICA Study Team based on the Cabinet Office “Smart City Reference Architecture White Paper”
 Figure 2-5 Data Platform Features

(4) Overview of the Use of Data Platform in Each Country and Region

This section summarizes different models of data platform that is already in use.

FIWARE is a representative data platform in Europe, a leading smart city, region, and consists of an open-source platform and software group. Application development based on FIWARE is carried out on the participation of various entities such as private companies, research institutes, and individuals.

Estonia’s X-Road and India’s IndiaStack are characterized by data integration in distributed systems equipped with personal authentication (personal identification number and biometric authentication) functions and are suitable for achieving e-government (digital government) solutions for national and local governments.

A Japanese-style data platform has been used in Aizuwakamatsu City and Takamatsu City. In the case of Aizuwakamatsu City, a framework for protecting personal information is established to implement the use of personal information bearing the provision of personal services to citizens and users in mind. On the other hand, in Takamatsu City, data such as GPS collected from various centers is used for disaster prevention measures and tourism without using personal information.

In this way, the initiative for setting up data integration infrastructures has been taken in various countries and regions, but those designs have different characteristics, functions depending on targets of smart city services and concept. Therefore, the key is, how to select the suitable smart city services for solving selected social issues and how to select functions which make these services possible, rather than competition. Meanwhile, one of the motivation for introducing data platform in Japan could be to avoid disconnections of intercity cooperation that could be caused by fragmentation of smart city services as result of individual implementation at the municipality level.

(5) Features of Past Cases Introducing A Data Platform

As shown in the table below, the data platforms of Aizuwakamatsu City and Takamatsu

City have different features.

First of all, the data platform of Aizuwakamatsu City is operated by the Aizu Smart City Promotion Council made up of collaboration between the public, private and the academia, while it is operated by the local municipality (ICT Promotion Office, Information Policy Division, Takamatsu) in Takamatsu City. The Smart City Takamatsu Promotion Council made up of the public, private sector and the academia also exists and collaborates with the other members.

In addition, the main purpose of the Aizuwakamatsu Digital Communication Platform (DCP) is to coordinate services from the viewpoint of citizens. As a result, the citizen utilization rate is high because it offers services that are highly required by citizens. On the other hand, in Takamatsu City, data interoperability among multiple areas and advanced data searches became possible by adopting the international data standard (NGSI: Next Generation Service Interfaces) and utilizing a function acquiring data on requests through the Context Broker application, and the framework has promoted the creation of new services.

Aizuwakamatsu City has launched a portal site called Aizuwakamatsu Plus for services to which the data platform is connected. Additionally, by adopting an opt-in method, it manages citizens' personal information and provides appropriate services associated with citizen IDs. In Takamatsu City, IoT services are introduced in several areas, such as disaster prevention and tourism, and implemented on the data platform. Particularly, in the disaster prevention field, Takamatsu City has been promoting the data with its neighboring municipalities, Kanonji City and Ayagawa Town.

	Aizuwakamatsu City	Takamatsu City
Platform Name	DCP: Digital Communication Platform	IoT Common Platform
Operating Entity	Aizu Smart city Promotion Council	Takamatsu City (local government)
Competent Authority In Public Administration	Planning and Policy Division	ICT Promotion Office, Information Policy Division
Business entity	Accenture Japan Ltd	NEC Corporation
Features of Data Coordination Platform	<ul style="list-style-type: none"> ■ Coordination of services from the perspective of service users (citizens, tourists, etc.) ■ Aizuwakamatsu Plus, a portal site that allows users to register individual accounts and use SNS accounts. ■ Link and manage user IDs and data associated with them ■ Prioritized display of information based on personal preferences and attributes Various services for citizens such as childcare, snow removal, health care, etc. are provided, and the site utilization rate by citizens is as high as 20%. 	<ul style="list-style-type: none"> ■ Utilizes FIWARE, the infrastructure developed and implemented under the EU's Next Generation Internet Public-Private Partnership Program (FI-PPP) ■ FIWARE (1) adopts NGSI, an international standard for context information management, to ensure interoperability in data distribution between fields, and (2) realizes advanced data retrieval through the Context Broker (a function that acquires data from sensors in response to requests from applications). ■ IoT services implemented in tourism, disaster prevention, etc. ■ Especially in disaster prevention, wide-area collaboration with neighboring cities, towns, and villages is realized.
Personal Information Presence or Absence	<ul style="list-style-type: none"> ■ Manage personal information when registering for an account ■ Adopt an opt-in method based on advanced security mechanisms and policies with guidelines for personal information 	<ul style="list-style-type: none"> ■ Manage data that does not constitute personal information, such as water level sensors for rivers and tides, GPS for rental bicycles, etc.

Source: JICA Study Team

Figure 2-6 Features of Data Platforms in Japanese Cities

(6) What to Consider When Introducing A Data Platform

Two pieces of information are required when considering introducing and building a data platform.

The first is the use case of services for solving problems in each domain/area. The service use cases to which the data platform is connected are identified by clarifying the followings:

what the domain of the applicable problem is; what kind of problem must be solved; what kind of service is required to solve the problem; who uses the service; and what value the service provides.

The second point is the content of the data necessary to realize the services. The following should be clarified: the subject of the data; how the data is generated, acquired and managed; how the attributes of the data and the relationship between data can be organized.

(7) Timing for Introducing Data Platforms in Developing Countries

Considering the cases and introduction points, the following are assumed as prerequisites for maximizing the effects of introducing a data platform.

Examples of conditions for obtaining effects by introducing the data platform

- When using shared data on multiple services, or when doing so reduces the burden on both public and private sectors
- When providing a shared user interface for multiple services
- When establishing a platform for service development that utilizes shared user data, etc.
- When the service use case is clear, and an effective system can be built by designing a data platform
- When the developed/operated application (use case) is used interchangeably between cities, etc.

From the above, it is not always necessary to build a data platform, although consideration must be given to subsequent connection to the data platform at the initial stage of implementing individual smart city services.

On the contrary, if the data platform itself is required as a service from the initial stages, such as in the case of Aizuwakamatsu City, where the operation and management of the shared portal site and personal information is the main function, the data platform itself is the framework that provides the smart city services.

Once the quality and quantity of data used and services provided are clarified, the need for a data platform that utilizes these will grow. The risk of the introduction of the data platform at the timing of initial stage could be higher because of uncertainty of cost, possible complexity of functions which cannot have requirements for further phases, increase of additional development costs, and public opposition regarding data utilization.

Even if the concept and vision are planned for smart cities in developing countries, the introduction of desired services (or establishment as a business model) does not necessarily occur in the same order or at the same time as in the developed countries. This could be because developing countries must improve their quality of life differently from Japan and other developed countries and because they lack the basic infrastructure.

Therefore, it is also important to determine the timing when a data platform is necessary. In general, the data platform should not be implemented in a uniformed manner to all developing countries as it tends to lead to a situation where the initial cost and the maintenance cost does not payoff until actual business models and opportunities emerge in the later stage.

On the other hand, systems should be designed so that they are compliant with open APIs and data can be linked together in the future. By so doing, it is also possible to introduce the

data platform at an appropriate time to prepare for the expansion of services; therefore, national and local governments must be ready to participate in this phase. To this end, it is important at this point to conduct a “feasibility study” to determine what kind of valuable smart city services can be provided by introducing the data platform, and the scenarios taking into account advantages and disadvantages of introducing such an infrastructure at different stages. It is worth noting that at the point of writing this report, Aizuwakamatsu City and Takamatsu City are also at the stage of introducing initial versions of disaster monitoring and sensor networks, and thus, studies that can maximize the benefit of the data platform are just beginning.

2-2. Principles and Benefits of Smart City

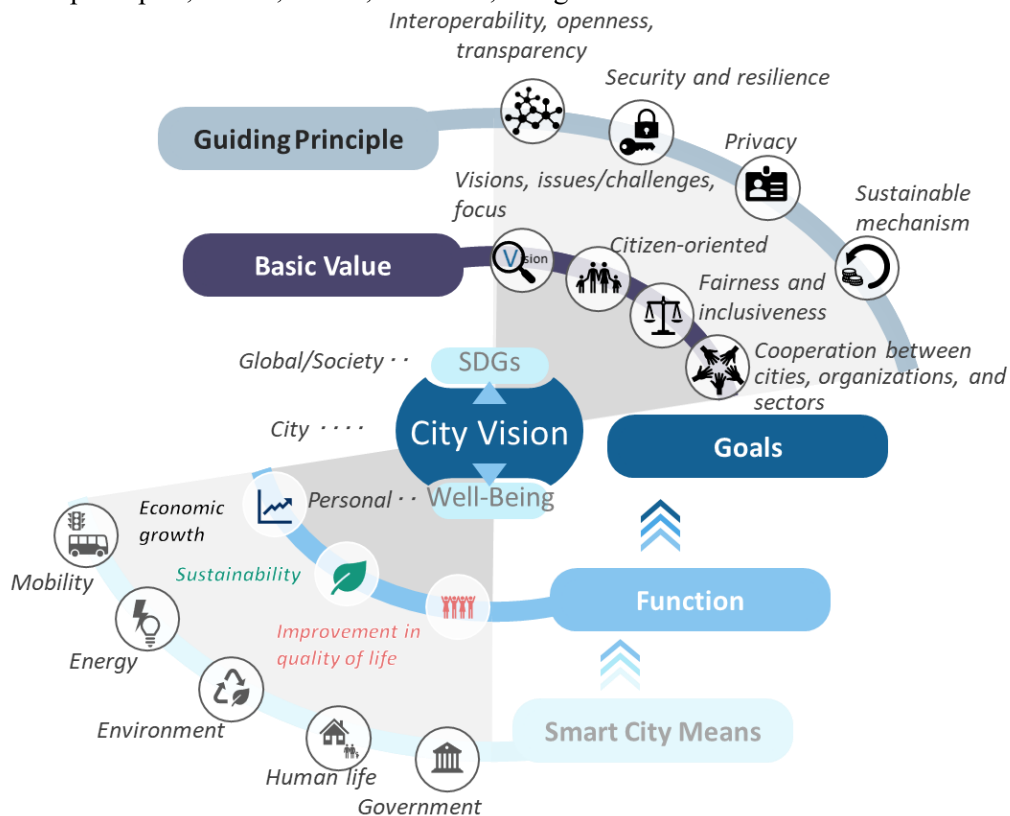
2-2-1 Smart City Concept Model

The definition of smart city is different by country and city, and thus their goals and focus may also differ. Having said that, there are some common aspects in terms of principles and basic values, and functions. Referring to the definition set out in the “Smart City Guidebook“ of the Smart City Public-Private Collaboration Platform Secretariat of Cabinet Office in the Government of Japan (hereinafter referred to as the “Smart City Guidebook“), while also incorporating the context of smart city in developing countries, smart city can be generally described as follows.

A Smart City is an initiative which:

- follows fair and transparent principles and rules. [Guiding Principles]
- is based on common value and principles such as public interest in society, promotion of the well-being of citizens, respect of diversity, and realization of social inclusion. [Basic Concept]
- comes from urban management and services in each field with digital technologies and utilization of various data. [Smart City Means]
- continuously creates new values while maintaining harmony between citizens' lives and natural environment. [Function]
- resolves problems in respective cities and achieves the vision, SDG's and well-being of citizens. [Goals]

Figure 2-7 below illustrates the image of the smart city system according to the preceding basic principles, values, means, functions, and goals.



Source: JICA Study Team

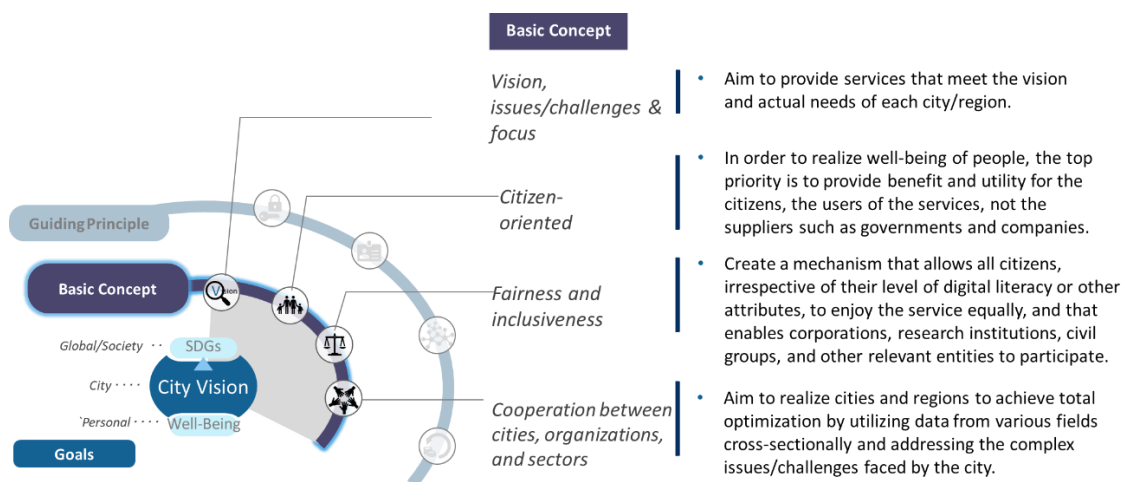
Figure 2-7 Image of Smart City System

2-2-2 Values and Principles of Smart City

The four basic values of smart city are as follows: “Vision-Task focused,” “Citizen-oriented,” “Fairness and Inclusiveness,” and “Cooperation between cities, organizations, and sectors.”

- Vision-Task focused: Aim to provide services that address the visions and actual needs of cities and regions, as well as international and social issues including SDGs.
- Citizen-oriented: In order to realize the well-being of people, the top priority is to provide benefit for the citizens and the users of the services, not the suppliers such as governments and companies.
- Fairness and Inclusiveness: Create a mechanism that allows all citizens, irrespective of their level of digital literacy or other attributes, to enjoy the service equally, and that enables corporations, research institutions, civil groups, and other relevant entities to participate.
- Cooperation between cities, organizations, and sectors: Aim to realize cities and regions to achieve total optimization by utilizing data from various fields cross-sectionally and addressing the complex issues and challenges faced by the city.

Although “fairness and inclusiveness” is classified as a principle in the Cabinet Office Smart City Guidebook, the study team positioned it in the domain of “value” because this is more appropriate when capturing the context of cities in developing countries and international development.



Source: JICA Study Team

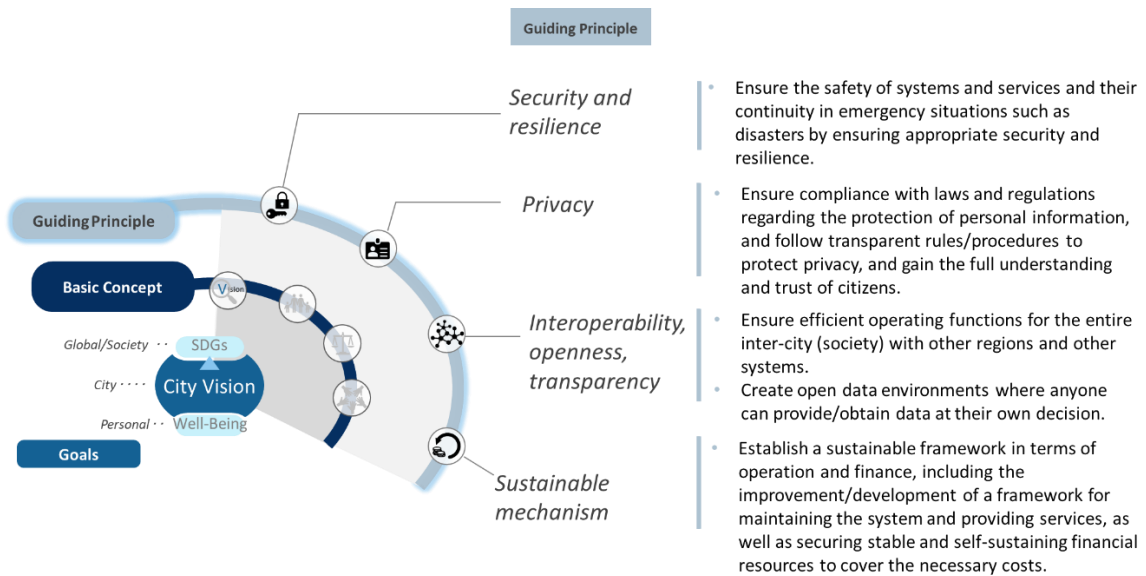
Figure 2-8. Basic Values of Smart Cities

The four guiding principles of Smart Cities are “Security and Resilience,” “Privacy,” “Interoperability, openness, transparency,” and “Sustainable mechanism.”

- Security and Resilience: Ensure the safety of systems and services and their continuity in emergency situations such as disasters by ensuring appropriate security and resilience.
- Privacy: Ensure compliance with laws and regulations regarding the protection of personal information and follow transparent rules and procedures to protect privacy and gain the full understanding and trust of citizens.
- Interoperability, openness, transparency: Ensure efficient operating functions for

the entire “inter-city” (society) with other regions and other systems. Develop an open data platform where everyone can provide and obtain data at their discretion and make data available under appropriate rules.

- Sustainable mechanism: Establish a sustainable framework in terms of operation and finance, including the improvement and development of a framework for maintaining the system and providing services, as well as securing stable and self-sustaining financial resources to cover the necessary costs.



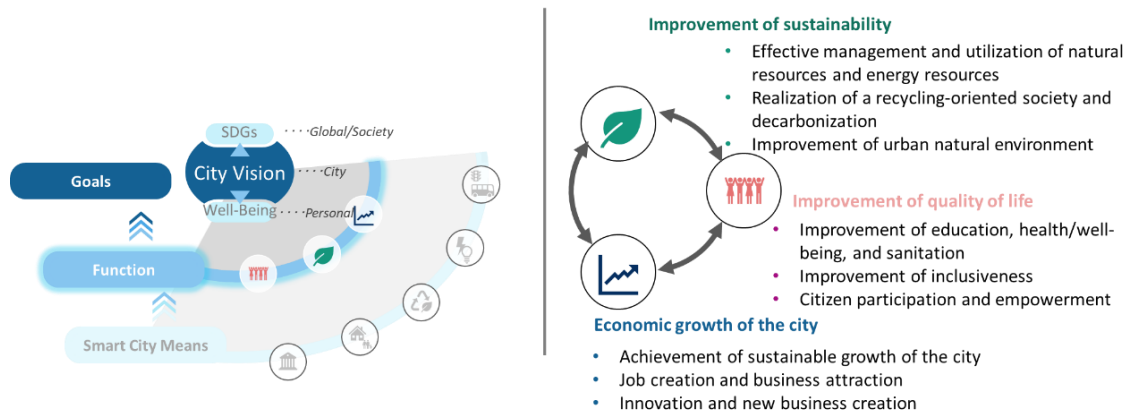
Source: JICA Study Team

Figure 2-9 Basic Principles of Smart Cities

2-2-3 Smart City Function and Means

By implementing smart city initiatives based on the basic value and principles previously described, maintaining harmony between citizens' lives and the natural environment, and also creating new values sustainably, it can be expected that each city's urban challenges will be eventually solved, while visions, SDGs and well-being shall be eventually achieved.

To this end, important functions for smart city will be: ensuring sustainability for natural resources, energy, society and economy as well as growth of city by promoting employment and economic activities and creating innovations and improvement of the quality of life of citizens.

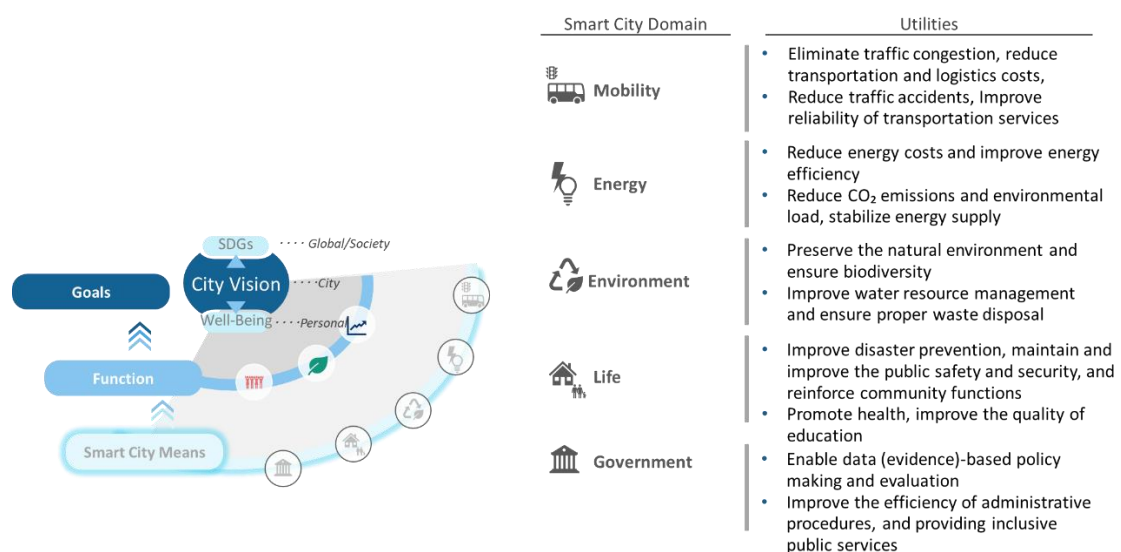


Source: JICA Study Team

Figure 2-10 Smart City Functions

In the concrete urban management, new methods or means of urban management that utilize digital technology and data are expected to provide holistic solutions for various urban challenges.

Figure 2-11 below shows examples of the content of Smart City Means in mobility, energy, environment, life, and government.



Source: JICA Study Team

Figure 2-11 Smart City Means

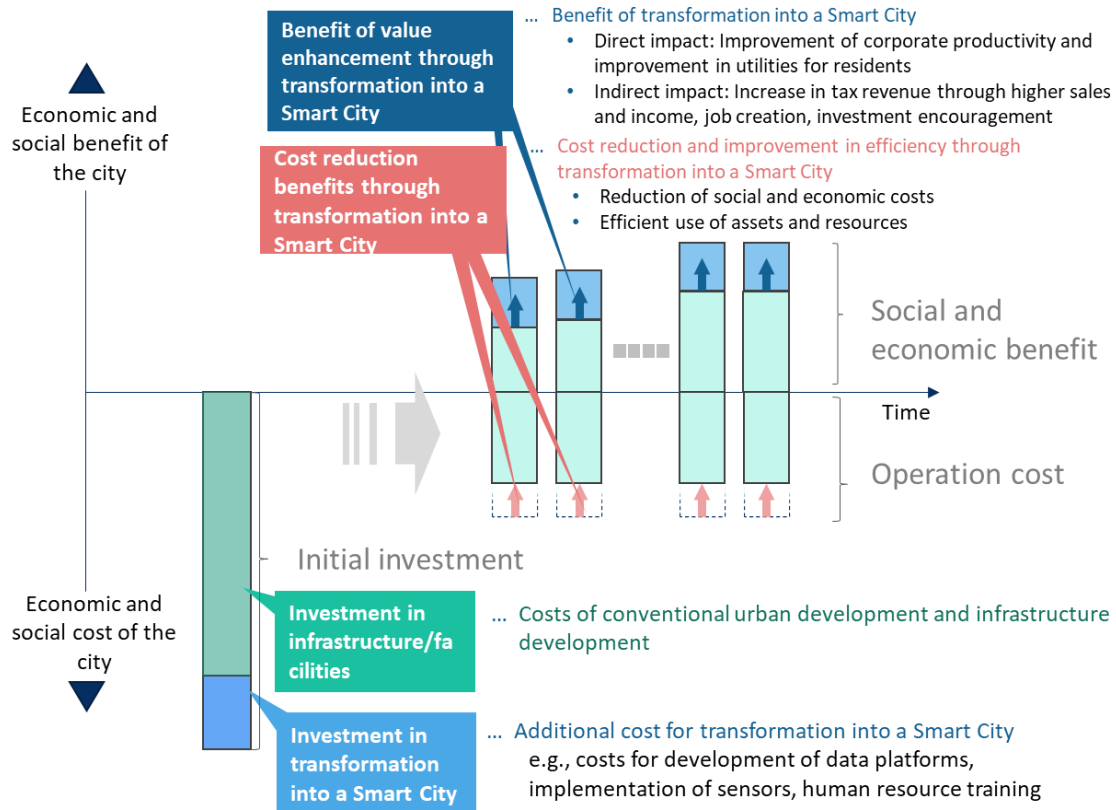
2-3. Benefits of the Smart City

2-3-1 Smart City Benefits: Cost Reduction and Creating Value

In an attempt to conceptualize the quantitative benefits of the Smart City, the cost-benefit concept is applied. For the cost side, additional investment incurred on top of the conventional infrastructure and facility development costs shall be taken into account. This includes development of data platforms, introduction and installation of sensors and IoT equipment, and personnel education expenses for using these advanced technologies. On the other hand, the benefits of the Smart City can be divided into:

- 1) the effects of increasing the added value, such as improving productivity, improving the convenience of residents, improving tax revenues for government, and promoting employment; and
- 2) the effects of cost reductions through the effective use of assets and resources, such as automation technology and AI solutions.

The concept described in the preceding is illustrated in Figure 2-12 below.



Source: JICA Study Team

Figure 2-12. Conceptual Image of Quantitative Benefit and Cost of Smart City

Reference: Examples of Actual Smart City Benefits

Smart City Initiatives in Barcelona

i) Overview

- Since the establishment of Smart City Barcelona Task Force in 2011, the city has been actively leading smart city initiatives.
- IoT devices, such as sensors, are installed in various locations and facilities, and integrated on platforms.

- These data are linked with the City OS and utilized for improving efficiency of urban service.
- ii) Benefits of Smart Cities
The following effects have been reported as examples of actual benefits of Smart Cities.

Table 2-1. Smart City Benefits examples

Benefits	Quantitative effects
Job creation	IoT-related business of Barcelona created an estimated total of 47,000 jobs ¹²
Improvement of income from transportation services	A smart parking system that manages and discloses parking space vacancies resulted in increased parking fee revenue of \$50 million per year. ¹²
Reduction in power consumption	Introducing LED streetlamps and streetlights that detect people and automatically control lighting intensity saved \$37 million per year through smart lighting business. ¹³
Effective use of water resources	A system which monitors rainfall and water utilization conditions of fountain and tap water in the city park and manages water supply remotely by motor valves saved about 25% of water annually with a cost savings of about \$560 thousand. ¹³

Source: Prepared by the survey team based on various sources mentioned below

2-3-2 Recipient of the Benefits of Smart City

The following figure summarizes the initiatives and expected benefits of the smart city plans promoted by local governments in Japan.

An overview of the benefits of smart cities can be categorized into three types; initiatives that improve the sustainability of society as a whole, those that aim to increase value, and those that seek to reduce costs. In addition, in general, initiatives aimed at improving the sustainability of society need to be promoted through the efforts of government and public institutions, as the benefits are not easily converted into monetary terms. On the other hand, many of the initiatives that bring benefits to citizens (end-users of services) and businesses can also be established as independent initiatives; therefore, it is effective to support voluntary initiatives by businesses and private organizations.

¹² Forbes “Cisco’s Chambers Says Internet of Everything, \$19 Trillion Opportunity, Is Next Big Thing”:
<https://www.forbes.com/sites/connieguglielmo/2014/01/07/>

¹³ Harvard Kennedy School “How Smart City Barcelona Brought the Internet of Things to Life”:
<https://datasmart.ash.harvard.edu/news/article/how-smart-city-barcelona-brought-the-internet-of-things-to-life-789>

Types of Benefits	Recipient	Examples of Effects	Examples of Smart City technologies	
Improvement in social sustainability	Entire society	<ul style="list-style-type: none"> Improvement of disaster prevention capacity and resilience to hazards Improvement of public security, safety and assurance Improvement of energy consumption efficiency Protection of ecological diversity, conservation of the natural environment Creation and maintenance of a good urban environment Improvement of city vitality, promotion of interaction, increase in land value Provision of inclusive urban services 	<ul style="list-style-type: none"> Disaster prediction technology, real-time observation and alarm systems Community surveillance services, face recognition systems Smart meter, smart grid, ZEB Green infrastructure, remote sensing Environmental sensors, environmental monitoring Creating a walker-friendly and comfortable city E-government (digitization of administrative services) 	<p>Difficult to convert benefits into monetary values => Requires encouragement by the government</p> <p>Easy to convert benefits into monetary values => Support for autonomous initiatives is effective</p>
Value enhancing effects	Citizen	<ul style="list-style-type: none"> Improvement of convenience in daily life, improvement of quality of life Improvement of citizen's health, extension of healthy life expectancy Expansion of capabilities and possibilities for self-actualization 	<ul style="list-style-type: none"> Cashless payment, mobility services (e.g., MaaS) Telemedicine services, health support applications Lifelong learning and education services 	
	Corporation	<ul style="list-style-type: none"> Increased corporate sales through increased production and quality control Facilitation of marketing and sales Creation of business opportunities through new technologies and services 	<ul style="list-style-type: none"> Smart agriculture, smart factories, smart logistics services Online marketing using citizen/visitor data Business matching using the platform 	
Cost reduction effectiveness	Citizen	<ul style="list-style-type: none"> Saving time in everyday life Lower service fees 	<ul style="list-style-type: none"> Mobility services, shopping order and delivery services Matching services, remote services (e.g., education, medical care) 	
	Corporation	<ul style="list-style-type: none"> Reduction of labor costs Lower capital costs through asset and property sharing Lower R&D and market research costs through data sharing 	<ul style="list-style-type: none"> Implementation of AI systems and robots Rental (co-work space) and lease (subscription) Open data platform 	

Source: JICA Study Team

Figure 2-13 Types of Smart City Benefits, Recipient of The Benefits, And Example of Smart City Technologies

3. Data Collection and Analysis of Smart City Cases of Early Adopters

In Chapter 3, six cases of early adopters of smart cities in Europe, the U.S., and Japan are studied. The perspective of the case study includes the backgrounds, policy, institutional arrangement, and detailed information on projects and smart solutions.

This chapter also analyzes the success factors of smart cities that are derived from the case studies and other various studies; the Smart City framework of 5 domains consisting of 21 elements is then formulated by extracting the essence of the success factors.

3-1. Perspectives on Data Collection of Cases of Early Adopters

3-1-1 Perspectives on Data Collection of Cases of Early Adopters

The study aimed to examine the context, history, ecosystem, and drivers (i.e., technological, economic, institutional, governance) of smart city development in developed countries in addition to the technologies, services and other initiatives actually used in the cases of early adopters. Specifically, the study was carried out focusing on three key points:

1. Vision - What kind of urban problem is posed and aimed at through smart cities?
2. Organization and implementation system - What organization and system are there to implement smart cities?
3. System and mechanism - What policy and mechanisms are being underlaid to operate smart cities, including mechanisms for citizen participation and consensus building mechanisms?

3-1-2 Selected Cities for the Cases of Early Adopters

Relevant data were collected on cities from developed countries that engaged in smart city planning and implementation. The table below presents a list of these cities, their smart city-related projects and activities, and the methods used for data collection.

Table 3-1 Selected Cities and Perspectives of Data Collection

Target cities	Activities	Methods of data collection
Barcelona, Spain	<ul style="list-style-type: none"> • Smart city frontrunner of Europe, engaging in smart city projects since 2000. • Urban management using sensor systems 	<ul style="list-style-type: none"> • Literature survey • Interview
Copenhagen, Denmark	<ul style="list-style-type: none"> • Eco-system formation through cluster organization. • Human-centered smart city promotion 	<ul style="list-style-type: none"> • Literature survey • Interview
Helsinki, Finland	<ul style="list-style-type: none"> • Framework development for organizational cooperation among industry, government, academia, and the private sector through Quadruple Helix • Formation and utilization of testbeds and Living Lab for scalability and effective social implementation 	<ul style="list-style-type: none"> • Literature survey • Interview
Amsterdam, Netherlands	<ul style="list-style-type: none"> • Establishment of the Amsterdam Smart City (ASC), a public-private partnership organization. • Provision of city space for Living Lab's projects leading to the discovery of various issues and 	<ul style="list-style-type: none"> • Literature survey

Target cities	Activities	Methods of data collection
	development of innovations.	
Chicago, US	<ul style="list-style-type: none"> Formation of an ecosystem of innovation in the industry, government, academia, and the private sector, with a focus on City Tech 	<ul style="list-style-type: none"> Literature survey
Kashiwa no Ha, Japan	<ul style="list-style-type: none"> Support through government subsidy for Kashiwa no Ha, which is an area development and area management type initiative led by private sector 	<ul style="list-style-type: none"> Literature survey

Source: JICA Study Team

3-2. Data Collection of Cases of Early Adopters

3-2-1 Spain: Barcelona

(1) Overview

Initiatives for smart cities in Barcelona could be traced back to the “City of Knowledge” concept featured in the City Council Growth Strategy in 1999. Since then, it has been recognized worldwide as an advanced smart city adopter by implementing initiatives such as the Innovation District (22@) project, the utilization of sensor systems (Sentilo) for city management, and the creation of public spaces through innovative strategies like Superblocks. Barcelona has been the hub of smart cities in Europe, having been organizing and holding the Smart City Expo since 2011.

The smart city initiative in Barcelona City is characterized by the creation of a vision through the involvement of various actors including citizens, and the creation of a city-supported platform.

<p>Vision for smart cities</p>	<ul style="list-style-type: none"> • The “City of Knowledge” initiative which was promoted in the early 2000’s, was driven by goals such as strengthening competitiveness by promoting the knowledge industry, cultural development by incorporating new values, and strengthening social cohesion. • The Digital City Plan that was established in 2015 has been guided by the idea that digital technology should be utilized to improve the citizens’ quality of life and realize a citizen-centered society. It was envisioned to improve public services and support digital businesses and entrepreneurs. Furthermore, it aimed to empower and socially include citizens.
<p>Smart city promotion system and organizations</p>	<ul style="list-style-type: none"> • Instituto Municipal de Barcelona (Barcelona Information Institute IMI), which oversees the digital sector in Barcelona City, is the governing body for the smart city policy, and BCN Ecologia Urbana Agencia makes policy recommendations for sustainable urban development based on data and information. (Note: The functions held by BCN Ecologia Urbana Agencia is currently being transferred to the Regional Agencia Desenvolupament Urba (Regional Development Agency)
<p>Efforts in policy systems</p>	<ul style="list-style-type: none"> • Poblenou area, which was originally an industrial area, was designated as the Innovation District (22@), to create new industries and implement new technologies in conjunction with redevelopment projects, using sensor systems to streamline urban operations such as Sentilo. Methods are being taken to retrofit new technologies to existing infrastructures such as Superblock, which makes smart use of existing urban spaces. • Under the policy of Barcelona City, smart city initiatives are being implemented under the cooperation of various entities such as the private sector, administration, and citizens, while bottom-up type smart cities are being devised to open up the data held by private enterprises and citizens alike.
<p>Other:</p>	<ul style="list-style-type: none"> • The participatory platform Decidim introduced in 2018 reflects

Framework of citizen participation	<p>the opinions of residents regarding public policies. The concept of a bottom-up smart city, using applications such as Fix my street, is also considered.</p> <ul style="list-style-type: none"> · Citizens' participation in urban policies in Barcelona had traditionally been strong in the city. The “Citizen Commitment to Sustainability 2002-2012” on Agenda21 based community-level action plans adopted at the Rio Earth Summit were formulated with the involvement of hundreds of organizations and thousands of citizens. Subsequently, the “Public Commitment for Sustainability 2012-2022” was also formulated with the participation of citizens and has become widespread in civil society as a common goal.
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(2) Basic Concept Vision

1) “City of Knowledge” Initiative

Barcelona City Hall launched the “Project Barcelona, City of Knowledge” in early 2000 with the purpose of utilizing knowledge in all phases of the city management to promote new industries and strengthen social linkages because of the rapid progress of science and technology and the increasingly intense competition among cities coupled by the need to respond to the changes in the socio-economic structure.

“City of Knowledge”, as a concept, highlights openness and creativity that are characteristics of Barcelona City. It aims to transform the city into an information society and catalyze job creation and economic growth by promoting the information industry and active participation of civil society. This is an inclusive effort to promote science and technology and make them pervasive in the lives of citizens under fair and transparent procedures. In this concept, “Information” and “Knowledge” have been clearly distinguished. Furthermore, information accumulated through information technology can be used creatively.

The “City of Knowledge” initiative is, as mentioned previously, a broad strategy that includes the economy and the community while targeting the utilization and promotion of redevelopment projects in the Poblenou district called 22@Barcelona. The term “City of Knowledge” is still frequently mentioned in various city-related documents. Therefore, it can be said that it is the basis of smart city initiatives in Barcelona.



Source: Barcelona Ciudad del Conocimiento: Economía del Conocimiento, Tecnologías de la Infomacion y la Comunicacion y Nuevas Estrategias Urbanas (2004)

Figure 3-1 City of Knowledge Strategy

2) Barcelona Digital City Plan

The city of Barcelona has developed a “Barcelona Digital City” plan by utilizing digital technology to improve public services in urban cities.

In this plan, measures for improving public service, supporting digital business and entrepreneurship, empowering citizens, and promoting social inclusion have been prescribed for citizens, as well as public and private enterprises.

Efforts in the public sector are aimed at improving the quality of public services using technology and open data through digital transformation.

Efforts to create open data:

- Free & open software: FLOSS Barcelona
- Open Budget
- Transparency mailbox
- Progressive web applications

Initiatives to disseminate urban technology to citizens:

- City OS
- Sentilo
- Superblocks
- KIC Urban Mobility

Initiatives in the private sector are aimed at promoting digital business and supporting companies using technology and open data, with digital innovation as a keyword.

Efforts to Improve Digital Economy and Innovation Ecosystems

- Innovation ecosystem
- 5G Barcelona
- MediaTIC Incubator

Initiatives to bring innovation

- Digital social innovation in Barcelona
- Digital social innovation fund
- Maker Faire Barcelona

Initiatives as an Innovation Laboratory

- i.lab & Ca l'Alíer
- i.lab challenges
- Innovative public procurement

Initiatives for citizens are aimed at improving their quality of life using technology and open data through digital empowerment.

Efforts to ensure the use of democratic and free digital technologies

- Decidim Barcelona
- Cities Coalition for Digital Rights

Improving Citizens' Digital Skills

- Cibernàrium
- STEAM Bcn
- Fab Labs

Initiatives as an Innovation Laboratory

- Barcelona Declaration for digital social inclusion
- Empowering Women in tech
- REC: Barcelona's digital social currency



Source: https://ajuntament.barcelona.cat/digital/sites/default/files/pla_barcelona_digital_city_in.pdf

Figure 3-2 Barcelona City: Barcelona Digital City Plan

(3) Organization and Promotion System

1) Instituto Municipal de Informática (Barcelona IMI)

Instituto Municipal de Informática (IMI) is a central organization for ecosystems in Barcelona's smart cities.

IMI is a public utility under Barcelona City Hall's jurisdiction with its own assets and budgets and is responsible for developing, providing, and operating cross-sectional digital solutions to various local and utility companies in Barcelona. Specifically, its mission is to

provide comprehensive and concrete ICT solutions to all administrative agencies involved in municipal administration. It is also mandated to provide advisories to administrative agencies and citizens and to carry out marketing and networking activities through ICT.

IMI has about 270 IT talents and has a budget of 19.6 million EUR, which is about 3.4% of the city's budget. Furthermore, IMI plays a leading role in the development of concepts and specifications for digital technologies and services while also being responsible for monitoring and managing services. However, IMI actively outsources tasks related to the development and implementation of actual services to private companies. 377 contracts in ICT-related businesses have been signed with 278 different private enterprises, of which 76% are small and medium-sized enterprises. Moreover, most of these are local enterprises. Sentilo, City OS, Decidim, etc. are particularly well-known among projects implemented through this scheme.

2) BCN Ecologia Urbana (Barcelona Urban Ecology Agency)

Ecologia Urbana (Barcelona Urban Ecology Agency) is one of the organizations that are making characteristic efforts in urban planning and urban space formation in Barcelona City. (Note: since 2019, Regional Agencia Desenvolupament Urba (Regional Urban Development Agency) has begun the process of transferring personnel and assets).

Ecologia Urbana is a public utility under the jurisdiction of Barcelona City Hall, the Barcelona Metropolitan Area, and the Barcelona Parliament, which has its own assets and budgets. It is mandated to oversee and carry out the design and development of residential and sustained urban spaces, as well as the simulation, planning and execution of urban measures. Furthermore, it is tasked to systematically capture digital data on various fields such as mobility, energy, urban planning, and multi-culture symbiosis for crafting policy proposals for sustainable urban development in Barcelona City. Characteristic smart-city measures include Superilla (Superblock in English).

(4) Initiatives Related to Policy Systems

Barcelona City had been promoting new industries and implementing new technologies in conjunction with the redevelopment of Innovation District (22@) in the Poblenou area, which was originally an industrial area.

The 22@ Innovation District project (or 22@ Barcelona project) has been implemented under the leadership of the city since 2000 to realize the “City of Knowledge” and is the first large-scale smart city project in Barcelona. This project can be viewed as a redevelopment project aimed at building knowledge bases in the Poblenou region, which was originally an industrial zone consisting of small factories for the textile industry.

Poblenou area covering 200 ha (250 blocks), was owned by a private company and was close to the city center. Thus, preferable conditions for a redevelopment project to form a knowledge base were already in place. Through the redevelopment project, the industry cluster consisting of ICT, media, biomedical, energy, design industries, was gradually formed. By 2010, 7000 enterprises were established or relocated in the area with approximately 90,000 workers. Half of the enterprises currently located in this district were the ones that came after the 2000 redevelopment project. The redevelopment project entails creating green spaces as well as public spaces suitable for innovation.¹

¹ ECPA Urban Planning: “Case Study: 22@ Barcelona Innovation District”
<https://www.smartcitiesdive.com/ex/sustainablecitiescollective/case-study-22-barcelona-innovation-district/27601/>



Source: Barcelona City: Ajuntament de Barcelona “El Proyecto 22@ Barcelona: Un Programa de Transformación urbana, economía y social

Figure 3-3 Scope and Planning of 22@ Barcelona

In the 22@Barcelona project in Poblenou district, smart city technologies, projects, and solutions are explained below:

MEDIA-TIC Building: Media-TIC Building is a building with a state-of-the-art design featuring environmental techniques as a communications base, an R&D base, and an ICT- and media-related business base. It has been in operation since 2010.

Underground Galleries: Inter-block energy, communication, and regional air conditioning and facilities that connect waste and other infrastructure are installed in an underground space. It was constructed as a model of advanced urban infrastructure management, investing 200 million euros.

Fab Lab Barcelona: A Fab Lab is a laboratory and workspace for designing and manufacturing. It is equipped with machines such as laser cutters, 3D printers, and milling machines.

SIUR Project: This project is led by the Barcelona Digital Technology Centre and a joint venture concerning energy, lighting, and sensors. It implements smart lighting projects and controls infrastructures using sensors attached to streetlights.

Sensors for urban services: This is a project that involves the installation of sensors in the city, sharing data on a common platform, and allowing citizens, the municipality, and companies to utilize data. It is used to improve urban services such as waste collection, parking lot management, and environmental regulations.

Biosphere Certification: The city of Barcelona has been certified as a “Biosphere World Class Destination” and has established its position as a sustainable tourist city.

Forum Solar Photovoltaic Installation: Large solar panels have been installed in the

coastal area to provide a monument representing Barcelona's commitment to environmental protection.

Integral Waste Management Plant: This waste-to-energy project has been carried out for the efficient utilization of heat generated from waste treatment. The management entity is TERSA, a public corporation jointly owned by the city and the Barcelona metropolitan area (58% owned by the city whereas 42% owned by the metropolitan area).

DISTRICLIMA: A district heating and cooling system has been introduced to reduce energy and environmental costs. It was first introduced in Poblenou in 2002, and then expanded in the district of 22@Barcelona in 2005.

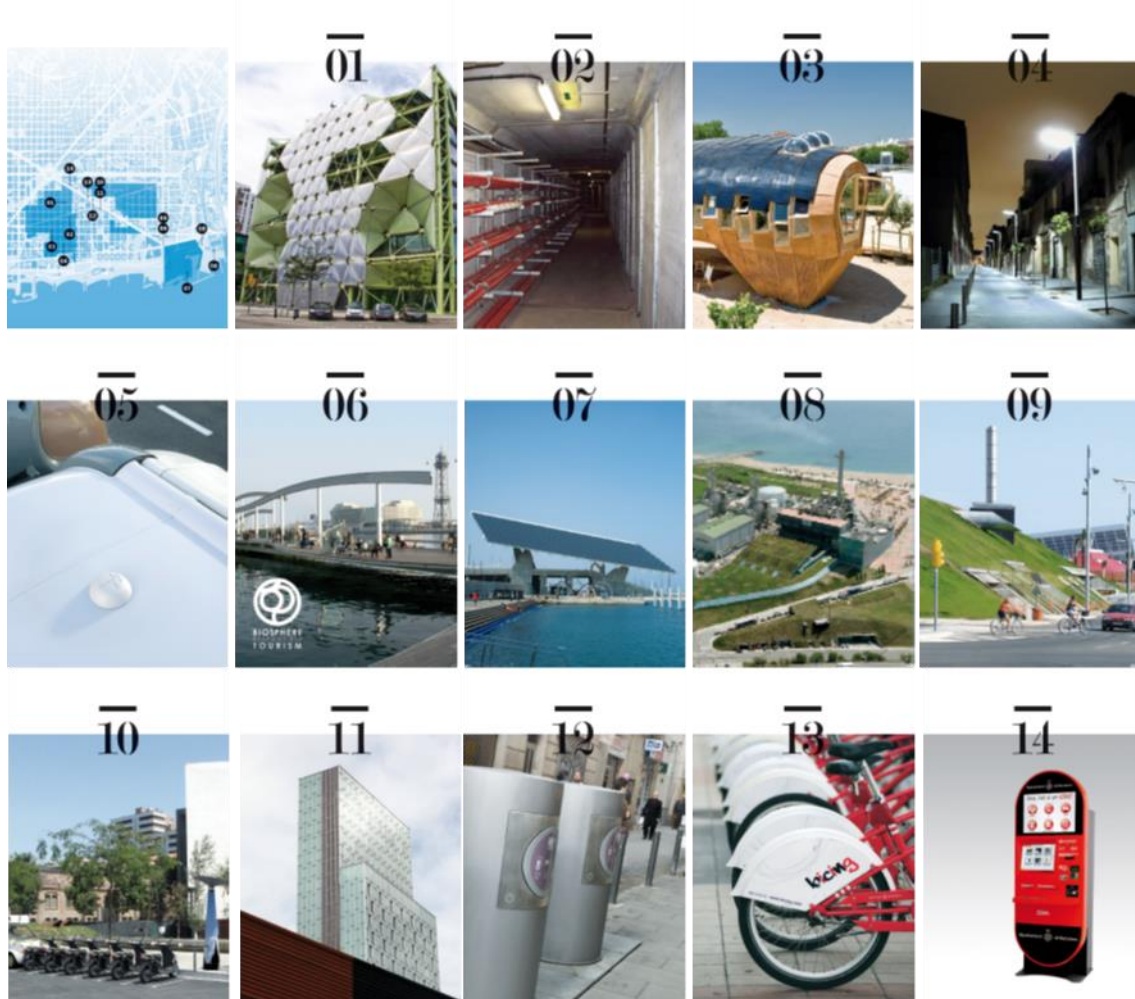
LIVE Barcelona Project: This project enabled more than 240 charging stations to be built to further promote the use of electric vehicles.

MOBEC Hotel: This is an effort to promote electric vehicles led by the city hotel association and municipal government agency. This project has allowed electric vehicles to be shared among tourists of member hotels.

Automated Waste Collection System: To create a cityscape with no noise or trash boxes due to waste collection, the city constructed an automated collection system that transports waste to collection sites using pneumatic pressure in underground spaces. It was implemented in the 1992 Barcelona Olympic athlete village and has been in operation since 2006 in the 22@ district.

BICING: Launched in 2007, BICING is a community bicycle-sharing system for mobility around the city.

E-Government: E-Government is an initiative aimed at making administrative services more efficient and accessible while securing transparency. This initiative enabled administrative procedures to be carried out online. It is characterized by the development and use of platforms for open data and administrative portals where online services are accessed in kiosks installed in various places in the city.



Source: Barcelona City: Ajuntament de Barcelona “Barcelona Smart City Tour
 Figure 3-4 Smart City Business at 22@ Barcelona

(5) Technologies and Systems

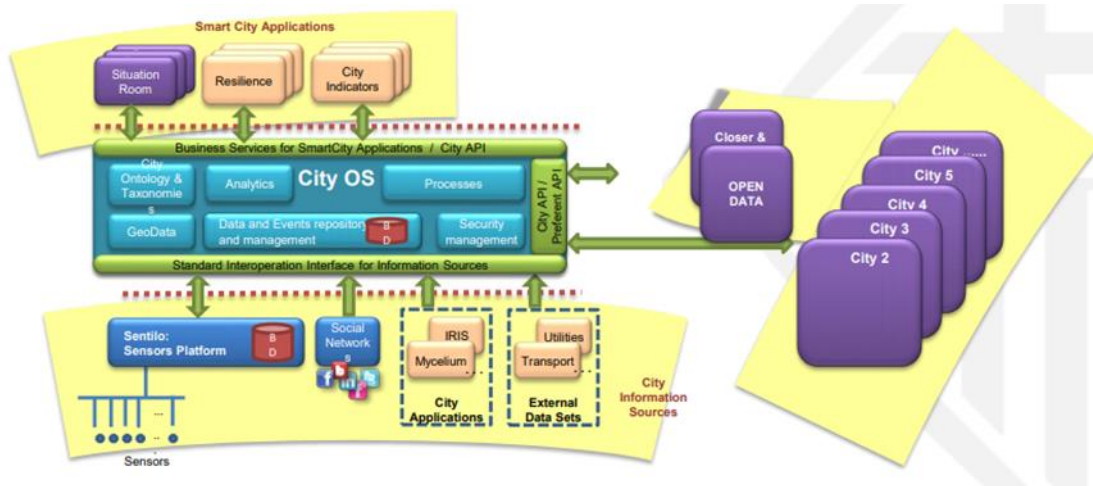
1) Sentilo

Since November 2012, Barcelona City (Barcelona IMI) has introduced Sentilo as a platform for sensor systems based on the concept of centralized management of sensor data in real-time. Cost reduction of administration, improvement of administrative service, improvement of the living environment, and improvement of administrative business through data utilization has been pursued as objectives of this initiative.

Sensors are attached to utility facilities such as streetlights and power generation facilities in Barcelona City. These sensors are used for the operations and management of various urban infrastructures and facilities. Data such as energy usage, noise, weather, parking area availability, air pollution, water quality, availability of shared bicycles, and movement of people and vehicles, are measured and collected in Sentilo, which is connected with the City OS, which controls the infrastructures. Some examples include 1) an automated control system for the efficient management of water supply and sewerage for fountains; 2) a system that controls the operation and brightness of streetlights for energy efficiency, and 3) parking apps that enable users to locate available parking spaces for minimizing traffic congestion.

Sentilo has been made public and open source so that it could be replicated and expanded

to other cities and facilitate information sharing. City OS in Barcelona is not a single system, but a combination of various systems developed by various ICT vendors. This is based on the principle of the city's data governance in which the city decides its own processes and policies, manages its own data, and operates it responsibly. Thus, the City ensures that ICT solutions are designed in accordance with the specific problems, needs, and applications of the City.



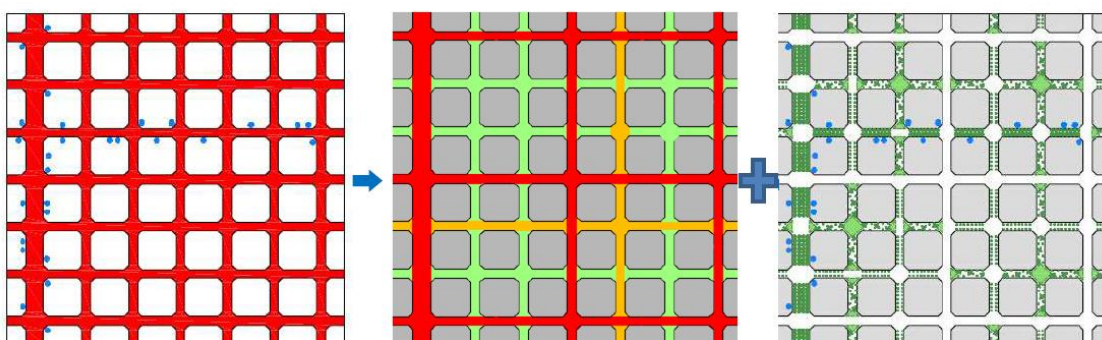
Source: https://ajuntament.barcelona.cat/imi/sites/default/files/hab_int_01_presentation_cityos_0.pdf
 Figure 3-5 Conceptual Diagram of the Digital Platform in Barcelona

2) Superilla (Superblock)

Various measures and projects for the creation of public spaces have been implemented since 2016 using a part of Barcelona's streets and blocks as a *Superblock* to address problems such as air pollution and traffic congestion in the city while generating public spaces for its citizens. By restricting access by private cars or imposing speed limits while prioritizing pedestrian spaces, roads inside the Superblock create comfortable and safe spaces for residents and businesses such as stores. Furthermore, various species of plants are planted in the area, making it a place for relaxation while promoting activities for leisure, interactions, and recreation.

As shown in Figure 3-6, the Superblock is an initiative to create green spaces by lining streets and intersections with plants and systematically defining private vehicle and public transport lines by layering the Barcelona grid-shaped road network.

Superblock's model



Source: Barcelona City

Figure 3-6 Superblock Modelling Concepts in Barcelona

The Superblock model was originally adopted by certain areas such as Poblenou and some blocks of districts such as Sant Antoni. In Poblenou, the car traffic was restricted from block streets for a limited time (weekend, etc.), and converting it into a public space was initially carried out as an experiment. When they moved to make it permanent, some of the residents initially opposed it. However, after holding discussions with the citizens on how to manage public spaces in a mutually beneficial way, opposition gradually decreased leading to its full implementation two years later.

In the Sant Antoni district, located at the center of the city where residential areas were filled with traditional markets, the construction of the Superblocks was implemented over a period. In the Sant Antoni area, residents were involved in planning, which facilitated the careful implementation of the project. A significant amount of time was spent discussing with residents regarding how they can enjoy more benefits from the project especially in the aspect of convenience in mobility.

Currently, the system has been adopted by the entire city including the Eixample area of Barcelona. Low Emission Zones (LEZs) are also set outside the superblock while a system to enforce the legal speed of vehicles as well as to control traffic lights is being implemented.



Source: Barcelona City

Figure 3-7 Creation of Public Spaces Through Superblock

3) Decidim

Decidim is an online platform for participatory democracy with functions to gather, promote and aggregate discussions that later feed into the decision-making process. It was launched in February 2016 under the leadership of IMI. Decidim means “decide” in the Catalan language and was developed as free software and digital platform for participatory democracy. Adoption of this platform is gradually spreading to cities such as Helsinki and in Japanese municipalities.

The city of Barcelona has been actively supporting offline citizen meetings along with Decidim for eliminating negligence, encouraging citizen participation, and realizing a citizen-led society. Specific topics of discussion include areas related to the lives of citizens, such as the use of Superblock plazas and public spaces, as well as the use of public budgets. Opinions from citizens are gathered through Decidim and are used to inform and guide the administration of the city.

As of August 2021, Decidim has solicited ideas from 97,393 participants, discussed 27,037 proposals, and decided on 12,308 commissioned proposals, indicating active use.



Source:https://ajuntament.barcelona.cat/digital/sites/default/files/pla_barcelona_digital_city_in.pdf

Figure 3-8 Citizen Assembly

(6) History of Smart Cities

If Barcelona's smart city agenda is to be viewed in chronological order, we can see that the “City of Knowledge” concept ideated in early 2000 was a key milestone that initiated events leading to the agenda’s current state. This “City of Knowledge” concept was based on the policy agenda set forth after Barcelona 1992 Olympic Games. To catalyze growth by creating new industries and to enhance competitiveness as a tourist city, promoting the development of state-of-the-art infrastructures while attracting companies to create innovations for the redevelopment of areas in the harbor district was the key policy of the agenda. Thus, projects and initiatives such as the redevelopment of Poblenou district, the development of Superblocks, the management of infrastructures through sensor technologies, district heating and cooling systems, and motorcycle and bicycle-sharing services have been demonstrated. It led to the design and development of prototypes for infrastructure systems and services that subsequently expanded to the whole city of Barcelona.

Among these initiatives, the sensor system (Sentilo) was launched in 2012 and has since been connected and expanded to various infrastructure systems such as waste collection and parking management systems.

In 2016, Decidim, an online platform for citizen participation in municipalities and city operations, was introduced. It encouraged citizens to participate in networking, discussions, and decision-making processes. Barcelona originally had a firm foundation of democracy and civil participation, as suggested by the fact that, for example, in the early 2000s, it developed and adopted Local Agenda 21, ahead of other cities, with the participation of community groups and individuals, based on the principles of the Rio Declaration on Environment and Development. Decidim has made the administration open to a participatory decision-making process and administration. The Digital City Plan, which was initiated in 2015 is based on the promotion of digital technologies in three areas: administration, enterprises, and citizens. In this plan, measures were laid out to improve public services, support digital businesses and entrepreneurs, and promote empowerment and social inclusion of citizens.

3-2-2 Denmark: Copenhagen

(1) Overview

Denmark's smart city initiatives were driven by its concern for rising prices of fossil fuels due to various factors including increased energy consumption in many countries around the world. With this, its government set a goal of eliminating external risks through providing electricity using renewable energy by 2030 aiming to provide for 55% of the country's energy consumption.

Supporting the national policies, Copenhagen has declared that it aims to become the world's first carbon-neutral capital by 2025 with smart cities being promoted as one of the means for realizing this vision.

Vision for smart cities	<ul style="list-style-type: none"> The Danish Smart City White Paper defines smart cities as follows: "Smart cities are a society that builds mechanisms to enable citizens to participate in innovative ecosystems with the purpose of realizing comfort, sustainability, and prosperity, and harnesses digital solutions. The important thing is that a model of new technology and new governance becomes a means of welfare and sustainable growth for citizens rather than the solution itself."
Framework of policies and systems related to smart city promotion	<ul style="list-style-type: none"> Under the vision and goal of creating a livable city in a smart city and achieving sustainability and growth, waste, mobility, water, building, air conditioning, and energy are set as the target green sectors. Furthermore, digitization was set up to encompass and support these initiatives.
Smart city promotion system and organizations	<ul style="list-style-type: none"> A cluster organization has been set up for each field (cluster) such as mobility, energy, and building environment. As the central organization for the smart city ecosystems, it coordinates between the stakeholders of local governments, private enterprises, research institutions, etc., and conducts matching, business development, funding support, human resource recruitment, etc.
Other: Framework of resident participation	<ul style="list-style-type: none"> "Living Lab" has been established as an activity base for exploring activities related to problem-solving while soliciting participation and collaboration from administrative entities, enterprises, and citizens. This creates opportunities for prototyping new technology while facilitating service development. It also serves as a space for open innovation, collaborative design and development, and experience as well as knowledge-sharing with other cities overseas.

(2) Basic Concept Vision

1) Basic Concept

The goal is to become the world's first carbon-neutral capital in 2025.

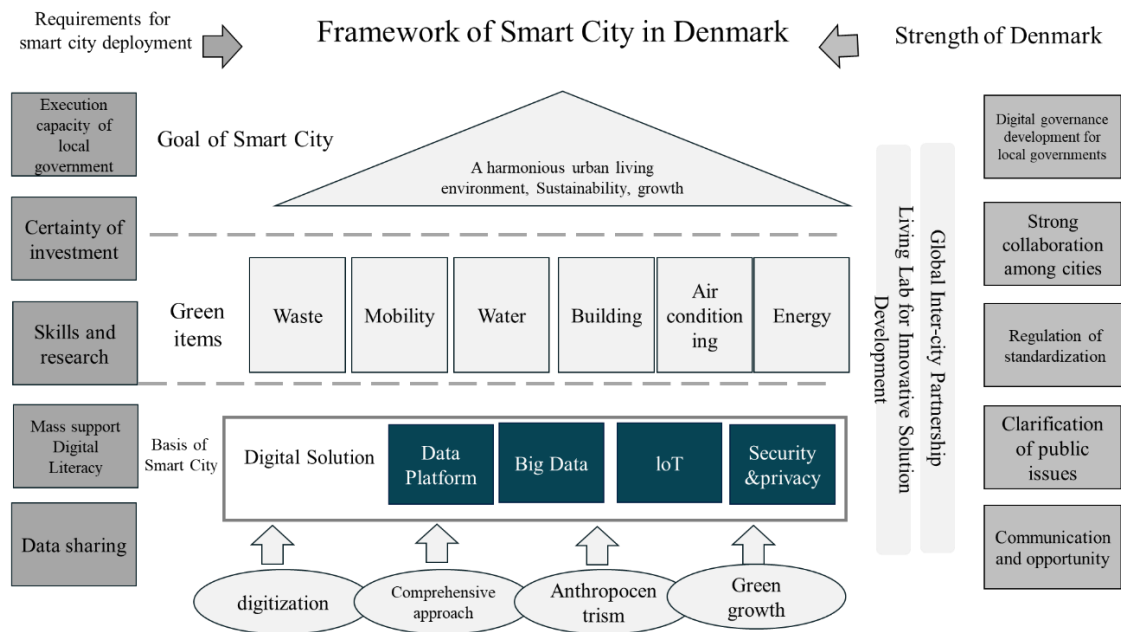
In response to the Danish national plan for a complete shift away from fossil fuels by 2050, Copenhagen, the capital, has declared that it will be the world's first carbon-neutral capital by 2025.

2) Smart Cities as A Means Rather than A Purpose

In Denmark, smart cities are defined as follows and are clearly positioned as a means to an end.

“Smart cities are a society that builds mechanisms to enable citizens to participate in innovative ecosystems and harnesses digital solutions with the aim of realizing comfort, sustainability, and prosperity. The important thing is that a model of new technologies and new governance becomes a means of welfare and sustainable growth for citizens rather than the solution itself.”

Figure 3-9 below illustrates the framework of the smart city concept in Denmark. Six green items supported by a digital infrastructure are shown to lead to a harmonious urban living environment, sustainability and growth.



Source: “Danish Smart City” by Kensuke Nakajima, Gakugei Shuppansha
Figure 3-9 Smart City Framework in Denmark

(3) Organizations

In Denmark, policies are promoted through a people-centered approach in which citizens play a leading role. Thus, while the government has announced its policy regarding smart cities, independent participation from the industry, academia, government, and the private sector are solicited through the industry-academia-government cooperation (triple helix) or industry-academia-government-private cooperation (quadruple helix).

When working on innovations such as smart cities, organizations have been established in Denmark as an avenue for industry, academia, government, and the private sector to participate at the national and municipal levels. The major organizations involved in Copenhagen's smart cities are as follows.

1) Copenhagen Solutions Laboratory (CSL)

CSL was established in 2014 as an incubator for Copenhagen's smart city initiative. The organization develops and coordinates smart cities throughout Copenhagen and serves as a hub connecting the Quadruple Helix. To create new ideas, technologies, and solutions for

urban challenges, CLS identifies and coordinates the needs of smart cities in each municipal sector and matches existing knowledge and solutions in the market.

2) Gate 21

Gate21 is a non-profit organization that coordinates local governments, corporations, and knowledge/research institutes to develop, demonstrate, and disseminate energy/resource efficient solutions that promote green landing and the green economy. It is the largest promoter of the Green Economy Transition in Denmark (as of 2018) with members and partners from 90 companies and research institutions, including 38 municipalities. It has implemented more than 100 projects since 2009 involving more than 700 companies. Funding sources consist mainly of revenue generated from projects implemented, as well as membership fees from local governments and corporations. Revenues in 2018 were approximately 6.6 million EUR (calculated with rate 1DKK = 0.13 EUR).

Its priority areas include renewable energy; smart cities and communities; sustainable mobility; circular economy and resources. Furthermore, research and development, as well as simulations and experiments at Living Labs are carried out.

3) 14 Business Clusters

In Denmark, there is a state-owned cluster composed of companies, research institutes, public agencies, end-users, etc. to facilitate development and innovation, as well as accelerate growth and value creation. Clusters are a symbol of innovation that drive transitions for adapting a company's products to sustainable solutions and new technologies. The clusters are divided into 14 areas, including 1) sustainable construction and circular economy, 2) digital transformation and automation, and 3) architectural and construction in which smart cities are considered to be priority items. Smart city experiments applied to different areas such as urban infrastructure, are carried out by utilizing Living Labs.

The 14 clusters are:

1)	Defense, Space and Security
2)	Environmental technology
3)	Finance & FinTech
4)	Life Science and Welfare Technologies
5)	Sound technology
6)	Digital technology
7)	Energy technology
8)	Food and bioresources
9)	Design, fashion and furniture
10)	Advanced production and manufacturing
11)	Shipping and logistics
12)	Robot & Drone Technology
13)	Animation, games, and movies
14)	Architecture and construction

(4) Policy System

1) Energy Strategy in Denmark, A Prerequisite for Smart Cities

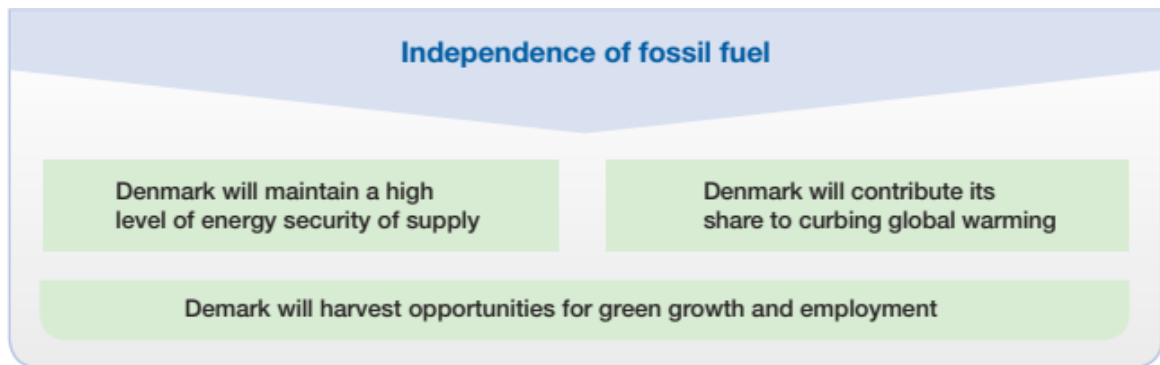
In 2011, Denmark announced its Energy Strategy 2050, which aims to move away from fossil fuels, in anticipation of 2050. It states that it aims at a complete escape from fossil fuels by 2050. Specifically, the company has set a milestone of achieving 100% renewable energy by 2050 using wind, biomass, biogas, and other renewables in 2020, and has set a target of reducing the share of renewable energy by 30%, the transport sector by 10%,

primary energy consumption by 4% compared to 2006, and the non-ETS sector by 20% compared to 2005.

As the background of the decision, it was necessary to exclude external risks such as price fluctuations of fossil fuels in Denmark without resources in energy competition against the backdrop of rising energy demand due to the growth of emerging countries, etc.

Three key goals have been set in the Energy Strategy 2050:

- [Track 1] Procedures for converting to energy targets: improving renewable energy and energy efficiency
- [Track 2] Procedures in the planning and preparation stages: Introduction of high-performance energy systems such as smart grids, and measures in the transport sector such as electric vehicles.
- [Track 3] International cross-disciplinary collaboration and procedures for technology development: Implementation of district heating and large-scale heat pumps while supporting the development of new technologies such as renewable energy



Source: THE DANISH GOVERNMENT “Energy Strategy 2050 – from coal, oil and gas to green energy”

Figure 3-10 Aim of the Energy Strategy

Table 3-2 Targets and Strategies for Energy Strategy 2050

Government target	Energy strategy 2050
Complete independence from fossil fuels by 2050	Reduce fossil fuel use in the energy sector by 33% by 2020 relative to 2009 levels, thanks to the Danish government's efforts to expand the use of renewable energy and improve energy efficiency
Increase the share of renewable energy ratio in final energy consumption 30% (in contrast with EU target of 20%)	Increase the share of renewable energy to 33% by 2020 through government efforts to expand the use of biomass, wind power, and biogas
10% renewable energy share in the transport sector by 2020	Government Initiatives to Promote Electric Vehicles, in addition to Government Initiatives to Reduce Biofuels to 10% by 2020
Reduce primary energy consumption by 4% in 2020 compared to 2006	Government Initiatives to Improve Energy Efficiency in Households, Companies, Countries, and Local Governments
Reduce emissions in the non-ETS sector by 20% compared to 2005 levels by 2020, in stages from 2013 to 2020	Governmental efforts to reduce fossil-fuel emissions will reduce emissions in the non-ETS sector by 400 to 5 million tons CO ₂ . Non-ETS emissions reduced 4 million to 5 million tones of CO ₂ between 2013 and 2020

European Union Emission Trading System (European Union Emission Trading Scheme abbreviation: EU ETS)
 Source: THE DANISH GOVERNMENT “Energy Strategy 2050 – from coal, oil and gas to green energy”

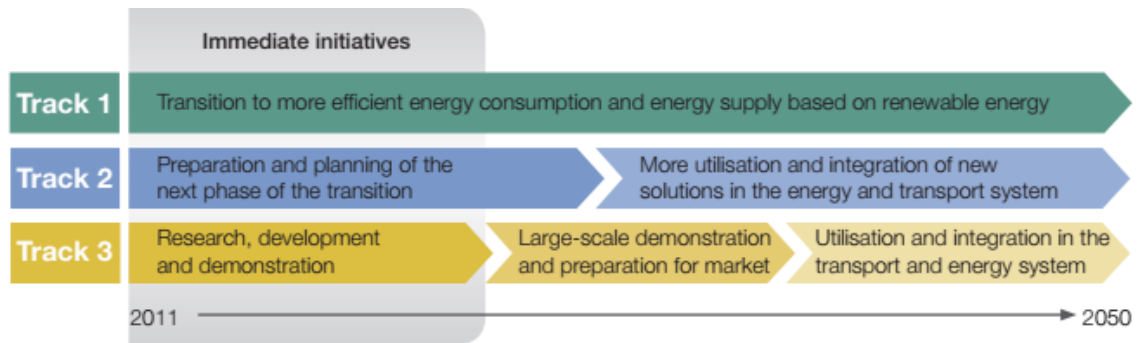


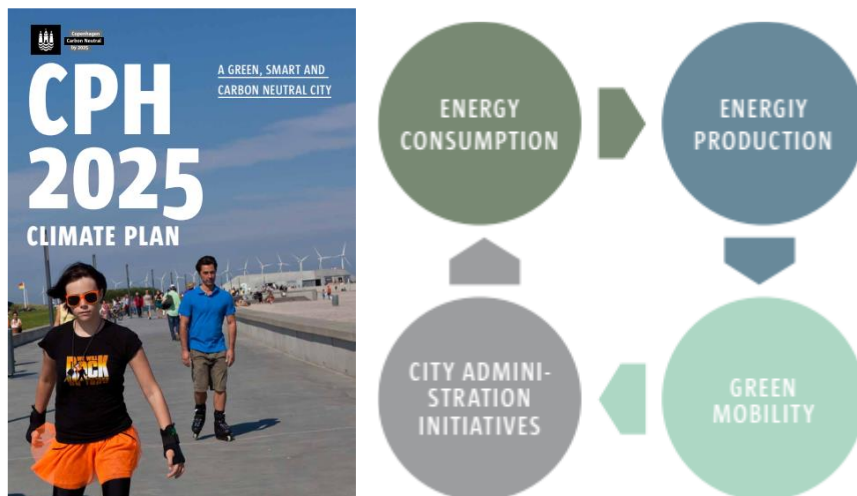
Figure 0.11 The three tracks

Source: THE DANISH GOVERNMENT “Energy Strategy 2050 – from coal, oil and gas to green energy”

Figure 3-11 Procedure for Realization

2) Smart Cities in Copenhagen

Concrete plans for smart cities are described in CPH2025 Climate Plan. The main goal, carbon neutrality, is addressed through the following four approaches : Energy consumption, Energy production, Green mobility, and Efforts of municipal authorities. Among these four approaches, smart cities are cited as concrete measures on the Energy consumption.



Source: THE CITY OF COPENHAGEN “CPH2025 CLIMATE PLAN”

Figure 3-12 CPH2025 Climate Plan

Denmark's smart cities differ from common smart cities in the following respects.

- Coverage of other areas aside from energy and transportation
- Implementation through a “human-centered approach” in which citizens actively participate rather than being promoted mainly by the industry and municipalities.

	Typical Smart City	Smart City in Denmark
Vision	The concept of using ICT to improve the efficiency of infrastructures such as electricity, transportation, buildings, and government services to build environmentally friendly cities and achieve sustainable growth.	Same as on the left
Purpose	Sustainable growth of cities + Development of industry and technology in the field of social infrastructure, and improvement of the urban environment.	Aiming to simultaneously achieve citywide efficiency and green growth
Current status	It is a partial optimization type that achieves efficiency and data coordination mainly in the energy and transportation sectors.	Energy, transportation, water, agriculture, health care, welfare, and education are becoming increasingly integrated through IT, and sustainable growth (green growth) is linked to the well-being of citizens. overall optimization type
Promoter	Promoted by related organizations mainly in industry and technology	Citizens are the main players Human-centered approach
Main participants	Local governments, electric power companies, IT service companies, general contractors, and house builders	Governments, local governments, universities, research institutions, corporations, citizens, designers, cultural anthropologists Comprehensive
Technology	IoT, 5 G, Big Data, AI, Robots, Self-driving	Big Data, Sensing, IoT, Social system design, Self-driving
Business model	Both the investment model and business model through PoC have not yet been completed.	Solutions are beginning to be implemented in society through PoC.

Source: “Danish Smart City” by Kensuke Nakajima, Gakugei Shuppansha

Figure 3-13 Comparison of Smart Cities in Denmark And Other Countries

(5) Technology and Tools

1) Concrete Promotion Items

Solutions related to smart cities include:

- Digital Infrastructure: Optimization of energy consumption through monitoring of energy consumption (especially in buildings)
- Flexible Energy Consumption and Smart Grid: Building a flexible energy consumption system with utilization of renewable energy in mind
- Smart Building: Efficient energy consumption in buildings
- Smart CPH2: Producing hydrogen with surplus electricity from wind power generation and providing it to traffic
- Supply of On-Shore Electric to Cruise Ships: Supply of electricity from land to cruise ships of engine generation

Table 3-3 Copenhagen 2025 Climate Plan Targets and Priorities

	Energy consumption	Energy production	Green mobility	Efforts by municipal authorities
Target	<ul style="list-style-type: none"> • Reduce heating consumption by 20% compared to 2020 levels • Reduce electricity consumption of commercial and service companies by 20% compared to 2010 levels • Reduce household electricity consumption by 10% compared to 2010 levels • Install solar cells that account for 1% of total consumption 	<ul style="list-style-type: none"> • Make the global heat supply carbon neutral • Ensure that wind and biomass power generation exceeds Copenhagen demand • Sort plastics • Implement waste treatment using biogas 	<ul style="list-style-type: none"> • Make 75% of travel in the city walk and use bicycles or public transport • Make 50% of all commuters and students in the city use bicycles • Increase public transport users by 20% compared to 2009 levels • Carbon neutral base for public transport • 20-30% of compact passenger cars will be based on new fuels (power, hydrogen, biofuels) • Make 30-40% of heavy-duty vehicles into new fuels (electricity, hydrogen, biofuels) 	<ul style="list-style-type: none"> • Reduce energy consumption of city-owned buildings by 40% compared to 2010 levels • Meet energy-saving standards for city-owned buildings • Make all city owners electric vehicles, hydrogen vehicles, and biofuels • Reduce energy consumption in city streetlights by half compared to 2010 levels • 60,000 square meters of solar cells installed in existing city buildings and new buildings
Priorities by 2025	<ul style="list-style-type: none"> • Improve the framework in the construction sector • Introduce energy-efficient buildings • Promote solar cells • Facilitate innovation and analysis of low energy consumption in the building sector • Promote smart cities 	<ul style="list-style-type: none"> • Onshore wind power • Offshore wind power • Supply energy to other municipalities through wind power generation • Engage in bidding partnerships in wind power projects • Biomass power generation in a thermoelectric power supply plant • Next-generation thermal units (geothermal facilities, heat pumps and heat production systems utilizing renewable energy including solar heat) 	<ul style="list-style-type: none"> • Promote bicycle cities • Switch to new fuels (power, hydrogen, biofuels) in the traffic sector • Promote the use of public transit • Establish Intelligent Transport Systems (ITS) • Make investment plans to improve mobility 	<ul style="list-style-type: none"> • Ensure systematic consumption mapping and energy management • Facilitate construction of energy-efficient buildings • Introduce solar cells in city-owned facilities • Make city owners shift to new fuel vehicles • Implement green procurement (Add city's joint purchasing contract environmental requirements to achieve green growth)

	Energy consumption	Energy production	Green mobility	Efforts by municipal authorities
		<ul style="list-style-type: none"> • Convert peak production to carbon-neutral fuel for energy • Establish a new waste treatment center • Establish a food waste disposal center • Separate plastics in waste 		<ul style="list-style-type: none"> • Strengthen commitment to staff (Implementation of drills to raise awareness of environmental and climate change among municipal staff) • Shift to energy-efficient streetlights

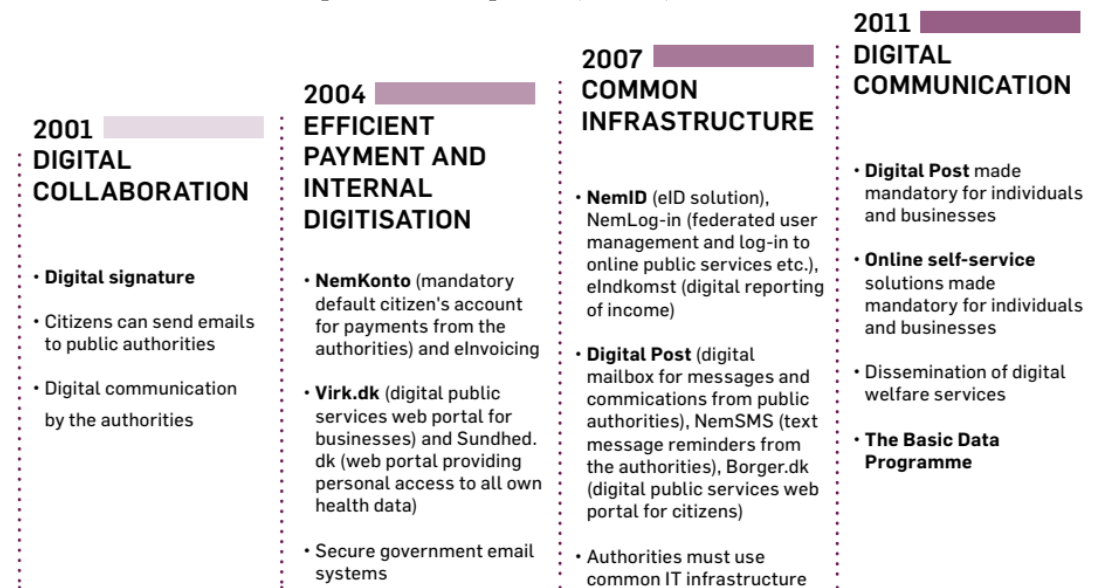
Source: "Danish Smart City" by Kensuke Nakajima, Gakugei Shuppansha

2) Digital Infrastructure Supporting Smart Cities

In Denmark, the digitization strategy (Digital Strategy 2016-2020) led to the construction of the digital infrastructure. Digitization is increasing among various documents and procedures making the potential for smart cities high.

An example of building a digital infrastructure:

- NemKonto: Citizen's essential account for payments from authorities
- NemID: Secure electronic authentication solutions (online authentication)
- Digital registration of real estate rights facilitates the purchase and sale of real estate.
- Portal (sundhed.dk) with access to personal health-data
- Single point (borger.dk) with access to all digital public services
- Public service portal for companies (virk.dk)



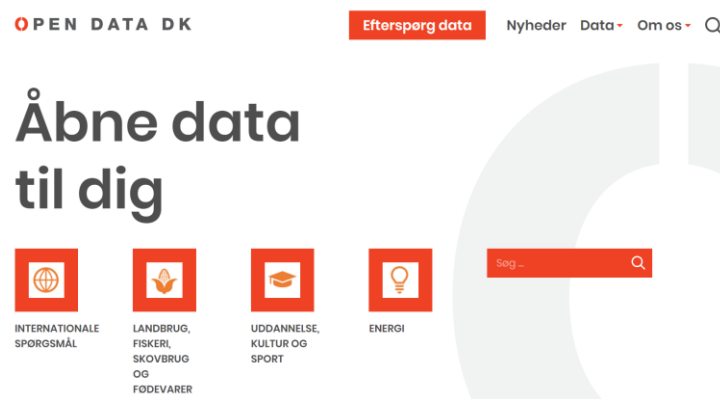
Source: Digital Strategy 2016-2020

Figure 3-14 15 years of Digital Strategies

In Denmark, various cities are cooperating to promote active open data.

Urban cooperation on data (major cities, other cities):

- City Pack (Ofs City, Copenhagen City, Odense City, Allbo City, Vayu City)
- Open Data DK (40 of 98 Danish municipalities participated in 2015)



Source: <https://www.opendata.dk/>

Figure 3-15 OPEN DATA DK

(6) History of Smart Cities

Denmark has been strongly concerned about the risk of running out of energy resources because of its size. This has become a strong driving force for it to aim for carbon neutrality. Copenhagen, the capital city, has decided to promote carbon neutrality by declaring that it plans to become the world's first carbon neutral capital in 2025. Smart cities, in this regard, have been promoted as one of the city's means to realize this goal.

(7) Supplemental Information According to Local Interviews

The items to be supplemented in Denmark's (Copenhagen) smart city policy are organized based on information obtained from local interviews.

Promote smart cities with the idea of solving problems from the perspective of the people

- The idea has taken root of positioning smart cities within green transitions and solving problems from the perspective of the people rather than being technology-driven.
- The smart city efforts in Copenhagen are not technology-oriented, rather, they focus on improving quality of life (QoL), economic growth, and sustainability by using technology.

Companies are sufficiently aware of the importance of green transitions

- Although Denmark is promoting green transition as a national policy, companies are sufficiently aware of such needs. Because the government has significant backup investment, companies are taking a proactive stance, which is playing a part in promoting smart cities.
- Although companies may need to bear additional costs for green transitions, in the EU, the European Green Deal policy provides incentives for corporations engaging in sustainable activities. There is also a framework in place to support the mindset of companies in corporate activities as they work to attain zero emissions by 2050, and obligatory reporting on the degree of goal achievement.

The most important conditions for government procurement are social impact and quality

- At a typical start-up in Denmark, products are developed on the concept of making people happy. Additionally, partnerships with the government have taken root, and prices are not the most important condition in government procurement, rather social impact and product quality are taken into consideration.

Scale-up of business in one's own country is an issue, but it is important to understand the target domain when expanding to other countries

- Denmark has been praised as a relatively easy environment for start-ups, however, scaling up is difficult due to the small size of the country. Additionally, prices tend to be important in other countries, so it is still difficult to develop.
- When scaling up, it is important to first establish effective use cases for PoC, and to provide services that take the local context into consideration according to the region where the rollout is planned.
- When expanding into Asia, some NPOs that support overseas expansion recognize that expansion in Japan is important, however, the lack of awareness of Danish start-ups in Japan is an issue.

Support by public specialized institutions to attract investments from overseas

- There exists a public institution (Copenhagen Capacity) that aims to attract investments

and lending from overseas and create business opportunities, and this also plays a role in foreign investment in promoting smart cities.

3-2-3 Finland: Helsinki

Since smart cities in urban areas of Helsinki are heavily influenced by and interconnected with smart city strategies at the national and municipal levels, we first outline the policies at the national level followed by efforts at the urban level.

(1) Finnish National Smart City Strategy

1) Country-Level Smart City Strategy: 6Aika Strategy

As a Finnish national-level smart city strategy/policy, Finland has set a 6Aika (Six City) strategy and is promoting smart cities in six cities (Helsinki, Espoo, Vantaa, Tampere, Turku, Oulu), where 30% of the country's population live. 6Aika aims to create cities that will serve as a global model through the development of infrastructure for innovation, and to strengthen the competitiveness of the entire country through its rippling effects on surrounding urban areas. It is an initiative that has been proactively promoted by six cities from 2014 to 2020 under the supervision of the Ministry of Employment and the Economy with a strong economic policy. Over the past six years, approximately 60 projects have been carried out in the areas of mobility, education, health and wellbeing, recycling-oriented economy, and energy.

In implementing this strategy, overall productivity gains and inclusiveness were aimed at encouraging participation of other cities and regions, as well as the public and private sectors, local communities, and citizens thereby making these efforts open and accessible.



Source: Smart Specialization Platform “Multi-level governance for Smart Specialization: 6Aika – The Six City Strategy” (2018) (<https://s3platform-legacy.jrc.ec.europa.eu/>)

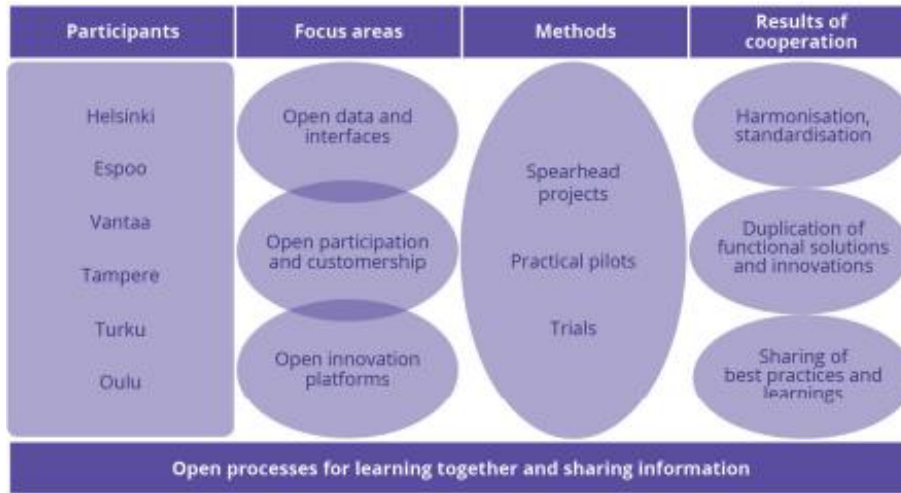
Figure 3-16 6Aika (Six Cities) Target cities

2) 6Aika (Six City) Strategy Policy

6Aika Strategy has the following three policies.

- **Open Innovation Platforms:** Provide platforms as an environment for experimenting and implementing new products and services in real cities.
- **Open Data and Interfaces:** Promote business activities such as SMEs and start-ups by ensuring data compatibility among cities and sharing and disclosing data on shared media.
- **Open Participation and Customer Ship:** Encourage innovation, create new services and improve public services through open and easy-to-use channels and systems through collaboration with users and consumers.

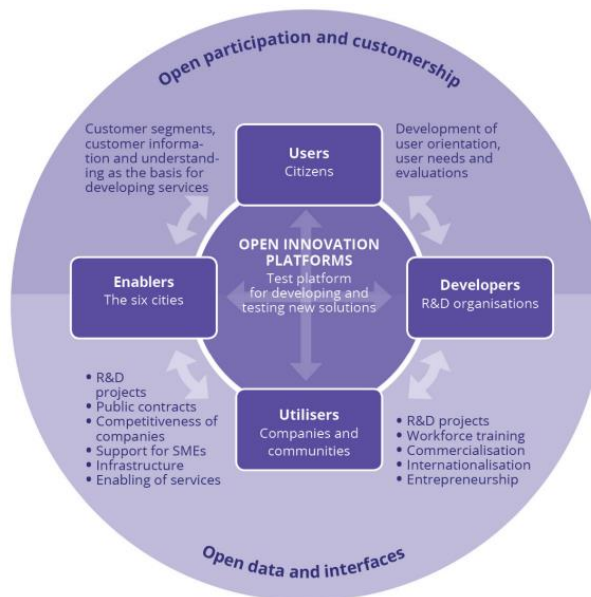
Demonstration and social experimentation of new technology are carried out under the above policy. Furthermore, it promotes following standard procedures for full-scale implementation and horizontal development accompanied by an open exchange of knowledge and best practices.



Source: 6Aika, European Union “The Six City Strategy – Open and Smart Services” (2014)
https://6aika.fi/wp-content/uploads/2015/11/6Aika-strategia_p%C3%A4ivitys_2015_EN.pdf
 Figure 3-17 6Aika (Six City) Policy

The 6Aika Strategy, despite varying from city to city, is known to have a strong strategic framework. It highlights the role of the Quadruple Helix of industry, government, academia, and citizens, and the collaboration among the four actors: the six cities as Enabler, enterprises, and communities as Utilizer, researchers as Developer, and citizens as User.

6Aika's Three Guidelines: Under Open Innovation Platforms, Open Data and Interfaces, and Open Participation and Customership, it aims to organically collaborate with these diverse entities while sharing data and knowledge based on open and easy-to-understand methods and processes on a common platform.



Source: 6Aika, European Union “The Six City Strategy – Open and Smart Services” (2014)
https://6aika.fi/wp-content/uploads/2015/11/6Aika-strategia_p%C3%A4ivitys_2015_EN.pdf
 Figure 3-18 Quadruple Helix of 6 Aika (Six City)

3) 6Aika (Six City) Strategy Implementation Budget

The size of the public budget prepared for the 6Aika Strategy is 80 million Euros. Fifty percent of the budget is from the European Regional Development Fund (ERDF), 17% is from the national budget and 33% from the cities. In addition, although not a specific nominal budget for 6Aika Strategy, the European Social Fund (ESF) is also available for individual municipal projects. Including this, would bring the total public budget to 100 million euros.²

The use of ERDF and ESF budgets requires projects to meet the funding objectives (i.e., to correct regional disparities and enhance regional connectivity in the case of ERDF, to create jobs and provide social security in the case of ESF). It also requires budgets to be used according to the European Commission guidelines. Of the projects implemented, 40 are budgeted according ERDF requirements while 19 are budgeted according to ESF requirements.

Proposals are received for 6Aika Strategy projects, which are evaluated and selected based on their ability to match and fulfill urban needs, feasibility, conformity to budgetary requirements, and consistency with 6Aika guidelines.



Source: European Commission (2018): “Integrated Sustainable Urban Development Strategies”
https://ec.europa.eu/regional_policy/sources/conferences/udn_espoo/6aika_peer.pdf

Figure 3-19 Budget Allocation for ERDF in 6 Aika (Left) And Budget Allocation for ESF (Right)

4) Examples of Projects in 6Aika

i) Last Mile Project (Mobility)

The Last Mile Project is a mobility service available in Aviapolis of Espoo's waterfront area, Nuukio park, Jatkasaari district of Helsinki, and Vantaa to meet the travel demands of commuters, citizens, and tourists. It includes the development and piloting of a booking app for boats called Bout.

In this project, 200 organizations participated in the joint development of services, and 20 pilot projects were carried out. In addition to continuing efforts by Jatkassari Mobility Lab to develop services in Helsinki, this project continues to serve commuters in Espoo and Vantaa.

² European Commission (2018): “Integrated Sustainable Urban Development Strategies”
https://ec.europa.eu/regional_policy/sources/conferences/udn_espoo/6aika_peer.pdf

ii) Autonomous Buses (Mobility)

The SOHJOA Project, which featured autonomous buses, was carried out with the deployment of these buses in a normal traffic environment coexisting with ordinary vehicles on public roads in Helsinki, Espoo, Tampere, and Vantaa. Innovation-oriented small and medium-sized tech companies, universities, research institutions, etc. participated in the project. Technical knowledge was gained through piloting these services and products while data collected was shared with universities and researchers for analysis and later fed into the development of a platform for Finland's automated driving technology.

Start-ups like Sensible 4 started as a spin-off of the SOHJOA Project. Sensible 4 cooperates with Ryohin Keikaku Co., Ltd. (MUJI) for the conceptual design and pilot testing of automated driving vehicles called GACHA.

iii) The City IoT Project (IoT)

This project aimed to secure mutual compatibility of IoT systems with urban data. It was also an initiative for the integrated management of these systems through standard definition, reference building, and API improvement of open and integrated data platforms. Parallel to the construction of these data platforms were the implementation of pilot projects related to infrastructure management (monitoring of road conditions, etc.).

A total of 160 companies and organizations participated in the project where 42 pilot projects were carried out in the cities of Tampere and Oulu. These data platforms employ Fiware technologies through the continuous involvement of Tampere University and University of Oulu.

iv) Energy Wise Cities Project (Energy)

Energy conservation in residential and municipal public facilities (schools, sports facilities, day care centers, etc.) were promoted through carrying out ESCO pilot projects, energy management business at the district level, renewal of energy facilities, etc.

In six cities, 227 companies and organizations participated, and various pilot projects were carried out through coordination and co-creation among cities, private enterprises, and users.

v) HIPPA Project (Living and Well-being)

The HIPPA Project, which is being promoted as a smart service business involving Finnish service houses (houses for welfare services such as houses for the aged), the development of safety limits, testing of applications as a communication tool for families and staff, and the development of tools for promoting exercising were carried out.

More than 100 organizations in various fields such as healthcare, ICTs, buildings, and real estate cooperated in this project. Demonstrations were carried out at facilities such as Tampere, Oulu, Helsinki. The project aims to follow a user-centered service design by establishing a TUTTU net testing and support network as a platform for linking users, experts, researchers, and businesses for co-creation. Furthermore, the Metropolia University of Applied Sciences will operate it even after the demonstration projects have concluded.



Last Mile Project



Autonomous Buses

Source: The Aika Strategy Office, "Era of Cities" <https://6aika.fi/en/6aika-results-era-of-cities/>



CityIoT Project



HIPPA Project

Source: 6Aika homepage (<https://6aika.fi/en/project/>)

Figure 3-20 Advanced Cases of Projects in 6 Aika

5) Assessment of 6Aika Projects and Utilization of Results

Budgets and programs for 6Aika strategies have ended in 2020. As noted previously, many projects that have been implemented are still being continued even after the end of the program. The program is also recognized for achieving certain results in establishing mechanisms such as the creation of the Quadruple Helix between the private, public, academia, and the citizens, as well as knowledge sharing among cities in aspects other than actual project formation and technological development. This has laid the foundation for developing smart city initiatives in other cities since 2021.

(2) Helsinki Smart City Overview

Helsinki's smart city initiatives are linked to the 6Aika (Six City) Strategy's efforts, a Finnish national-level strategy, to build platforms for creating new technologies and services through innovation in collaboration with diverse entities such as local companies, citizens, communities, universities, and research institutions.

Co-creation is a key element of the 6Aika (Six City) Strategy and Helsinki City's strategy. In creating new technologies/projects, the government, academia, and private sectors are participating in agile society experimentation and pilot projects. Technologies that have gone through these experiments and had satisfactory results are then implemented in the city.

Vision for smart cities	<ul style="list-style-type: none"> • Helsinki envisions itself according to its City Strategy (2017-2021) as “The most functional city in the world”, aiming for a fair, forgiving, open and inclusive society. • In this strategy, the city of Helsinki stipulates that it will become a platform for pilot projects and innovation in businesses, and that it will realize carbon neutrality by 2035. Smart city initiatives are also being promoted under the vision and its policies.
Smart city promotion system and organizations	<ul style="list-style-type: none"> • The 6Aika Strategy, which is a Finnish national-level strategy, is overseen by the Economic Development Department of Helsinki. • Forum Virium Helsinki, a non-profit organization that promotes digital services and innovation and is positioned as an innovation unit of Helsinki, plays a central part in the bridge and coordination among the industry, government, academia, and the private sector. • Other major players include 1) Helsinki Partners, a Helsinki City marketing-and investment-promoting public corporation, 2) Smart & Clean Foundation, a clean-development promotion organization, and 3) Uusimaa Regional Council, a prefectural capital in which the city of Helsinki is located.
Efforts in policy systems	<ul style="list-style-type: none"> • Helsinki is working as a flagship city for the construction of a platform for co-creation of new technologies and services by diverse entities such as local companies, citizens, communities, universities, and research institutions. • Kalasatama area and Jätkäsaari area are being used as smart city testbeds for experimenting, testing, and demonstrating new technologies and services. Initiatives include the promotion of mobility technologies and services such as MaaS and automated driving, technologies leading to a decarbonized society such as smart grids, as well as proposals for new lifestyles utilizing IoT technologies. • The Agile Piloting Programme was devised and introduced to conduct pilot projects involving citizens in a short period of time, reliably and effectively in smart cities of the Kalasatama area. This program extends beyond Helsinki to other cities, areas, and businesses.
Others: Framework for resident participation	<ul style="list-style-type: none"> • Helsinki aims to become a user-oriented smart city and promotes participation of users and citizens at each stage of conception, planning, execution, and evaluation of the pilot projects. It also aims to improve the quality of technologies and services through open innovation.

(3) Basic Concept and Vision

Helsinki City Strategy (2017-2021) has been established as a top-ranking strategy for Helsinki. Various initiatives related to smart cities are being promoted as measures to realize the vision of it being the most functional city in the world.

Furthermore, various strategies and plans, including traffic plans and environmental action plans in Helsinki are consistently set under the umbrella of the city's strategy. The

strategy and traffic plans are described below:

1) Helsinki Strategy (2017-2021)

Helsinki's vision of City Strategy (2017-2021) is to be the most functional city in the world while aiming for a fair, forgiving, open and inclusive society. In this City Strategy, four policies are set in line with this vision.

- Securing sustainable growth, the most essential task of the city: Set targets for achieving carbon neutrality by 2035
- Developing services: Helsinki City will serve as a platform for pilot and innovation businesses.
- Responsible management of finances, the foundation of a prosperous city: Sound and sustained financial operation
- Helsinki strengthens and diversifies its promotion of interests: As Finland's capital and largest economic base, it will disseminate value both domestically and globally, centering on its strengths in digital technology and climate change initiatives.



Source: Helsinki City (2017): "Helsinki city strategy 2017-2021"

<https://www.hel.fi/en/decision-making/decision-making/strategy-and-economy/strategy>

Figure 3-21 Strategic Axis in Helsinki City Strategy 2017-2021

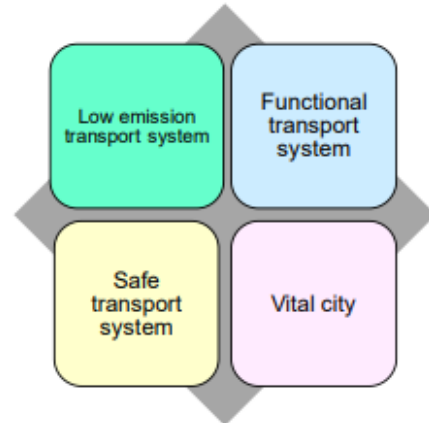
2) Helsinki Intelligent Transport System Development Programme 2030

Intelligent Transport System Development Programme is linked with the city's vision and defines the vision for its transport system as follows:

"Together with the ecosystem, the vital Helsinki will create the world's most functional, efficient and safe carbon neutral transport system. Helsinki will use intelligent systems to cost-effectively address the diverse needs of people and logistics and support their sustainable choices. Everybody will feel safe in traffic."

The following four goals are set for the achievement of this vision.

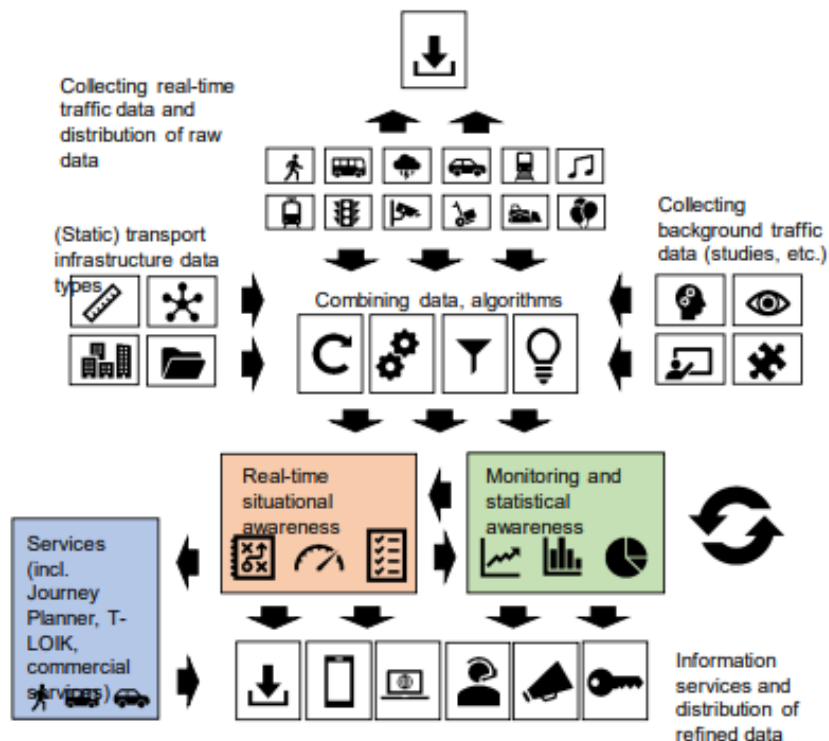
- Low emission transport system: Reduce CO₂ emissions from the transport sector by 60% and reduce noise and pollution by 2030.
- Functional transport system: Establish reliable and efficient systems, improve connectivity between modes including bicycles, track traffic, create good urban spaces, and improve logistics efficiency.
- Safe transport system: Reduce accidents and make citizens feel safe and secure when moving.
- Vital City: Promote corporate growth and attract global companies as a platform for creating projects by sharing and utilizing data and testing new mobility businesses.



Source: Helsinki City (2019): “Helsinki Intelligent Transport System Development Programme 2030”

Figure 3-22 Four Goals

The program highlights the importance of comprehensively gathering and highly utilizing various data from various entities toward program planning, monitoring, evaluating, and creating new services for the achievement of the program’s goals. It aims to aggregate information from various sources into a common platform and provide relational entities with open interfaces after efficiently extracting and connecting reliable real-time data, time series data, and related data with the relevant algorithms.



Source: Helsinki City (2019): “Helsinki Intelligent Transport System Development Programme 2030”
<https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-16-19-en.pdf>

Figure 3-23 Comprehensive Data Utilization Concept

The following seven themes are set up in this program.

Table 3-4 Contents and Budget Size of Helsinki Traffic Program

Package of measures	Investments (tEUR)	Operating costs (tEUR)
1. Developing platforms for the collection of traffic data	1,250	380
2. Developing situational aware-ness, monitoring, and statistical awareness	2,000	180
3. Interactive and collaborative Traffic Management 2.0	1,500	123
4. Developing traffic light control	1,050	130
5. Economic instruments	-	150
6. Public transport system that utilizes automation	100	180
7. Physical and digital infrastructure for self-driving vehicles	1,500	100
Total	7,400	1,243

Source: JICA Study Team

(4) Organization and Promotion System

Based on the national and municipal planning systems, various initiatives are being promoted by several bureaus and related organizations in Helsinki. More specifically, the smart city of Helsinki has played a central role in the bridging and coordination among industry, government, academia, and private actors by Forum Virium Helsinki.

The main components of Helsinki's smart city efforts are summarized below:

1) City of Helsinki

Initiatives from the 6Aika Strategy are overseen by the Economic Development Department, which is under the Central Administration City Executive Office of Helsinki. Urban space planning and transportation planning are also supervised by the Urban Environment Division.

2) Forum Virium Helsinki (FVH)

Forum Virium Helsinki (FVH) is a non-profit organization in Helsinki that promotes digital services and innovation and plays a central role in bridging and coordinating efforts between the industry, government, academia, and private entities while conducting demonstration experiments and pilot projects for smart city initiatives. FVH supports the development of various businesses in the past, including traffic information platforms and Helsinki Region Infoshare, which have already been implemented through demonstration tests conducted in the city, in cooperation with private, civilian, university, and research institutes.

FVH's main business areas include smart cities, wellbeing, media, new public procurement, innovation communities, and business incubation. Regarding smart city businesses, there are cases where it manages the entire project and is involved in the entire full project life cycle through various roles involving advisory, coordination, and project evaluation at the conceptual and implementation stages. Most of the budget for these activities is provided by the city government office and is partly derived from the EU fund.

Media and communications-related companies such as Elisa, Nokia, TeliaSonera, Tieto, YLE Finnish National Broadcasting Corporation joined together to establish this

organization in 2005 for the purpose of developing digital services that meet the needs of users through public-private and civilian cooperation.

3) Jätkäsaari Mobility Lab

Jätkäsaari area served as a testbed to support tech companies and start-ups for scaling-up their business. The Mobility Lab supports digital solutions related to mobility, and large-scale infrastructures as well as district developments that are not included in the project scope.

The budget is derived from the Innovation Fund of Helsinki.

4) Business Finland

Business Finland is a national organization under the Ministry of Employment and Economy, which provides financial support for new industries, innovation projects, and R&D to promote Finnish industries.

Originally, financial support for R&D was provided by Tekes: The Finnish Funding Agency for Technology and Innovation established in 1983, which provided support for companies and projects related to smart cities. Since 2018, it has been integrated with Finpro (Finnish External Trade Organization) to create and promote new industries in an integrated manner, including the strengthening and fostering of export industries.

5) VTT: Technical Research Center of Finland

VTT Technical Research Center of Finland Ltd is a research institute that conducts applied research in technical fields for devising practical solutions. After its merger with the Finnish National Institute of Standards Certified Research (Center for Metrology and Accreditation: MIKES) in 2015, the company became a limited liability company owned by the country.

Through the utilization of research and knowledge, VTT aims to provide specialized services to domestic and overseas customers and partners in both private and public sectors. Regarding smart cities, VTT has a track record of collaboration with many companies in the concept design and demonstration stages of innovative projects for transportation, the environment, and energy.

(5) Policy System

Helsinki is conducting a variety of demonstration projects, known as the “Agile Piloting Programme”. The program facilitates testing and demonstration of new technologies in a short-term, low-budget, real-world setting. The program has been introduced in the urban areas of Kalasatama, and has been applied not only in Helsinki, but also in other Finnish cities and Stavanger, Norway, because of its success.

1) Objectives of Agile Piloting Programme

The Agile Piloting Programme is a program that aims to test and demonstrate new techniques and services in real-world environments in a short period of time and with a limited budget. The program is intended to facilitate learning together and emphasizes the importance of the participation of many entities, such as private enterprises, research institutions, and citizens. It also promotes the use of open and accessible information and transparent processes in the implementation of pilot projects.

The program was devised as a lesson from technology-driven failures in large, closed smart-city projects and was first introduced in Kalatasama region.

2) Characteristics of Agile Piloting Programme

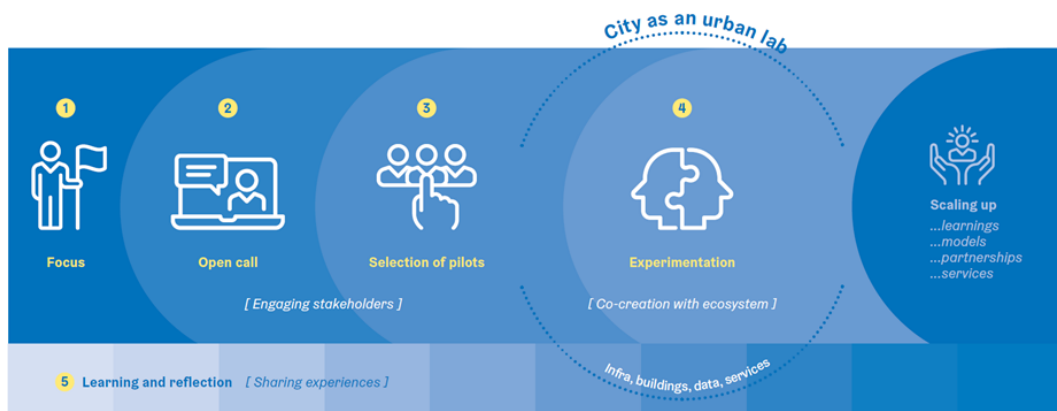
The features of Agile Piloting Programme are as follows.

- **Generating Synergies:** The program typically implements 3-5 pilots simultaneously to create synergies and collaborations with other pilots and to optimize cost-effectiveness.
- **Demonstration tests in a “living” lab:** The center provides an experimental site for buildings in areas where people live, schools, welfare facilities, etc., and provides direct feedback on services from citizens, users, etc., leading to improved services.
- **Promotion of Co-creation through a Facilitator:** Facilitators (e.g., Forum Virium Helsinki, etc.) promote co-creation by coordinating with various entities and activities.
- **Simplified procurement models:** Pilots cost typically around 5,000 to 10,000 euros on a budget scale, making it easier for SMEs and start-ups to participate.

3) How Agile Piloting Programme Works

Agile Piloting Programme is carried out according to the process shown below.

1. **Definition of objectives:** After setting pilot project objectives and scope, key stakeholders and detailed issues are identified.
2. **Public solicitation:** Public solicitation to connect with potential solution providers is conducted.
3. **Pilot selection:** Qualified proposals are selected considering the established criteria.
4. **Demonstration experiment:** A demonstration experiment is prepared and carried out by the project team with a duration of up to 6 months. The facilitators (Forum Virium Helsinki and others) will provide support for the promotion of collaboration and co-creation among stakeholders. They also facilitate various adjustments for the implementation of pilots (e.g., connectivity with urban infrastructures, support for obtaining licenses, administrative procedures, etc.), as well as gathering knowledge and lessons from pilots and information-sharing.
5. **Learning and feedback:** Since the purpose of the program is to maximize learning, it is necessary to evaluate the project and gather knowledge as well as lessons learned. Engagement with people such as researchers and consultants familiar with the program, is recommended at this time.



Source: Forum Virium Helsinki, (2020), “Pocket Book for Agile Piloting”

<https://fiksukalatasatama.fi/en/agile-piloting/>

Figure 3-24 Processing Agile Piloting Programme

4) Projects in Agile Piloting Programme

The following projects have been implemented in Agile Piloting Programme.



Smart Pedestrian Crosswalk



Urban food logistics



Personalized meal bags



Prototype rain garden

Source: Forum Virium Helsinki, (2020), "Pocket Book for Agile Piloting"

<https://fiksukalatatama.fi/en/agile-piloting/>

Figure 3-25 Example of Agile Piloting Programme

(6) Technologies and Systems

Kalatatama area and Jätkäsaari area are being used as smart city testbeds for the demonstration and pilot testing of new technologies and services. Efforts are mainly focused on advanced mobility technologies and services such as MaaS and automated driving, a decarbonized society such as smart grids, as well as proposals for new lifestyles utilizing IoT technologies. The following is a summary of the projects carried out on these two test beds.

1) Technologies/Systems in Smart Kalatatama

i) Outline of R&D Project in Kalatatama Area

In 2013, Helsinki decided to redevelop 175 hectares of land in the Kalatatama area, where port facilities, plants, and warehouses were located as port areas, into a Smart District. The district is planned to be developed as a residential area, with a population of 25,000 and is expected to create 10,000 jobs in 2035. The population reached 3,500 in 2019.

Forum Virium Helsinki is leading the field for demonstrations and experiments of various smart technologies and services which will be used to build and equip the smart cities. More than 140 companies and private organizations have participated in the smart-

city project in the Kalasatama area, and one-third of the residents have participated in the project.



Source: Fiksu Kalasatama “Smart Kalasatama

https://fiksulalasatama.fi/wp-content/uploads/2015/08/Fiksu_KS_MIPIM_FINAL_web_pages.pdf

Figure 3-26 Outline of Smart City Initiatives in Smart Kalasatama Area

ii) Smart City Vision in Kalasatama Area

The smart city initiative in the Kalasatama area envisions increasing disposable hours by one hour, or “one more hour a day,” by incorporating a variety of technologies for increasing convenience in all aspects of living.

iii) Kalasatama Area Smart Technology: Automated Waste Collection System

A huge investment was made for the development and implementation of an automatic collection system utilizing the underground spaces for efficient waste treatment without depending on garbage collection vehicles. The trash posts installed in each block are connected by underground pipe networks where trash is collected at the base via pneumatic pressure.

Electronic keys for the processing facility were distributed to all residents. Whenever someone with a key would approach, the door automatically opens. Each electronic key is assigned an identification number that is associated with the owner of the key, making it possible to acquire data on how much garbage is produced by each resident.



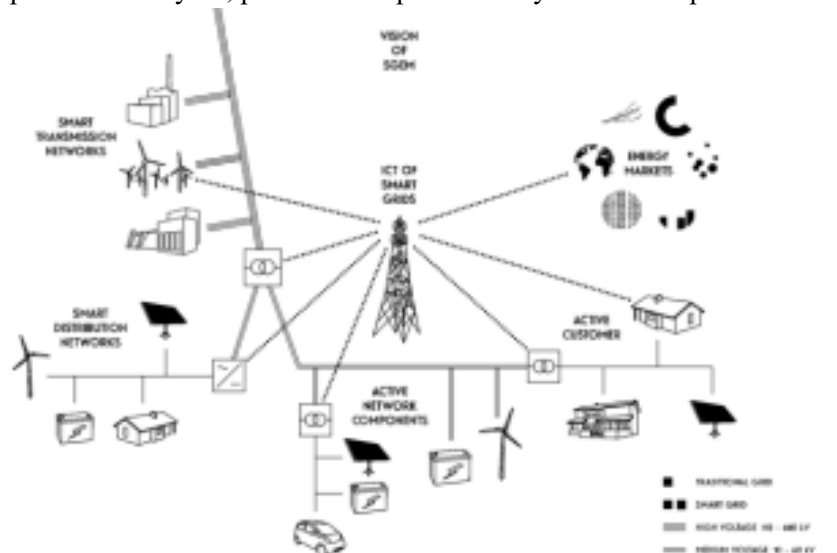
Source: Presentation material by Forum Virium Helsinki, “Smart Kalasatama”

<https://www.ekyl.ee/wp-content/uploads/Vanhanen-17042019.pdf>

Figure 3-27 Automated Garbage Collection in Smart Kalasatama Area

iv) Kalasatama Area Smart Technology: Smart Energy

Kalasatama area is composed of smart grids, and by incorporating the prediction of electric power loads by AI, peak cut and peak shift by demand response are enabled.



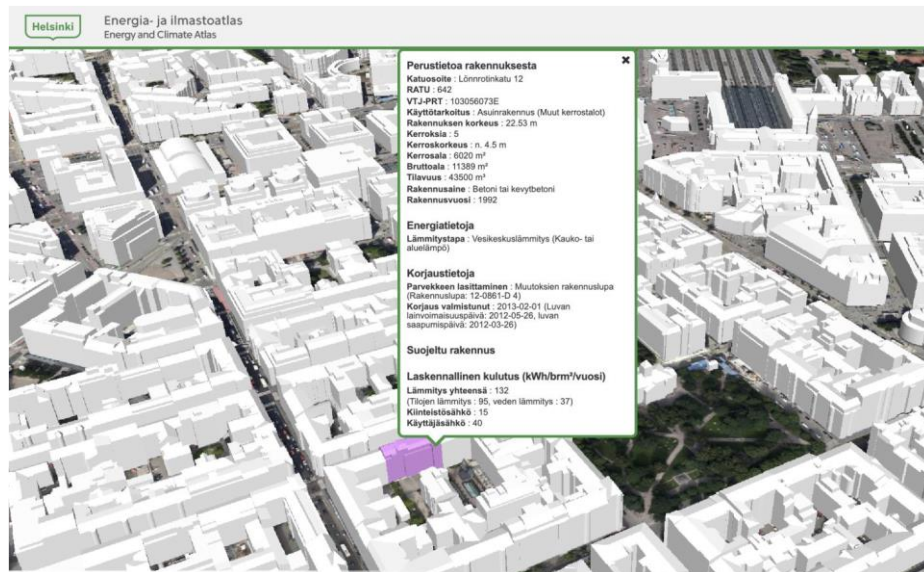
Source: Presentation material by Forum Virium Helsinki, “Smart Kalasatama”

<https://www.ekyl.ee/wp-content/uploads/Vanhanen-17042019.pdf>

Figure 3-28 Smart-Grid in Smart Kalasatama Area

v) Kalasatama Area Smart Technology: Digital Twins Project

A 3D model (digital twin) of the Kalasatama area has been constructed and published as open data. The digital twin is expected to be utilized as a tool for information sharing and communication with inhabitants as well as for simulating the deployment of services and hydraulic analysis.



Source: Presentation material by Forum Virium Helsinki, “Smart Kalasatama”
<https://www.ekyl.ee/wp-content/uploads/Vanhanen-17042019.pdf>

Figure 3-29 3D Digital Twin of Smart Kalasatama Area

2) Technologies/Systems in Mobility Lab of Jätkäsaari

i) Outline of R&D Project in Jätkäsaari Area

In 2009, Helsinki decided to redevelop the Jätkäsaari area (about 100ha) where port and distribution facilities were located. It became a test-bed area for demonstrating and pilot testing advanced mobility projects.

Redevelopment projects in the district were planned to take place in from 2010 to 2025. The district is expected to have a population of about 16,000 and create 6,000 jobs by 2030. The population grew to 8,500 in 2019.

ii) Mobility Demonstration of Mobility Lab

Mobility Lab utilizes Jätkäsaari as a testbed to support tech companies and start-ups in up-scaling their products and services through pilot-testing and demonstrating smart mobility technologies and services. This area provides an environment for pilot and demonstration projects to be tested with actual users and residents in actual building areas. The company is also focused on the development of smart infrastructures in the district such as sensors and the introduction of a signal system that can be controlled within the district.

iii) Mechanism of Mobility Lab's Mobility Demonstration Project

Mobility Lab cooperates with Forum Virium Helsinki and the Helsinki-Uusimaa Regional Council to conduct various demonstration projects in Jätkäsaari.

Through Forum Virium Helsinki's leading Agile Piloting Programme, the company has maintained a track record of successfully facilitating several pilots, including hailing services for smart crossing and boats, and low-carbon distribution and mobility services using bicycles. It also established the Mobility Launchpad program utilizing ERDF's European Funds in collaboration with Helsinki (Helsinki-Uusimaa Regional Council) to promote mobility projects for small and medium-sized enterprises as well as start-ups. The project was carried out from 2018 to 2020 with a budget of 650,000 euros (of which

the budget for Forum Virium Helsinki was 305,839 euros).

iv) Example of Mobility Lab's Mobility Demonstration Project

- Trombia Free Street Sweeper: Since April 2021, Mobility Lab has been pilot testing an automated street sweeper, a low-noise, low-emission autonomous vehicle that can operate in residential areas.
- Automated Delivery Vehicles: Demonstration and pilot testing of home delivery robots, which deliver goods to residents' doorsteps autonomously began in November 2021.

Smart Pedestrian Crosswalk: Sensors and cameras are attached to traffic signs on pedestrian crossings in the Jätkäsaari area to collect vehicle traffic information (such as speed and traffic volume). A warning system for pedestrians was developed and pilot tested based on this data.



Trombia Free street sweeper



Automatic delivery vehicle



Smart Pedestrian Crosswalk

Source: Helsinki City website (<https://www.hel.fi/uutiset/en/>)

Figure 3-30 Example of Business in Mobility Lab Area Of Jätkäsaari

3-2-4 Netherlands: Amsterdam

(1) Overview

The smart city initiatives of the city of Amsterdam are grounded on the strategic use of ICT to achieve the goal of “reducing greenhouse gas emissions by 40% by 2025 compared to 1990 levels”. This was proposed in the New Amsterdam Climate action plan for Climate Change in 2008. This led to the establishment of Amsterdam Smart City (AMC) in 2009, a consortium owned by the public and private sectors. Initially, AMC has been the key facilitator for energy-related projects at the beginning. It then led to more diverse inter-related projects run by the partnerships with various actors through AMC’s open platform, which was fostered by the increasing interest among civic participants and the growing network of academic, public, private, and civic groups.

<p>Expected benefit and vision</p>	<ul style="list-style-type: none"> • At the beginning of the Smart City initiative, many energy-related projects, such as the reduction of greenhouse gas emission, were proposed and implemented as a response to the city's climate change action plan, which was called the “New Amsterdam Climate” issued in 2008. • As efforts continue, a wide range of projects are promoted to provide the solutions to wider urban issues, such as improvement of the living environment and transformation to a circular economy, through the participation of a wide range of actors -typically the participation of citizens.
<p>Organization and implementing partners</p>	<ul style="list-style-type: none"> • Supported by the policy of the Amsterdam City, Amsterdam Smart City (ASC) facilitates the programs and individual projects in cooperation with various partners including the private sector, research institutes, and communities.
<p>Policy and institutional development</p>	<ul style="list-style-type: none"> • The uniqueness of the smart city initiative of Amsterdam is represented by the open platform that promotes the partnerships of different sectors and multiple layers of organizations; allow the peer-to-peer sharing of each other’s ideas and resources, and co-create the solutions and new values. • Summarizing the development process to date, it is divided to two stages: (i) Experimental stage in which participating companies were expanded and the range of data and knowledge sharing was gradually expanded; and (ii) Development stage based on the accumulation and experience of the experimental phase, in which activities are directed more arbitrarily or intentionally induced innovation in line with the city's vision and goals.

(2) Basic Concept Vision

To adapt and to take lead of a knowledge-based urban and industrial transformations through ICT centered innovation is the important national strategies for the Netherlands and regional states, and Amsterdam City the top economic hub in the Netherlands, shares the vision.

As for the concept of Amsterdam City, the utilization of ICT-based innovation is considered to be indispensable to solve urban challenges to targeting the higher objectives,

such as decarbonation, improvement of urban resilience, and vitalization.

A mechanism of innovation as a means to solve urban challenges has been established through the development cycle of planning, demonstration, monitoring and evaluation by industry, government, and academy with the participation of citizens, and the wide dissemination of the experience.

(3) Organizations

1) Amsterdam Smart City (ASC)

Amsterdam Smart City (ASC), a subordinate organization under the Amsterdam Economic Council, was jointly established in 2009 by the Foundation Amsterdam Innovation Motor (AIM), Liander, and the city government of Amsterdam. The AIM is an organization that aims to promote knowledge-based industries in Amsterdam while Liander is a power grid company.

The mission of AMS is to work towards a smart, green and healthy future of the Amsterdam Metropolitan Area, by improving the quality of life of citizens through the utilization of data and technology. For that purpose, they emphasize the value of data and knowledge sharing as well as collaborative learning.

With these goals in mind, the ASC initially led projects. However, a mechanism to mutually collaborate and develop demonstration and pilot programs was eventually created through the cooperation of various entities including the participation of citizens on the open platform, which led ASC to gradually shifted its role into that of a facilitator; as such, the organization was recognized as a model for establishing systems of innovation.

Initially, the project formation was closely linked to the efforts of Amsterdam's climate program, "New Amsterdam Climate" (issued in 2008), focusing on CO₂ reduction and environmental sustainability through the active use of ICT technologies. In 2009 and 2010, pilot projects including smart meters, smart lighting, building energy management systems (BEMS), and electric vehicles, were implemented.

The costs associated with the early stages of ASC (2009-2011) was Euro 4 million (USD 4.9 million). This was shared among the city of Amsterdam (20%), private corporations (40%), and the European Reconstruction Fund (ERDF) (40%). Currently, a variety of funding sources such as partner corporations and public grants (EU funding, national and municipal) are tapped depending on the nature of projects.

As of October 2021, 22 permanent members, 652 organizations, and about 8800 individual "Innovators" have been registered. Permanent members pay the annual membership fees and are granted rights to participate in decision-making for the operation of the ASC and other privileges.



Source: Amsterdam Economic Board “Smart Stories”

Figure 3-31 Amsterdam Smart City Permanent Member

2) The City of Amsterdam

The Chief Technology Officer (CTO) was a new position created by the city in 2014. The innovation team that is led by the CTO plays a vital role in quickly assessing new initiatives and linking them to practical use while collaborating with businesses, research institutions, start-ups, social organizations, and civil communities.

The Research, Information and Statistics Division (OIS), collects, analyses, and process city-data. It also has research functions and plays a major role in managing open data, which heavily supports smart city-related activities as well as provides for the data-related needs of various city departments and innovation teams.

OIS develops and manages DataPunt and related websites, which provide data to the municipal government. It also provides data and data products to the city and its citizens. It also holds a workshop called DataLab and supports the operation of knowledge centers and open stages for data experts and people who are interested in data-based jobs and activities.

3) Incubators, Community Organizations, Universities and Research Organizations

Amsterdam Institute for Advance Metropolitan Solutions (AMS Institute)³

The AMS institute is an educational and research institute established in 2014. Delft Institute of Technology, University of Wageningen, and MIT built the foundation for its establishment while CTO of Amsterdam provided support.

It is an educational and research institute specializing in smart cities, which develops comprehensive solutions for the challenges of large cities including Amsterdam. By attracting smart city professionals to Amsterdam and increasing their number, it

³ <https://www.ams-institute.org/>

strategically supports Amsterdam's vision of becoming an innovation hub in the world.

In addition to Amsterdam City and organizations related to urban innovation, comprehensive consortia, which are formed on a project basis by several research institutions, public organizations and private enterprises, work with Amsterdam's city government and civil platforms. Notable activities of the consortia also include providing support for start-ups.

Currently, the research portfolio in urban challenges includes smart urban mobility, urban energy, climate resilient cities, circularity in urban regions, metropolitan food systems, and responsible urban digitization.

City Innovation Exchange Lab (CITIXL)⁴

The City Innovation Exchange Lab (CITIXL) is an organization jointly established by the city of Amsterdam and the private sector. Working in conjunction with ASC and AMS, CITIXL links the city and city partners to citizens and creates a living Lab with cloud-sourced solutions. This method has revolutionized the process of designing, prototyping, testing and implementing, and sharing results. It also provides services to cities other than Amsterdam and partners by sharing and exchanging information through tours and workshops.

The Amsterdam Economic Board (AEB)⁵

AEB is a public-private partnership organization consisting of various organizations including the research organizations of local companies and universities, and governmental institutions. Three programs are overseen by the AEB - the Amsterdam Smart City, TECH CONNECT and HOUSE OVSKILL.

Furthermore, the AEB is working on the following themes: (1) promotion of initiatives to realize a recycling-oriented society; (2) promotion of digital technology and data-driven innovation; (3) energy; (4) realization of a healthy, long-lived society; (5) promotion of sustainable mobility; and (6) creation of a resilient and attractive labor market.

To achieve its goals related to the themes, AEB developed expertise in new trends and developments, present topics of high urgency, and as of October 2021, it has made policy recommendations for administration by conducting activities that promote the linkage of various organizations and citizens and organizing events and networking meetings.

Pakhuis de Zwijger⁶

Pakhuis de Zwijger renovated its cold-storage warehouse built in the 1930s into a multimedia warehouse consisting of five large and small halls, a cafe, and a restaurant. It then began operating it as a platform for creation and innovation in 2006. Events are held in an accessible, independent, and secure public meeting space for everyone, and are shared online.

The number of programs planned and run by Pakhuis de Zwijger and partners exceed 600 per year, addressing twenty themes related to future urban and metropolitan areas, the nation, and the world with seven major topics - societies, space planning, sustainability, technology, economy, democracy, and creative industries. The projects are also implemented to contribute to the creation of a better living environment for everyone.

⁴ <http://www.citixl.com/>

⁵ <https://amsterdameconomicboard.com/en>

⁶ <https://dezwijger.nl/>

Themes related to smart cities, such as “smart,” “tech for society,” and “green,” are incorporated into 20 ambitious goals, and play an important role as a platform for discussions on smart cities. These issues are tackled through the planning of events and meetings, which serve as avenues for exchanging information and discussing various cultural issues (e.g., privacy, data protection, public participation, etc.).

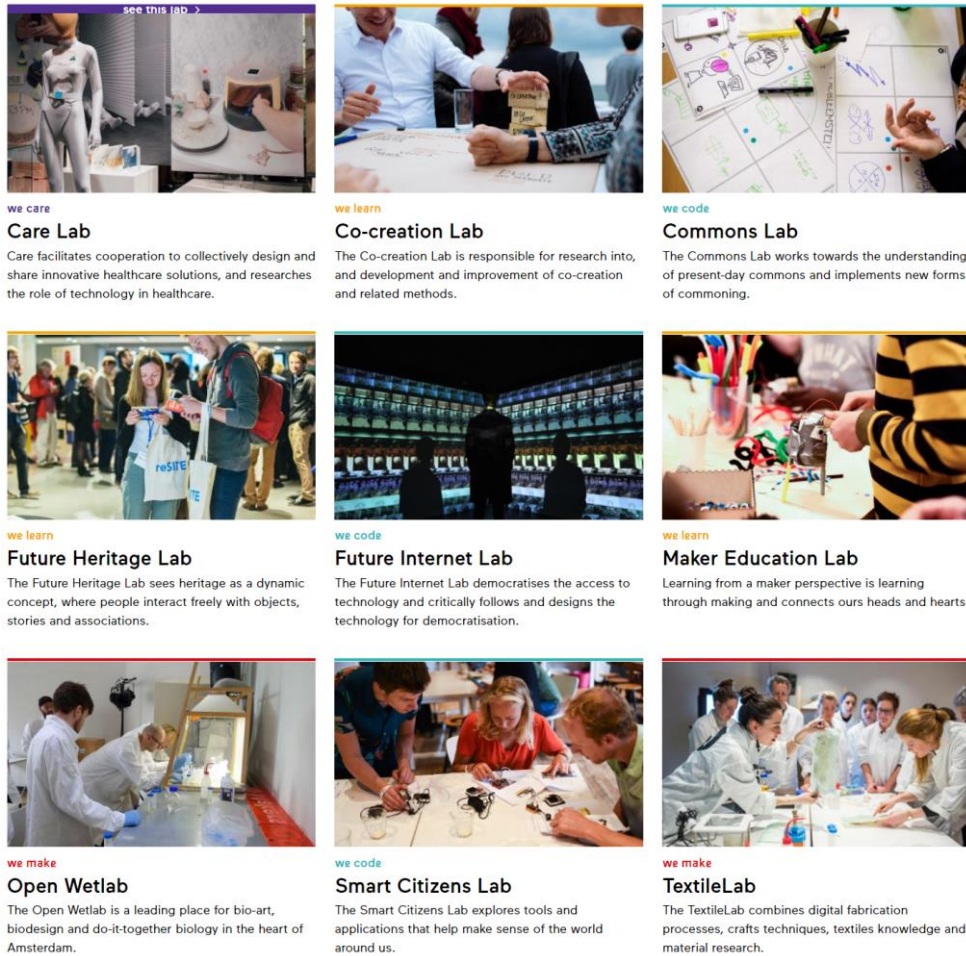
Waag Technology & Society⁷

Waag Society is a charitable foundation whose mission is to promote social innovation that connects citizens with cutting-edge technology and impacts society through open research and open-source technologies in cross-cutting areas, including art and science, and technology.

In 2021, the Ministry of Education, Culture, Science and Technology mandated the organization to act as a “Future Lab” in recognition of its achievements in its research activities and projects. These projects were recognized because they were open and shared as public domains. The organization facilitated fund-raising activities with government agencies, private enterprises, and research organizations and collaborated with them. “Future Lab” is defined as a center for developing designs in a future-oriented manner and using design and technologies for solving social issues.

Waag has twelve research labs, broadly classified into four areas: manufacturing, coding, cross-disciplinary learning, and care, all of which have a strong affinity for smart cities. These labs employ a method of “public research” that takes special attention to the social environment and the perspective of citizens, with the aim of empowering as many people as possible and enabling them to design their own future.

⁷ <https://waag.org/>



Source: <https://waag.org/en/research>

Figure 3-32 Waag Research Laboratory

Citizen-participatory programs and educational programs are also in place, providing a point of contact with citizens in government and private enterprise projects related to smart cities. Waag Society also catalyzed the establishment of a large number of social businesses and projects where it served as a center for incubation in social businesses.

(4) Policy System

The smart city concept is not directly a part of Amsterdam's vision but urban innovation using digital technology is incorporated in a strategy or tool to reach its vision. The current Amsterdam City policy (2019-2022) includes “innovation,” with the objective that new solutions utilizing data and technology are used for the benefit of Amsterdam’s citizens.

For that purpose, the bottom-up approach in which citizens participate is emphasized as a premise for and is incorporated in the philosophy of policy and system design. It views that the city, citizen organizations, and private enterprises are not competitors, but rather partners who walk together and support each other with bringing their own expertise.

On the other hand, since there are no policies or systems focusing on smart cities, the smart city elements are integrated into the policy and budget for challenges or issues in which the smart city solutions are considered to be effective. Examples include the sustainable city aimed for by Amsterdam, and their policy sectors, such as energy, transportation, circular economy, and adaptation to climate change.

Furthermore, funding activities are being carried out while coordination with other R&D agencies and measures for climate change and energy transformation as smart cities are major policies in the national and the EU agenda.

As the investment in urban infrastructure services such as energy, water, communications, and transportation, and private sector including tech companies become more active, it is considered essential to establish a robust business case, in addition to conventional CSR and charity, by promoting business through partnerships between the industry, government, academia, and communities. Thus, Amsterdam Smart City (ASC) has become a model in governing the whole process from the development to implementation of smart city technologies involving various parties.

(5) Technology and Tools

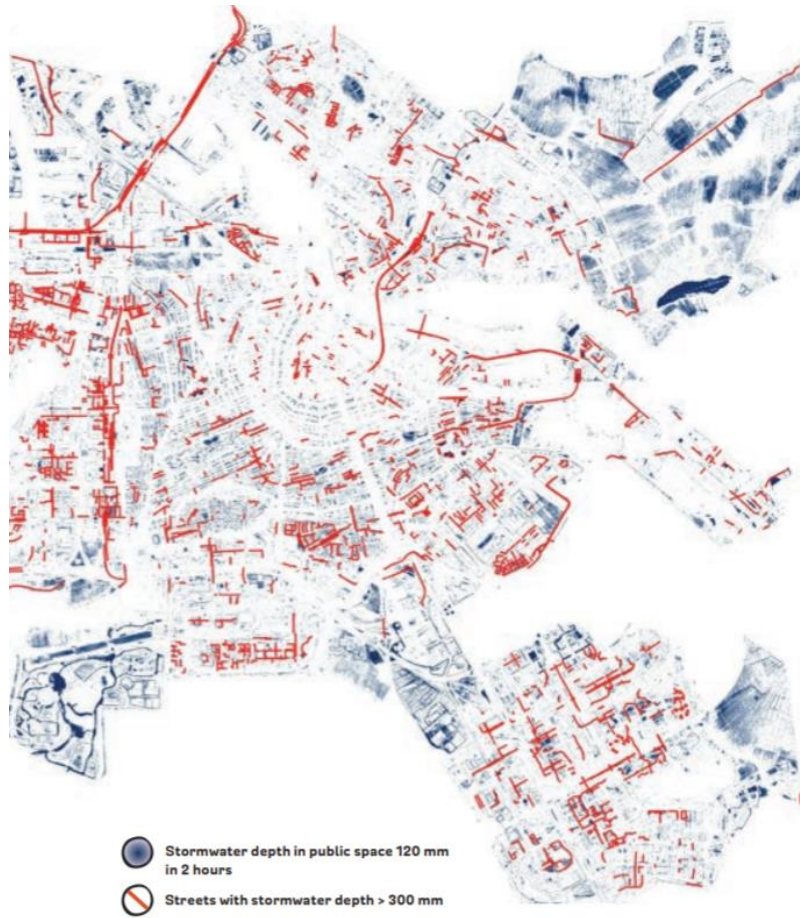
Community Development Resilient to Flood Damage by Information Provided by Citizens and Digital Technologies

Due to the low elevation of land, flood control has been an important subject throughout the history of the Netherlands.

Waternet and Siemens are carrying out pilot testing of a system that could evaluate risks caused by rising water levels and issue warnings by utilizing technologies such as the design of sensors and simulation models as well as AI-powered analysis of big data in Amsterdam.

In the Rainproof initiative, rainwater is stored on the rooftop and underground instead of discharging it directly. It is then used for providing water to gardens. As a result, the water circulation system is given relative importance with a mechanism being developed to adjust the amount of water in rivers and dams as a whole.

These efforts are based on detailed information with a fine mesh collected from the sensors installed in each location combined with the rainfall information reported by citizens through the app. It allows for the provision of sophisticated basin management including water storage and drainage by utilizing IoT to remotely control it.



Source: Amsterdam Smart City Homepage (<https://www.rainproof.nl/sites/default/files/rainproof-magazine-engels.pdf>)

Figure 3-33 Inundation Risk Assessment Using 3D Simulation Model

Buurzaam Wonen (Neighbourly Living) Project

As an energy-related pilot project in New West district (Geuzenveld) of Amsterdam, a smart meter and energy consumption monitor display was introduced in 60 houses.

The objective of the project was to raise awareness of the citizens of Amsterdam on energy consumption patterns and the behavior for sustainable energy consumption and deepen the debate.

The project also provided citizens with a hands-on experience in the use of smart meters and monitors and became an opportunity for business operators to try out a variety of technologies.

In the execution of this project, not only the participation of private service providers, but also the local governments cooperated to invite the wide participation of residents.



Source: Amsterdam Economic Board “Smart Stories”

Figure 3-34 Smart Living Solutions

eManagement Haarlem

eManagement Haarlem is a project that aims to pilot test an energy management system in 250 houses.

It built a system that measures the power consumption of home appliances through a device called Plugwise. This device was attached to a power socket and stores the data by communicating with a computer. The power consumption data of residents who participated in the project for four months were collected and analyzed.

Through this project, the energy consumption behavior of residents was carefully assessed and used to guide the promote energy-saving activities through quantifying and visualizing their own behavior with electricity consumption data and costs that were shown as feedback to the residents.



Source: Amsterdam Economic Board "Smart Stories"

Figure 3-35 Smart Solutions for Home Appliance

Mokum Mariteam

Mokum Mariteam is a project aimed at verifying that inland water transportation by motor vessels provide a good alternative to logistics done in roads by providing a sound business case. The project also explored potential clients and attempted to create demand.

The project was carried out with the leadership of Icovia, a waste-management firm. In 2007, the company planned the inland water transportation project using electric motor power in the canal network across Amsterdam, as a smart design of multi-modal urban transportation. Koninklijke Saan, a logistics service company, and three cruise companies participated in this initiative, and jointly developed an electric-powered transportation vessel.

The dimensions of the boats were 20m long and 4.75m wide, which was a little larger than the other boats in the canal. The boats were equipped with 260 batteries and ran on electric power alone instead of fossil fuels. The boats were equipped with a crane, which enabled both the delivery, collection, and transport of goods (e.g., collection and transport of garbage).

All business expenses were supported by the charity of companies, and after the pilot run, the five partner companies have established Mokum Mariteam Co. and have started the transportation business with the deployment of multiple electric transportation vessels.



Source: Amsterdam Economic Board “Smart Stories”

Figure 3-36 Smart Solution Using the Canal

(6) History of Smart Cities

In the 1990s, investment for urban revitalization based on the compact city policy began to take place in Europe to prevent the decline of large cities.

In the early 2000s, Amsterdam aimed to develop itself into a knowledge-based global city, as well as an active cultural environmental city in the era of EU integration and globalization. It succeeded in attracting people and a large number of leading-edge companies. The smart city policy also focused on the city's environmental issues and the use of ICT for sustainable urban construction, which was consistent with the above movement.

In 2007, Amsterdam Innovation Motors (AIMs), Lander, and municipal governments worked together to create smart cities and formulate the Amsterdam Smart City Programme as a strategic initiative, which was a pioneering effort in Europe. The program was launched in 2008. The ICT-based projects aimed at energy saving and carbon reduction were also implemented, being incorporated into the city's development framework, which had been formulated in parallel with the program, and closely linked with the New Amsterdam Climate Program.

Diverse working groups involved in the planning process created a new organization for concrete project promotion. The Amsterdam Smart City (AMS), established in 2009, has been the main organization that plays a major role as a proponent of smart city strategies and has been highly recognized as an urban innovation model based on the open platform.

In 2014, the Amsterdam City Office established the role of Chief Technology Officer and the Innovation Team. They began to organize and open the data owned by the city, supporting bottom-up smart city-related activities, and have proactively engaged in collaboration and coordination among various actors, including the promotion of administrative innovation and start-ups.

Through this mechanism, Amsterdam, in addition to its own funding, obtained funding from major private companies and the EU and achieved balanced results through the participation of the industry, government, academia and civilian communities. Recognized as a smart city representing Europe, it became the city of choice for developers, companies, and researchers of leading-edge technologies that are the driving force of growth.

3-2-5 United States: Chicago (Illinois)

(1) Overview

Chicago is the third largest city in the U.S. It has been developed as a transport hub in the Midwestern region and has a traditionally strong financial and industrial structure. It is also home to multiple famous universities and research institutions. However, it is also known as a divided city due to social and economic divisions within the city that has posed a big problem to its growth.

With the appointment of Mayor Emmanuel in May 2011, Chicago poised itself into becoming a smart city as the foundation of its growth strategy. The city of Chicago hired a Chief Information officer (CIO) and established a department in charge of improving the efficiency and level of administrative services through the development of ICT and open data and started building partnerships with external organizations one after another.

In 2015, the “Chicago City Tech Plan” was published, and its vision, strategy, and 28 initiatives have been clarified and implemented into concrete programs and projects in partnership with public, private, community, and research organizations.

A series of leading-edge projects aimed at transforming it into a data-driven city have attracted worldwide attention, stimulating technology companies and start-ups. Consequently, it has attracted technology-related companies and formed innovation ecosystems, including venture capitals (VCs) and research, and established its position as the nation's leading tech and start-up hub.

At the same time, education and training were considered to be a key pillar for ensuring equal access for citizens, and “Digital City for All” is also set as an important objective for post-Covid socio-economic recovery.

<p>Expected impact and vision</p>	<ul style="list-style-type: none"> • The Chicago Tech Plan, published in 2015, has set a vision of the cutting-edge city where technology accelerates opportunities, inclusion, engagement and innovation. • Leveraging technology, they are working to reduce costs, improve services, engage citizens, improve access to services and finance, improve skills, increase better employment opportunities, and increase the STEM workforce.
<p>Organizational and propulsive entities</p>	<ul style="list-style-type: none"> • The following are the main organizations. <ul style="list-style-type: none"> - Chicago Mayor, Chicago City Innovation & Technology Department (DoIT) - City Tech Collaborative, World Business Chicago (Non-Profit Partnership Organization) - Prominent universities and research institutes, such as the University of Chicago and the Northwestern University - Variety of non-profit organizations (e.g., LISC Chicago, iBio, Chicago Biomedical Consortium, The Clean Energy Trust) - Set of Tech companies, entrepreneurs, and investors
<p>Efforts in policy systems</p>	<ul style="list-style-type: none"> • By digitally connecting and engaging Chicago citizens and businesses, the foundation of technological strength is formed. Based on this foundation, urban growth is realized through the growth of effective, efficient and open public administration, civic innovation, and technology sectors.

(2) Basic Concept and Vision

“The Global Hub of Innovation and Technology” was the growth vision set forth by the former Chicago Mayor elected in 2011. Developing this growth vision, in 2013, the City of Chicago formulated the Chicago City Tech Plan, a strategy for becoming a “leading-edge city that accelerates opportunities, inclusion, engagement, and innovation through technology,” which was a comprehensive vision for the future created by advanced technologies.

There have been no major changes since the appointment of the new mayor in 2019, and policies are continuing to emphasize the smart city that is diverse and inclusive, while, at the same time, promoting the attraction of tech companies and the birth of start-ups.

(3) Organizations and Promotion System

1) Chicago City

Together with Chief Technology Officer (CTO) and Chief Information Officer (CIO), Chief Data Officer (CDO) was deployed as a leader in technology in Chicago City to oversee the city's open data portals, advanced analytics teams, and data and business intelligence team to form a system to lead strategic data use.

As a specialized department, Department of Innovation and Technology (DoIT, now merged with the asset division) supports the implementation.

2) City Tech Collaborative

In 2017, Smart Chicago Collaborative (SCCs) and City Digital merged to create a City Tech Collaborative to promote the Chicago Tech Plan, which will realize the mayor's vision. Currently the representative of City Tech is served by former CIO in the City of Chicago.



Source: <https://techplan.cityofchicago.org/>

Figure 3-37 Key Partners of City Tech

Smart Chicago Collaborative (SCCs), the predecessor of this organization, was established in 2011 by Chicago City, the MacArthur Foundation and Trust to improve Chicagoan's lives through the power of technology to bring about changes. SCC took leadership across sectors, provided the resources needed for Chicago's digital transformation, and paved the way for Chicago's digital transformation by developing digital infrastructure investment, programs and applications, which made the high-speed internet more familiar and beneficial to everyone.

City Digital was an organization established in 2015 in collaboration with several companies for cross-sector innovation in transport, urban infrastructure, water and sanitation, and energy management, and worked for technology developed and implementing pilot projects for underground infrastructure mapping in Chicago.

City Tech is a member-based consortium that combines tools and ideas provided by partners such as private companies, municipalities, start-ups, civic organizations, research institutions, and community organizations to promote collaboration to develop urban

solutions with inclusive technologies that have a significant impact on the market.

City Tech's programs are deployed in three dimensions: city solutions, inhabitant engagement, and thought leadership, based on methodologies to quickly realize and produce outcomes. While the themes of city innovation change one after another, the common purpose is to create highly effective solutions using sensing networks, advanced analytics, and urban design at the contacts of built environment, digital infrastructure, and public and private services.

The current city solution themes are as below. Multiple projects are set under each theme:

- Advanced Mobility Initiative
- Millennium Gateway Innovation Laboratory
- Healthy city
- Connected Infrastructure
- Emerging Opportunities

3) Incubators, Community Organizations, Universities and Research Organizations

In Chicago, the following organizations that support urban innovation are also active, forming an ecosystem for smart cities.

- Incubation organization: Typical examples are 1871 (operate coworking space on a subscription basis and support a large number of start-ups), mHUB (specialize in products such as robotics, digital devices, sensors, medical equipment, and smart buildings), MATTER (specialize in healthcare and life sciences), etc.
- Finance sector, including venture capital
- Universities and research institutions: Chicago University, Illinois University, Northwestern University, DePaul University, Loyola University, Argonne Institute, etc.
- Business Support: P33 (Non-profit established in 2018 as a support organization for a plan of Chicago as a world-class tech hub by 2033)

(4) Policy and Institution

The Chicago City Tech Plan, published in 2013 to realize the vision shown in (2) and updated after the 18th month, is composed of the following five strategies and 28 initiatives. Various programs and projects are deployed in a way that are linked to each initiative, with assessments of achievement and modifications.

Underlying strategies and initiatives
Strategy A. Next Generation Infrastructure Establish next-generation infrastructure that enables residents and businesses to become more digitally engaged
Initiative 1. Work with partners to increase speed and availability of broadband in Chicago Initiative 2. Enable a “Digital Public Way” Initiative 3. Implement policies and infrastructure to allow for urban technology experimentation
Strategy B. Every Community a Smart Community Ensure the full participation of all Chicago residents and businesses in the digital economy through training and engagement programs that make technology relevant, useful, and productive
Initiative 4. Establish a smart community benchmark and toolkit for broadband access

<p>and use</p> <p>Initiative 5. Scale up Smart Communities</p> <p>Initiative 6. Make free Wi-Fi available in public places</p> <p>Initiative 7. Increase options for low-cost broadband</p> <p>Initiative 8. Educate and engage young people in technology</p> <p>Initiative 9. Offer digital training and hands-on technology experience</p> <p>Initiative 10. Promote digital excellence activities</p> <p>Initiative 11. Provide public computer access and support</p> <p>Initiative 12. Make educational and creative resources available to residents</p>
<p>Strategies and Initiatives for Growth</p>
<p>Strategy C. Efficient, Effective, and Open Government</p> <p>Leverage data and new technology to make government more efficient, effective, and open</p>
<p>Initiative 13. Utilize data to drive efficiency and effectiveness</p> <p>Initiative 14. Increase and improve City data</p> <p>Initiative 15. Leverage technology to improve communications</p> <p>Initiative 16. Focus on Enterprise implementation of technology</p> <p>Initiative 17. Consolidate local government data centers</p> <p>Initiative 18. Focus resources on innovative technology solutions</p>
<p>Strategy D. Civic Innovation</p> <p>Work with civic technology innovators to develop creative solutions to city challenges</p>
<p>Initiative 19. Research data-driven solutions to major urban challenges</p> <p>Initiative 20. Bolster transparency and support civic hackers</p>
<p>Strategy E. Technology Sector Growth</p> <p>Encourage the vibrancy of Chicago’s Technology Sector by attracting and retaining STEM professionals and supporting the creation and expansion of technology companies</p>
<p>Initiative 21. Expand the number of physical incubator and co-working spaces in the city</p> <p>Initiative 22. Expand the number of successful networks that exist to connect entrepreneurs with customers, venture capital, and mentorship opportunities</p> <p>Initiative 23. Attract and retain a talented, diverse STEM workforce</p> <p>Initiative 24. Showcase “Why Chicago” is a destination technology city through consistent messaging and events</p> <p>Initiative 25. Encourage technology firms to promote their ties to Chicago</p> <p>Initiative 26. Strengthen connections with world-renowned academic research institutions</p> <p>Initiative 27. Foster a business-friendly environment</p> <p>Initiative 28. Promote ways to increase venture capital and other funding available to start-ups</p>

(5) Technology and Tools

Chicago City positions the promotion of the development of ICT infrastructures as a foundation of the policies, and it promotes establishing a whole area broadband network and providing free Wi-Fi in public spaces.

A map-based visualization platform based on an open data portal and big data was developed and the environment was prepared to enable the development of various applications based on the utilization of open data.

Pilot testing and roll-out of smart streetlights, IoT sensor networks, etc. are being promoted, and, in economically deprived areas, the projects, including ITS, smart community, and microgrid pilot projects are deployed.

1) Open Grid

In Chicago, since 2012, the Department of Innovation and Technology (DoIT) has led and collaborated with the University of Chicago, Argonne National Laboratory, and the University of Illinois Chicago, to collect 450 datasets of 15 critical departments in the city, including police, traffic, and firefighting, and in 2013, released Windy Grid - its own system to display integrated open data on a map in real-time.⁸

From this stage, Chicago City aimed to make its administrative services more efficient and innovative by analyzing and making future forecasts based on state-of-the-art data-driven decision-making, rather than merely integrating Open Data. After 18 months of development, Windy Grid was updated and released in 2017 as Open Grid - an information-sharing system with citizens and external organizations, as well as other municipalities.

Open Grid was also developed by DoIT and utilized a cloud-based open-source data hub at the University of Chicago Urban CCD (Urban Centre for Computation and Data). Software for data utilization was initially created by Smart Chicago (later City Tech), commissioning it to local companies with a proven track record in big data and cloud computing projects. This has laid the foundation in promoting innovation with open data.

2) The Array of Things (AoT)

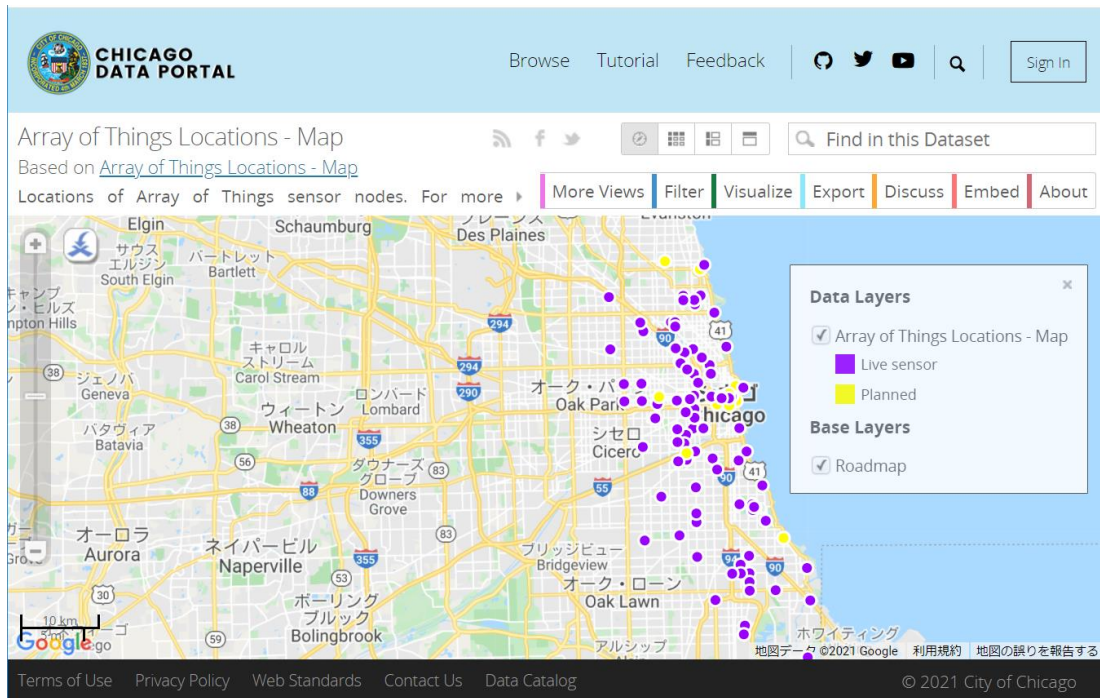
The AoT project is an IoT demonstration project that collects data of urban environments, infrastructure, and activities for research and public use through collaboration between scientists, universities, local government, and local communities. Proposed in 2013 and funded by the American Scientific Fund, site installation and data collection began in 2019. The same funding was acquired by Northwestern University in 2021, and it was deployed to SEGA (Software-Defined Sensor Network), and numerous universities and public organizations are cooperating.

AoT's technology uses the open software and hardware platform of an advanced wireless sensor with powerful computing capabilities, developed by Argonne National Laboratory for sensor-based environmental science and smart city research.

These data are provided through OpenGrid and provide an opportunity for innovation through the use of IoT, which is essential for smart cities⁹.

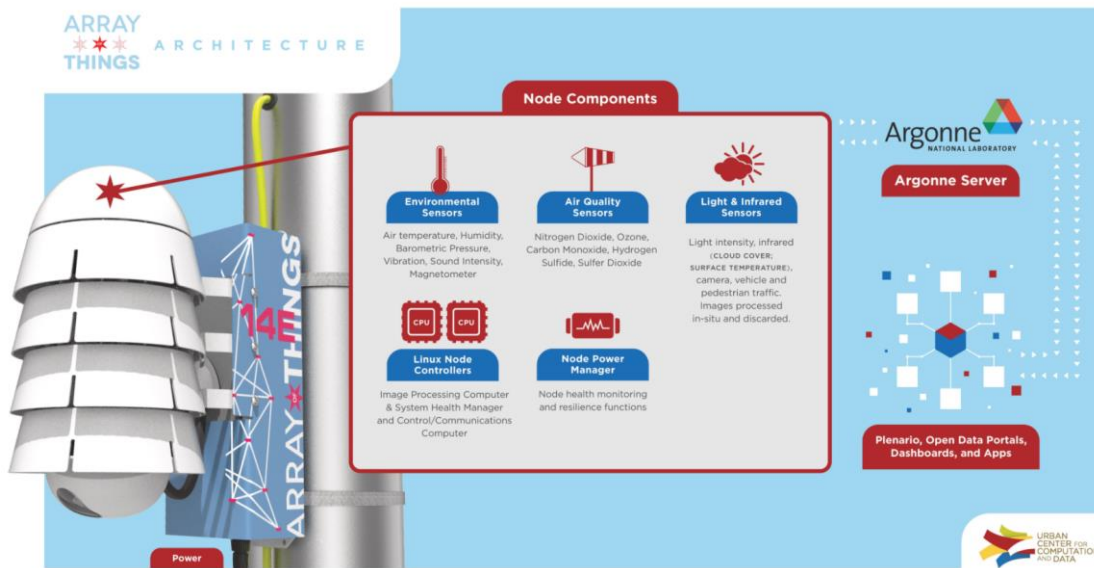
⁸ <https://opengrid.io/>

⁹ <http://arrayofthings.github.io/>



Source: <https://data.cityofchicago.org/Environment-Sustainable-Development/Array-of-Things-Locations-Map/2dng-xkng>

Figure 3-38 Chicago Data Portal



Source: <http://arrayofthings.github.io/>

Figure 3-39 Array of Things architecture

3) Smart Lighting Program

Chicago's smart lighting program is one of the largest projects in the United States to replace outdoor LED lighting. It started in 2017 with the goal of replacing more than about 270,000 high-pressure sodium luminaires with LED equipment in four years by October 2021. It is estimated that the cost can be reduced by \$10 million per year by improving energy efficiency, extending the life of lighting fixtures, and improving the efficiency of maintenance. As a result, it has been reported that the electricity cost actually has decreased by half due to the program.

To implement this project, the city of Chicago worked with the Advanced Lighting Team

of the Pacific Northwest National Laboratory, funded by the U.S. Department of Energy's Building Technology Office. The four-year project, implemented by Chicago Infrastructure, which is the implementing organization for large-scale infrastructure projects in the city, and supported by the City Transportation Department and the Innovation & Technology Department, was completed as scheduled. Streetlights were newly installed in 275 blocks in addition to the renewal of existing streetlights.

In this program, it is highlighted that Chicago simultaneously installed a control system that is connected to Wi-Fi as well as a management system for remote monitoring in addition to replacing the streetlights. Furthermore, through routing optimization, GIS, and various automation methods, activities were optimized, paper-based forms were eliminated, power failure time was shortened, and service levels such as reliability and maintenance drastically improved.¹⁰

(6) History of Smart Cities

The City of Chicago is characterized by a strong leadership of the mayor, which promotes projects with an emphasis on developing new social services through partnerships with enterprise and community organizations while advancing the transformation of administrative services through technology.

The smart cities related events of Chicago are summarized in chronological order as below.

- 2010: Open Data Portal Site “data.cityofchicago.org” opened
- 2011: Mayor Emmanuel’s administration started; Chicago City's growth vision - global hub for innovation and technology - proposed
- 2012-: Chief Data/Information Officer appointed. Open Data Administrative Directive were promulgated to accelerate the improvement of administrative services through ICT and Open Data. Tools such as Smart Data, Windy Grid started developing as the municipal administration.
- 2015: Announced comprehensive five-year technical planning “Chicago Tech Plan”
- 2016: Released Open Grid that evolved Windy Grid for citizens
- 2016: Array of Things started
- 2017: Chicago Smart Lighting Program started
- 2017: Chicago Smart Mobility Initiatives Rollout
- 2017: City Digital and Smart Chicago Collaborative merged to create City Tech Collaborative
- 2020: Chicago Connected program started

¹⁰ <https://chicagosmartlighting-chicago.opendata.arcgis.com>

3-2-6 Japan: Kashiwa-no-Ha Smart City

(1) Overview

The Kashiwa-no-Ha project was conceived as the next-generation urban node on a TOD (transit-oriented development) principle along the Tsukuba Express line (opened in 2005). The project has been formulated and implemented by a partnership among the national and regional governments, public universities and private-sector stakeholders for the purpose of establishing an advanced research hub that is driven by a triple-helix collaboration among academia, industry and businesses.

Establishing the Urban Design Centre Kashiwa-no-Ha (UDCK) as a collaborative platform, Mitsui Fudosan (master developer), Chiba University, and University of Tokyo (both invested in the new campuses) have joined forces with the ministries and agencies as well as the local governments to develop a pilot model for hosting various national strategic initiatives. In Kashiwa-no-Ha, the pragmatic approaches in urban management are aligned on three pillars of “environmental harmony”, “health and longevity”, and “innovation.” The operational knowhows that are derived from these practices are transmitted to domestic and overseas audiences for knowledge-sharing on the subject of urban management.

The smart city plan is the latest initiative on this evolving project, formulated on the basis of these three pillars and involving additional project partners and participants. The initiative aims to demonstrate the smart city systems and technology related to mobility, energy, and public space management across the project area.

One of the unique features of the Kashiwa-no-Ha project is that the government, private sector, and academia are inclusively involved in the development process to make the state-of-art city focused on the research and education. A system is in place to ensure that long-term efforts can be sustained through appropriate allocation of the roles among organizations and consensus building through consultation.

Designed effects and Vision	<ul style="list-style-type: none"> • The “smart city” plan aims to realize self-sufficient city management by linking decentralized urban facilities and promoting interactions on environment and healthy lifestyle.
Implementor and organizational structure	<ul style="list-style-type: none"> • UDCK serves as the platform for partnerships to carry out follow-up planning, community support, and public relations activities. The participants include the municipal government, educational/research institutions such as the University of Tokyo, and private-sector companies and entities that are involved in infrastructure, real estate, and community development and management activities.
Policy formulation	<ul style="list-style-type: none"> • Addition of smart city systems and technology to the urban development along new railway route by public, private, and academic partners. • Smart City Consortium, consisting of City of Kashiwa and private companies/organizations, was established as an implementing body, with universities participating as advisors. • UDCK Town Management (Urban Renaissance Promotion Corporation), whose primary members include the City of Kashiwa and Mitsui Fudosan, is to be the operational manager for data collection and re-use platform, with the aim of promoting effective and useful urban data utilization by a diverse range of service-providers and users.

(2) Basic Concept Vision

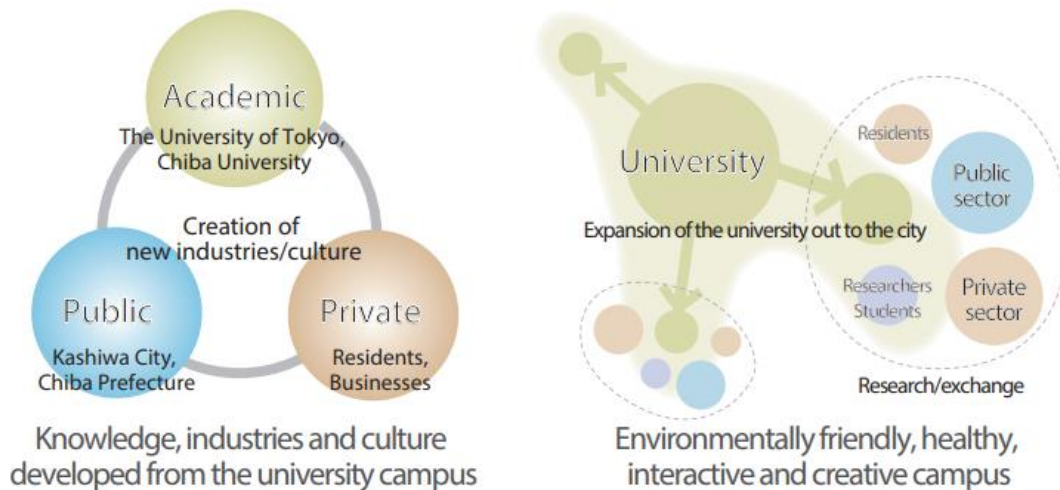
1) Kashiwa-no-Ha International Campus Town Project (2008, 2014, 2019)

With the opening of Tsukuba Express in 2005, integrated development of the surrounding region has been promoted. Around Kashiwa and Nagareyama areas in Chiba Prefecture, a proposed development of an advanced international academic-residential hub was put forth with the basic concept of creating “a city for environment, health, innovation and interaction,” with a partnership between the academic research institutions and the host region as the driving force.

Kashiwa-no-Ha International Campus Initiative was formulated in 2008 by four stakeholder parties: Chiba Prefecture, City of Kashiwa, Chiba University, and the University of Tokyo, setting concrete targets and policies across the project area. Along with eight project objectives, the three pillars of “environmental harmony” “health and longevity,” and “new industries and innovation” were set forth as the model principles for solving social issues across the target development.

The following five points were set forth as the concrete guidelines toward realization of the project concept.

- The entire city is to be campus-like, with spaces rich in greenery and high-quality amenities and services. It will be a place of intellectual exchange and learning.
- To achieve this, the “public” entities are to take responsibility for the civic services, the “private” entities are to pursue regional vitality and attractiveness, and the “academic” entities are to lead the advanced research activities based on expertise and technology. The three sectors will mutually collaborate beyond the conventional framework.
- With high degree of intellectual interactions among public, private and academic partners as the basic mode of operation, the project aims to become an international academic research hub for creation of new knowledge, industry and opportunities. The project also aims to be a model for the next generation of environmental city with high degree of sustainability and autonomy, in which coexistence with the natural environment and high quality of living and working environment are realized.
- Established and operated by public, private, and academic cooperation, Kashiwa-no-Ha Urban Design Centre (UDCK) has established a committee for continuous follow-up activities and action groups for each of the themes, where cooperation among various organizations is planned and conducted.
- Using the Kashiwa-no-Ha area as a pilot model, various experimental measures are carried out for sharing the results and knowledge to other cities, prefectures, and to the world.



Source: Kashiwa-no-ha Campus Town Project (2019)

Figure 3-40 Scheme of Kashiwa-no-ha International Campus Town

Furthermore, in the revised plan in 2019, the following three revision points were considered:

1. Emphasizing on attracting research facilities and related companies in cooperation with the existing tenant universities and research institutions, and on promoting data-driven urban development and management via cutting-edge technologies
2. Emphasizing measures to promote local culture, to enhance quality of lifestyle, and to improve working environment, in keeping steps with the increased resident population and maturity of the local communities
3. In alignment with the SDGs agenda, development issues related to the station functions were reconsidered.

From its inception, Kashiwa-no-Ha area development had a vision to develop a city of innovation and social experiments through public, private and academic partnerships, with universities and research institutions playing leadership roles. The orientation toward smart city was further strengthened by focusing on “data-driven urban development utilizing advanced technology”.

Table 3-5 Kashiwa-no-ha International Campus Town Project: Eight Targets

1. Formation of Garden City in Harmony with Natural Environment	2. Formation of Creative Spaces for Industry
3. Formation of International Academic, Educational and Cultural Spaces	4. Sustainable Mobility and Transport
5. Promotion of Healthy Lifestyle	6. Public-Private-Academic Collaboration in Area management
7. Design for Quality Urban Spaces	8. Innovation Field City

Source: Kashiwa-no-Ha Campus Town Project (2019)

2) City of Kashiwa Environmental Future City Plan

Kashiwa-no-Ha Campus: Special District for “Self-Sufficient Urban Management by Public-Private-Academic Collaboration” (2012-2017)

City of Kashiwa, in partnership with Mitsui Fudosan Co., Ltd., Smart Cities Planning Co., Ltd., Kashiwa-no-Ha Urban Design Centre, and TX Entrepreneur Partners, has formulated a model for creative, sustainable, and self-sufficient urban management through public-private-academic cooperation. New action plans, as well as necessary deregulation and tax measures, were proposed along the three axes of 1) energy, 2) healthcare/nursing care, and 3) urban management systems that support these activities, forming a “special zone for comprehensive regional revitalization”.

The proposed approaches are as follows. Citizens and academia are to work together to steadily promote these activities, aiming to disseminate and expand these implementation models nationwide, across Asia, and to the world as a model for future urban development practices.

Energy Sector

Through special measures in policies and regulations, self-sufficiency in the regional energy management is aimed, in which: 1) solar-generated energy is stored in large-scale storage batteries, 2) such locally generated energy is exchanged freely across city blocks and districts in the event of power outages and other emergencies, and 3) energy is supplied to prioritized area evacuation centers, groundwater pumps, and high-rise tower elevators, etc., to secure three days (72 hours) of lifeline supply.

Health and Nursing Care Sector

Through deregulation to allow non-medical organizations to operate as rehabilitation facilities, as well as to provide nutritional, oral, preventive and nursing care services, the establishment of “total healthcare stations” is to be promoted. In addition, enabling healthy elderly citizens to contribute to local health services as “citizen health supporters,” training courses will be organized to promote community-building in which local residents support each other's livelihood in a self-sufficient and vibrant manner.

Urban Management Sector

Through local standards and rules for road maintenance activities by the regional operator, as well as tax incentives for donations to such regional managers, the creation of vibrant urban spaces that generate new industries and employment is aimed.

3) Kashiwa-no-Ha Smart City Project

Smart Community Next-Generation Energy Technology Demonstration by Ministry of Economy, Technology and Industry, 2012

As a technical demonstration for the power-regulating model to be used at mixed uses facilities, the technical approaches for achieving peak cut and energy conservation were tested using power lines linking local renewable power plants on one end and consumer facilities such as shopping malls, offices, hotels, and apartment houses on the other ends. With such system, by regulating and distributing power supply from dispersed power sources (e.g., batteries, solar panels, etc.) to the interlinked city grid, approximately 26% cut in peak energy demand is to be expected. Furthermore, in times of power outage, the power supply from the locally dispersed renewable power plants and storage facilities will be distributed to the essential facilities for resident life support.

4) Kashiwa-no-ha Smart City Implementation Plan

Smart City Model Project for Realizing “Society5.0” by Ministry of Land, Infrastructure and Transport, 2019

In order to fully utilize urban infrastructure and facilities that are located in dispersed locations, to foster environmental and health interactions, and to realize self-sufficient urban management, MHI has set four themes of mobility, energy, public space, and wellness as a working model project for realizing smart cities.

MOBILITY - Improving the Convenience of Intra-Regional Mobility around the Stations	
Introduction of Autonomous Buses (Commencement of Demonstration in FY2019 / Full-scale Operation in FY2020)	In 2019, an automated bus was introduced to the shuttle bus (running 2.6Km) between Kashiwa-no-ha Campus Station and University of Tokyo Kashiwa Campus. Verification of business and social acceptability for introduction to ordinary route buses will also be carried out while upgrading technology through continuous operation.
Monitoring and Visualization of Traffic Conditions around Station Areas (Started monitoring in 2020)	Using traffic data collection platform such as ETC2.0 probe data*1, monitoring and visualization of traffic conditions around station areas are enabled. By understanding the movement of vehicles across the target area, development of new mobility services that respond to the changing demand by accumulation of urban functions. ※1 ETC 2.0 Probe data: Data such as running history and behavior history of vehicles obtained by mutual communication between ETC 2.0 compatible onboard equipment and radio equipment on the roadway
Energy - Environmentally Friendly Living Towards a Carbon-free Society	
Establishment of Energy-related Data Platforms for In-Area Facilities (plan for full-scale operation in FY2021)	By advancement in existing AEMS systems, increased data storage, promotion of cross-organizational data utilization via clouds, and optimization of power regulation and distribution via data-based demand projection are realized. By linking with Kashiwa-no-Ha Data Platform, power utilization data as well as climatic and pedestrian data are utilized to planning for reducing power consumption and carbon footprint.
Introduction of Automatic Detection System for Deterioration of Photovoltaic Panels (Full-scale Operation in FY2020)	Build an IoT platform to improve the efficiency of solar power generation. Maintains and improves the power generation efficiency of photovoltaic power generation equipment by managing the power generation status of each panel and automatically detecting dirt and deterioration status.
Public Space-Formation of Urban Space that Innovates People and Supports Living	
Installation of AI cameras and sensors, monitoring, and use of data (start of demonstration in fiscal 2019/full-scale operation in fiscal 2020)	AI cameras installed in facilities and parks centered around stations are used to “manage, develop, and utilize public spaces through human flow analysis,” “provide information on crowded urban areas,” and “provide information on watching children and the elderly.” Use environmental sensing*2 to assess the comfort of the area, as well as to develop optimal spatial designs and assess facility conditions.

<p>Preventive maintenance based on sensing and AI analysis (start of demonstration in fiscal 2019/full-scale operation in fiscal 2020)</p>	<p>Sensing enables the collection of under-road cavern analysis data and data on road irregularities, and unified visualization along with sewerage pipes and manhole data, to conduct hazard diagnosis and estimate causes of road cave-in, etc., and to realize preventive maintenance-type maintenance and management such as performing repairs in advance. ※2 Environmental sensing: Obtaining data on humidity, temperature, volatile organic compounds (VOCs), PM2.5, CO2, etc.</p>
<p>Wellness - A City in which all generations can live healthy and vibrant</p>	
<p>Providing health services and advice using diverse data (full-scale operation in fiscal 2020)</p>	<p>Taking advantage of the member network of the “Ashita” resident participation-type health building base in front of the station, where people and data are easily gathered, data is efficiently collected on activities, sleep volume, etc. through wearable devices*3 and sheet-type pressure sensors*4 and develop detailed health services and advice for each individual. Characteristics of life habits and medical histories that tend to extend healthy life expectancy are extracted from the data analysis of nursing care and medical reception data*5 and collected activity volume, sleep volume, etc., and participation in activities such as jobs, volunteers, and hobby circles conducted by the public toward the extension of healthy life expectancy is encouraged.</p>
<p>Reduction of patient waiting time by utilizing visitor flow data (full-scale operation in fiscal 2019)</p>	<p>Measuring and analyzing the flow of the patient after the arrival of the hospital, leads to the identification and improvement of the retention point. By realizing remote check-in at the time of arrival of visiting patient at the station, the waiting time can be effectively utilized in Kashiwa-no-ha area, and it can also be used for traffic guidance to hospitals (car park guidance and bus guidance).</p>

(3) Organizations

Kashiwa-no-Ha Smart City Consortium

City of Kashiwa, Mitsui Fudosan, and UDCK, together consisting the core of Kashiwa-no-Ha urban development, established a consortium in which leading companies and local businesses and organizations participate. Nineteen companies originally made up the partnership to carry out the implementation plan.

In addition to sharing and utilizing the state-of-the-art technologies and knowledge of each member, the University of Tokyo provided full support as an advisor to the consortium. While providing expert advisors in each of the related field, the University of Tokyo will be an active member in the project to realize Kashiwa-no-Ha smart cities.

Kashiwa ITS Promotion Council

The ITS Promotion Council was established in 2009 as a platform for administrative agencies, private enterprises, various organizations, and individuals to cooperate and coordinate for the purpose of promoting various research and development to realize “low-carbon mobility cities” and “next-generation environmental cities,” carrying out activities that contribute to the commercialization of various services in the Kashiwa-no-Ha area.

Twenty-two secretariat organizations and thirty three general organizations are participating (as of October 2021), and are conducting demonstrator experiments on autonomous transport operation, among others.

Urban Design Centre Kashiwa-no-ha (UDCK)

UDCK is operated jointly by eight constituent bodies, including University of Tokyo, Chiba University, Kashiwa City, Mitsui Fudosan, Kashiwa Chamber of Commerce and Industry, Tanaka Regional Furusato Council, Kashiwa-no-Ha Regional Furusato Council, and New Urban Railways in the Tokyo Metropolitan Area.

UDCK follows the basic philosophy of working under “cooperation between public, private, and academia” and to serve the functions as: 1) a center for research and proposal (think tank) related to new project development; 2) a coordination platform for strategies and commercialization in promoting urban development; and 3) a disseminator of information to citizens and society, encouraging participation and facilitating cooperation among various entities related to urban development.

Smart City Planning Co., Ltd.

Established in September 2009 as a joint venture by a group of environment-related leading companies with the aim of building a working model for smart environmental management in Kashiwa-no-Ha campus city.

Toward creation of a sustainable and attractive city that connects technology and people, we aim to incubate new business models that promotes multiple companies collaborating together, and mainly in the three pillars of 1) IoT sharing, 2) area management, and 3) energy generation and management sectors. We will collaborate with a diverse range of companies and experts to lead the conceptualization of ideas to verification of technologies, as well as their business operations.

Mitsui Fudosan

Mitsui Fudosan is the major landowner around the Kashiwa-no-Ha campus station and is to carry out mixed-use urban development including commercial facilities and housing.

As a collaborating partner of UDCK and a primary member of various consortiums and joint ventures, Mitsui contributes to community development through the framework for cooperation among public, private, and academic sectors.

In addition to utilizing various smart city technologies in its own development project, Mitsui plays a role in actively attracting universities and research functions to Kashiwa-no-Ha project.

The University of Tokyo

The University of Tokyo's Kashiwa Campus is the third major campus after Hongo and Komaba, being conceived as the University's hub for developing new and advanced research and exploration fields in the 21st century. Graduate School of Science for Creation of New Area, as well as more than ten laboratories, institutes, and research centers, have been established within the hub so far.

From the formulation of “Kashiwa-no-Ha International Campus Town Concept, the university has participated as an advisor to a series of smart city demonstration projects, and is actively conducting R&D, design, and demonstration of smart city technology.

Kashiwa City

Kashiwa City formulated its urban development planning along the Tsukuba Express line in cooperation with Chiba Prefecture. Based on this planning, the project plan for the integrated land adjustment around Kashiwa-no-Ha campus station was formulated. Additionally, keeping in step with the national and prefectural development policies and plans, the necessary urban infrastructure, parks, education and healthcare facilities, and other community service facilities are developed.

With the aim of promoting a sustainable and self-sufficient “next-generation environmental city,” coexistence with natural environments as well as healthy and quality living and working environments are to be realized. Furthermore, quality urban design is pursued in close cooperation with UDCK, with the implementation of area management operations to involve public-academic cooperation. Finally, the Kashiwa-no-Ha Smart City Consortium serves as secretariats to handle contacts with external parties and as a collaborative platform with the central government's initiatives.

(4) Development Policies and Regulations

The development of the Kashiwa-no-Ha area, with compact city planning principle at its core, is closely integrated with the development plan of the new Tsukuba Express railway and has been driven by the national-level policy on research hub development.

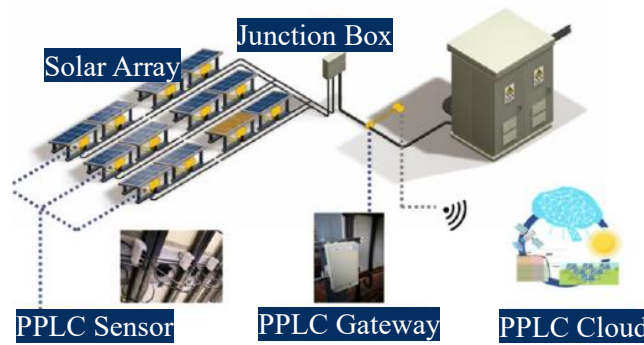
In addition, government initiatives targeting cities such as Future Environmental Cities, Smart Communities, and Smart Cities are calling for proposals through public-private-academic collaboration, each of which is guided to national-level policy goals by ministry and agency.

(5) Technology and Tools

1) Energy Management System

Kashiwa-no-Ha Smart City has introduced an area energy management system (AEMS) based on “Kashiwa-no-Ha Smart Centre,” utilizing advanced systems to operate, manage and regulate energy distribution across the whole town. The energy usage data, previously managed in a closed system, is now put on the cloud in the current generation AEMS, in order to ease the external data usage by outside vendors and service providers. In addition to conventional demand forecasting methods based on event schedules and facility operation data at a particular location, the meteorological and historical data are incorporated into the power demand forecasting, so as to further improve accuracy of the analysis.

In the selected renewable energy system, the lithium-ion batteries (with the storage capacity of about 3800 kWh), the photovoltaic solar panels (with the total power output of about 720kW) and the auxiliary gas generators (with the power output of about 2000 kW) are installed. By enabling flexible power regulation via the smart grid, the system can achieve optimum power peak cut and energy-saving. For the photovoltaic solar panels, the IoT platform by Energy Corporation is used to improve the efficiency of equipment maintenance and management. Sensors installed on each panel are used to automatically detect presence of dirt and deterioration on panels, and the overall performance of the photovoltaic power plant is managed to maintain optimum efficiency.



Source: March 2020 “Kashiwa-no-ha Smart City Implementation Plan”

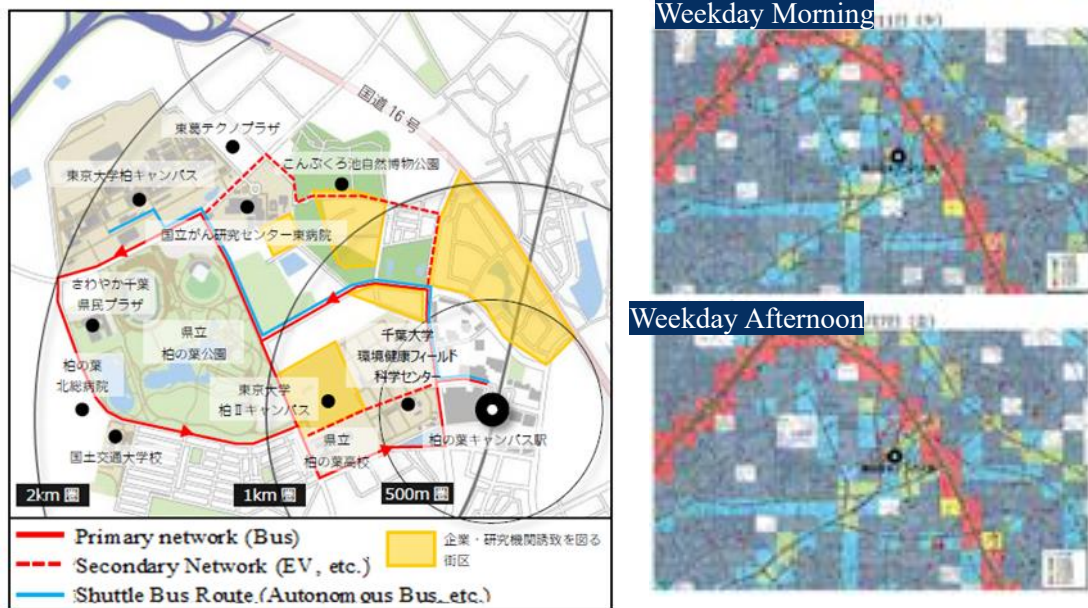
Figure 3-41 IoT Platform for Maintenance Management of Photovoltaic Power Generation Facilities

2) Mobility Services

The Kashiwa-no-Ha International Campus Town concept in the Smart City project aims to realize a town where one can “travel without stress by means of transportation systems with minimum environmental footprint.” Setting sustainable transportation as one of the project’s primary targets, the convenience of travel around the station area is maximized. Among them, demonstration experiments are being carried out on an autonomous shuttle bus system which connects the main facilities within the 2km-sphere around the station, as well as a data collection platform that aggregates the user data on regional movement.

At present, Kashiwa-no-ha Smart City is carrying out a technical demonstration for understanding challenges in the operation of autonomous bus service. The project is operated by Tobu Bus East Co., Ltd., utilizing the rolling stock equipped with autonomous driving system by Advanced Mobility Co., Ltd. It is experimentally operated at the Level 2 autonomy mode at this point, with achievement of Level 4 autonomy being the ultimate objective in the medium to long term.

On establishing a traffic data collection platform, the operational datasets such as ETC2.0 probe data are aggregated and analyzed to monitor and to visualize current traffic conditions around the station area. These traffic data are aimed at being utilized for development planning for new mobility services such as the aforementioned autonomous bus services, and also to enhance intermodal coordination with other mobility services such as railroads, taxis, share cycles, and car-sharing. Technical demonstrations for these other mobility systems are ongoing parallelly, ultimately to be integrated into a MaaS network across the area.



Source: March 2020 “Kashiwa-no-ha Smart City Implementation Plan”
 Figure 3-42 Example of Data Visualization Using Regional Traffic Network Plan (Left) and Probe Data (Right)

3) Environmental Sensing

The raw data on energy consumption in Kashiwa-no-Ha Smart City is to be used to analyze, evaluate, visualize, and provide advisory information for individual users at housing, commercial facilities and offices through Area Energy Management System (AEMS), Home EMS, and IoT technology to promote the transformation of user behaviors toward sustainable energy consumption.

In addition, AI cameras, Wi-Fi sensors, and other devices are installed in parks and public spaces around the stations to analyze pedestrian flow and congestion, and to detect suspicious persons via surveillance services, while aiming for superior area management in operating comfortable and high-quality urban spaces. At present, AI camera operation and other technological demonstrations are underway for these services, with the useful utilization of AI camera-acquired images are studied and explored. These activities are conducted in compliance with the Guidelines for the Protection of Personal Information, as well as considerations for various challenges.



Source: March 2020 “Kashiwa-no-ha Smart City Implementation Plan”
 Figure 3-43 Image of Urban Operation Using AI Cameras/Sensors, Etc.

3-3. Implications Based on Cases of Early Adopters

3-3-1 Examination of Success Factors

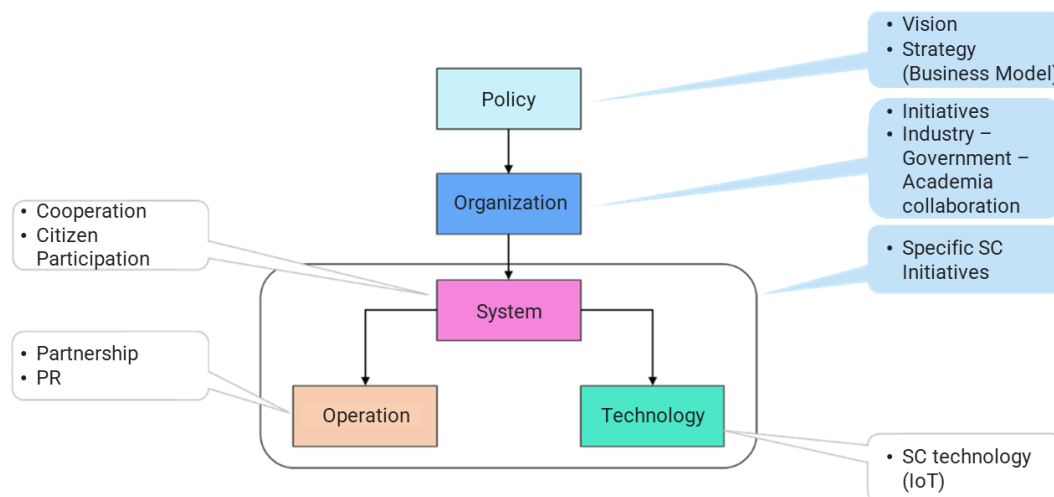
Based on the advanced case studies in 3-2, the success factors of the smart city approach are extracted and organized. The following table shows 6 evaluation criteria for “success” in the advanced cases: Relevance, Effectiveness, Impact, Coherence, Efficiency, and Sustainability, in reference to the OECD DAC development framework.

Table 3-6 Evaluation Criteria for Smart City Success

Criteria	General meaning	Meaning in the context of smart city initiatives
Relevance	The direction of the objective is right.	The purpose (motivation) of the smart city approach is appropriate.
Effectiveness	The measures contribute to the achievement of the objectives.	The measures contribute to the achievement of the objectives (KPIs, etc.)
Impact	The measures are creating positive effects other than achieving the objective.	Positive effects to multiple fields can be expected.
Coherence	The entire measures are consistent.	Smart city policies are consistent at each level or type
Efficiency	Resources are utilized efficiently.	Existing infrastructures and resources in cities are effectively utilized.
Sustainability	Long-term effects can be expected.	City management initiatives are sustainable and autonomous.

Source: JICA Study Team

Along with the 6 success factors, five smart city components were set: “Vision and Policy,” “Organizational Structure,” “System,” “Technology,” and “Operation”, based on the framework for collecting and organizing information on the cases of early adopters in 3-2, and in reference to an existing literature.



Source: Compiled by the Study Team based on material by Mitsubishi UFJ Research and Consulting

Figure 3-44 Five Elements in Success Factor Extraction

Policy

It is important to clearly show the vision and policies, a specific process towards the smart city establishment, in order to ensure the smooth collaboration between government agencies, private companies, research institutes, and citizens on the smart cities, and to build trust in the whole process.

Organizational Structure

To promote the smart city, it is vital that organizations from different sectors participate actively and cooperate with each other, including government agencies, municipalities, private companies, universities, research institutes.

System

Even with the Policy and Organizational Structure described above, smart city initiatives are not able to proceed on their own. A mechanism, or system, is needed to link these elements and make them function..

Technology

Technology for smart cities here, not only includes ICT and digital technology, but also physical technology (such as urban infrastructure). It should not be technology-oriented; it is important that initiatives are undertaken with the aim of resolving challenges and fulfilling visions.

Operation

Smart city initiatives should not be a one-shot event, but a continuous effort in the city management.

The success factors based on the six evaluation criteria and five smart city components are summarized in the following Table 3-8.

Table 3-7 Extraction of Success Factors for Smart Cities

Criteria	Success Factors
Relevance	<ul style="list-style-type: none">• The objectives of smart cities are consistent with the national and local challenges and appropriate for the country, cities and the international society. [Vision and Policy]• The citizen-centered philosophy is consistent, and smart cities are positioned as means and tools for that purpose. [Vision and Policy]• Each of the entities involved in smart cities shares the same values and principles. [Organizational Structure]• Communication with citizens has cultivated an understanding of smart city initiatives. [System]• Vision and problem-solving efforts are taking place, not technology-oriented type. [Technology]
Effectiveness	<ul style="list-style-type: none">• Realistic and concrete measures, projects, and roadmaps to achieve the vision are defined. [Vision and Policy]• A System to promote smart cities has been established in the System. [Vision and Policy]• Appropriate targets (KPIs, etc.) have been set. [Vision and Policy]• There is a cross-disciplinary and cross-organizational collaboration and cooperation System centered on a qualified promoting entity with capacity and authority. [Organizational Structure]• There are mechanisms to integrate citizens' voices into the

Criteria	Success Factors
	<p>administrative process or to participate in the co-creation process. [System]</p> <ul style="list-style-type: none"> The status of achievement of goals is monitored, and feedback on measures is provided so that improvements and countermeasures can be taken in a timely and appropriate manner. [Operation]
Impact	<ul style="list-style-type: none"> It is not limited to individual efforts in each field but is aligned as a comprehensive approach that includes cities, industry, environment, and welfare. [Vision and Policy] The goal is not only to solve problems, but also to create innovation and new value through co-creation. [Vision and Policy] There are open Systems and platforms that allow various entities from industry, government, academia, and the private sector to collaborate with each other. [System] Data is shared and utilized across disciplines and organizations, and technologies and services are provided from a multi-solution perspective. [Technology] Promoting support for demonstration experiments, knowledge sharing, matchmaking, etc. for scaling up. [Operation]
Coherence	<ul style="list-style-type: none"> Policies and visions are consistent across the national, city, and district hierarchies, and the Systems are aligned. [Vision and Policy] Consistency of themes and approaches in each field is ensured. [Vision and Policy] The missions and roles of each entity related to the smart city are clear and consistent. [Organizational Structure] Personal information, privacy, and data security are safely protected by appropriate and transparent rules and regulations. [Technology] Appropriate technologies and services are being implemented for urban issues in an appropriate process. [Operation]
Efficiency	<ul style="list-style-type: none"> Based on the status of the city's resources: people (organizations), goods, money, and information, a rational strategy and priorities are established for measures and projects. [Vision and Policy] There is a public-private partnership System based on an appropriate and fair sharing of resources, capabilities, risks, etc. [Organizational Structure] There is a System and environment for disclosing and sharing information, knowledge, and techniques of the project with other cities and organizations. [System] Smart approaches are being developed while utilizing existing infrastructure, services, and other resources effectively. [Technology]
Sustainability	<ul style="list-style-type: none"> Specific action plans have been established for the medium and long term. [Vision and Policy] The financial flow of the budget and business model has been established or embodied. [Vision and Policy] Mechanisms for operating and maintaining the organization and Systems are integrated into the plan, and budgetary measures and business models are defined. [Organizational Structure] An ecosystem has been established to support autonomous development, including the development of new technologies and support for start-ups. [System] New technologies, including ICT technologies, are integrated with

Criteria	Success Factors
	<p>the existing infrastructure and services, as well as with the local natural environment and culture. [Technology]</p> <ul style="list-style-type: none"> • Companies (including start-ups) that share the vision of the city and are committed to the development of the area are involved. [Operation]

Source: JICA Study Team

The following figure illustrates the points made in the table above.

	Factors related to Relevance	Factors related to Effectiveness	Factors related to Impact	Factors related to Coherence	Factors related to Efficiency	Factors related to Sustainability
Vision and Policy	<ul style="list-style-type: none"> The objectives of smart cities are consistent with and appropriate for national and urban issues, and ultimately, international social issues. The citizen-centered philosophy is consistent, and smart cities are positioned as means and tools for that purpose. 	<ul style="list-style-type: none"> Realistic and concrete measures, projects, and roadmaps to achieve the vision are defined. A system to promote smart cities has been established in the system. Appropriate targets (KPIs, etc.) have been set. 	<ul style="list-style-type: none"> It is not limited to individual efforts in each field but is placed as a comprehensive approach that includes cities, industry, environment, and welfare. The goal is not only to solve problems, but also to create innovation and new value through co-creation. 	<ul style="list-style-type: none"> Policies and visions are consistent across the national, city, and district hierarchies, and the systems are aligned. Consistency of themes and approaches in each field is ensured. 	<ul style="list-style-type: none"> Based on the status of the city's resources: people (organizations), goods, money, and information, a rational strategy and priorities are established for measures and projects. 	<ul style="list-style-type: none"> Specific action plans have been established for the medium and long term. The financial flow of the budget and business model has been established or embodied.
Organization structure	<ul style="list-style-type: none"> Each of the entities involved in smart cities shares the same values and principles. 	<ul style="list-style-type: none"> There is a cross-disciplinary and cross-organizational collaboration and cooperation system centered on a qualified promoting entity with capacity and authority. 		<ul style="list-style-type: none"> The missions and roles of each entity related to the smart city are clear and consistent. 	<ul style="list-style-type: none"> There is a public-private partnership system based on an appropriate and fair sharing of resources, capabilities, risks, etc. 	<ul style="list-style-type: none"> Mechanisms for operating and maintaining the organization and systems are integrated into the plan, and budgetary measures and business models are defined.
System	<ul style="list-style-type: none"> Communication with citizens has cultivated an understanding of smart city initiatives. 	<ul style="list-style-type: none"> There are mechanisms to integrate citizens' voices into the administrative process or to participate in the co-creation process. 	<ul style="list-style-type: none"> There are open systems and platforms that allow various entities from industry, government, academia, and the private sector to collaborate with each other. 		<ul style="list-style-type: none"> There is a system and environment for disclosing and sharing information, knowledge, and techniques of the project with other cities and organizations. 	<ul style="list-style-type: none"> An ecosystem has been established to support autonomous development, including the development of new technologies and support for startups.
Technology	<ul style="list-style-type: none"> Vision and problem-solving efforts are taking place, not technology-oriented type. 		<ul style="list-style-type: none"> Data is shared and utilized across disciplines and organizations, and technologies and services are provided from a multi-solution perspective. 	<ul style="list-style-type: none"> Personal information, privacy, and data security are safely protected by appropriate and transparent rules and regulations. 	<ul style="list-style-type: none"> Smart approaches are being developed while utilizing existing infrastructure, services, and other resources effectively. 	<ul style="list-style-type: none"> New technologies, including ICT technologies, are integrated with the existing infrastructure and services, as well as with the local natural environment and culture.
Operation		<ul style="list-style-type: none"> The status of achievement of goals is monitored, and feedback on measures is provided so that improvements and countermeasures can be taken in a timely and appropriate manner. 	<ul style="list-style-type: none"> Promoting support for demonstration experiments, knowledge sharing, matchmaking, etc. for scaling up. 	<ul style="list-style-type: none"> Appropriate technologies and services are being implemented for urban issues in an appropriate process. 		<ul style="list-style-type: none"> Companies (including start-ups) that share the vision of the city and are committed to the development of the area are involved.

Figure 3-45 Organizing the Success Factors of Smart Cities

3-3-2 Implications based on Success Factors and Key Points

The following is a list of key factors and points related to the success or failure of smart cities based on the analysis of the success factors:

Policy

1. Establishing concepts and vision
2. Comprehensiveness of vision and policy
3. Specifics of vision and policy
4. Policy Alignment
5. Sustainability of vision and policy

Organizational Structure

6. Sharing and PR of visions and concepts
7. SC Promotion Body
8. Collaboration between industry, government, academia, and the private sector
9. Organizational Effectiveness and Capacity

System

10. Building Ecosystems
11. Creating a Trust
12. Setting of laws, regulations, and systems
13. Co-creation with Citizens
14. Cross-disciplinary

Technology

15. Urban infrastructure platform
16. Utilizing the Data
17. Ensuring Digital Security
18. Social system design and implementation in smart environments

Operation

19. Ensuring flexibility in the promotion system
20. Strengthen collaboration and partnerships and promotion
21. Ensuring sustainability

Table 3-8 Smart City Frameworks

No	Theme	Points	Detailed Perspectives	
Policy	1	Establishing concepts and vision	Aligned with national strategy and urban planning, positioned as an approach to creating new value in cities, improving the well-being of citizens, and achieving sustainable urban development.	<ul style="list-style-type: none"> The concepts and vision of SC have been set based on overall national strategy and urban planning. In addition to solving the social problems associated with urbanization, SC is also expected to create value that leads to urban development. Elements of digitalization and decarbonization are incorporated, and it is clearly stated that they will contribute to improving the QoL of citizens.
	2	Comprehensiveness of vision and policy	The vision is positioned as a comprehensive approach, and it includes the possibility of spreading to various areas and creating new value.	<ul style="list-style-type: none"> Comprehensive elements are envisioned (SDGs linkage, urban growth and improvement of citizens' well-being, etc.), rather than just vertical approaches in individual fields. Perspectives of innovation and value creation are incorporated.
	3	Specifics of vision and policy	A clear message, purpose, direction, and measurable targets for Smart City are presented.	<ul style="list-style-type: none"> The SC vision is not just a universal and abstract message but is organized in a way that reminds us of concrete method of making the best use of regional characteristics. The purpose and direction of the SC vision are clearly stated. Specific measures (initiatives) and roadmaps to achieve the SC vision are defined. Numerical targets have been set and their operation has been clarified.
	4	Policy Alignment	The target domain of Smart City is clear and consistent with existing urban planning and DX strategies (SC and urban planning/DX strategies are not separated)	<ul style="list-style-type: none"> The objectives of SC are closely linked and aligned with national development and urban planning. KPI of urban planning and the objectives of SC are linked. Digitalization and decarbonization elements are incorporated.
	5	Sustainability of vision and policy	Business cases, investment strategies are considered, and business models are (at least partially) in place.	<ul style="list-style-type: none"> A budget for implementing the measures is formed and business models are being tested.
Organization	6	Sharing and PR of visions and concepts	Each entity involved shares the concept, vision, and values of Smart City, and promotional activities is conducted for citizens.	<ul style="list-style-type: none"> Each of the entities involved in the smart city project understands the vision of SC that the country or city has, and the mission and role of each entity within that vision are clearly defined. The concept and vision of SC are accurately and regularly publicized to citizens, and the relationship between SC-related entities and citizens is close.
	7	Promotion Body	A competent organization or organizational structure is in place to take on a leading and pivotal role in the implementation of Smart City strategies and policies.	<ul style="list-style-type: none"> Organizations, councils, clusters, etc., that have the capacity and authority, including human, material, financial, information, and technological resources, have been established for the construction of SC.
	8	Collaboration among public, Private, citizens, academia	A triple-helix (or quadruple-helix with the private sector) system of industry, government, and academia is incorporated into the Smart City ecosystem.	<ul style="list-style-type: none"> Cross-sectoral and cross-organizational collaboration and cooperation among industry, government, and academia (and private sector), with authority and capabilities, such as clusters, are being established.
	9	Organizational effectiveness and capacity	There is an internal or an external organization that functions to steer the technical side of Smart City initiative, able to draft specification; manage selection, demonstration, implementation; and evaluation of smart technologies and solutions.	<ul style="list-style-type: none"> An expert (e.g., Chief Technology Officer), a specialized team, or an external specialized organization exists within the organization as the entity that selects, demonstrates, and evaluates technologies based on the latest technologies. An external organization exists to impartially evaluate, demonstrate, and recommend technologies and solutions to the city.
System	10	Building Ecosystems	An effective, functional, and sustainable ecosystem has been formed to promote Smart City.	<ul style="list-style-type: none"> There is an open system that allows various entities such as private companies (including start-ups), sponsoring organizations and investors, universities and research institutions to participate freely. In the advanced technology verification experiment, there is a mechanism to ensure the development from a verification experiment to social implementation by linking the formulation of a business case, compliance with laws and regulations, and human networks for business development.
	11	Creating a Trust	Trust has been built among stakeholders (government, businesses, and citizens) in the formation of Smart City, especially in urban management process of planning,	<ul style="list-style-type: none"> Trust in the social system has been formed to some extent in terms of history, climate, and culture. Cross-sectoral trust-based institutional design and communication among government, business, and citizens is in place.

		implementing, and operating the city to promote Smart City.	<ul style="list-style-type: none"> Legal frameworks for open systems, process transparency, data management, and personal information protection are in place to ensure trust.
	12	Setting of laws, regulations, and systems	<p>Norms regarding legal and administrative processes, etc. necessary for Smart City have been clearly defined, and incentive mechanisms and facilities for promotion are in place.</p> <ul style="list-style-type: none"> A standardization process has been set up, including guidelines that define smart city development. There are effective laws, regulations, and systems to ensure public-private partnerships in smart city development. Facilities such as special zone system (deregulation), incentive and financial support system, information sharing portal site, and platform development for collaboration.
	13	Participation and co-creation with Citizens	<p>A system for citizen participation is in place (a system for citizen co-creation is being considered or implemented for Smart City).</p> <ul style="list-style-type: none"> A system for citizen participation in identifying urban issues and needs, deciding on measures, and providing feedback on measures has been established or is being implemented. A mechanism to reflect citizens' needs and perceptions in city administration is being established or studied (citizen-participatory city management).
	14	Cross-disciplinary	<p>Smart City is linked to decarbonization, digitalization, urban (industrial) development, environmental consideration, crisis response, and improvement of the quality of life of citizens.</p> <ul style="list-style-type: none"> There is a structure to build and promote mutually beneficial relationships through collaboration across industrial and business domains. Approaches and mechanisms to connect the domains are being considered and established (e.g., decarbonization through bicycle use, health promotion, stress reduction of COVID-19, integrated value creation by reducing social security costs through healthier citizens, etc.)
Technology	15	Urban infrastructure and ICT platform	<p>ICT platform (City Operating System) that connects the infrastructure for the Smart City solutions and data collaboration is established or being planned (either partially or at full scale).</p> <ul style="list-style-type: none"> IoT, cloud systems, and City as a Service (CaaS), which are the foundation of SC infrastructure, have been built, partially prepared, or under consideration.
	16	Data utilization	<p>Urban open data has been organized and is being used (or considered) as big data for Smart City, while also sufficiently accounting for data privacy.</p> <ul style="list-style-type: none"> Open data collected through sensors installed in the city is managed and utilized as a shared asset in a form that protects personal information (including in the planning stage). Basic urban data is maintained as a base registry and is used for developing the SC solutions (including the planning stage). Guidelines for the use of personal information have been established and citizens' understanding has been obtained.
	17	Ensuring Cyber Security	<p>ICT infrastructure (servers, DBs, NWs, sensors, various control systems) is secured from cyber-attacks and contingencies.</p> <ul style="list-style-type: none"> Operational systems such as guidelines, defense systems, and action plans are in place to respond to cyber-attacks and other crises.
	18	Social system design and implementation	<p>In the construction of Smart City, the aspect of social design has been introduced, and the selection and implementation of smart technologies and solutions have been optimized.</p> <ul style="list-style-type: none"> Smart initiatives are being developed while making effective use of existing infrastructure, services, and other resources (Integration of traditional assets and advanced technology). Appropriate smart technologies and services that meet the challenges and needs of the city and are consistent with its vision and strategy are integrated harmoniously with existing infrastructure and services, as well as with the local natural environment and culture.
Operation	19	Ensuring flexibility in the implementation	<p>A system that can flexibly modify and respond to changes in the political situation, social environment, and technological trends, as well as to the diverse needs of citizens, is incorporated.</p> <ul style="list-style-type: none"> The status of achievement of goals is monitored, and feedback on measures is provided so that improvements and countermeasures can be taken in a timely and appropriate manner. In promoting SC, a gradual approach through trial and error is allowed, and while accepting a wide range of opinions and views, an operational system that can flexibly respond to changing social trends and citizen needs is being developed and reviewed.
	20	Strengthen collaboration and partnerships	<p>Inter-city partnerships with neighboring regions and other countries to share the latest knowledge is established.</p> <ul style="list-style-type: none"> Promoting the sharing of information and lessons learned on SC measures (knowledge sharing including best practices) among entities involved in SC and among regions, and support for matchmaking, etc.
	21	Ensuring sustainability	<p>A mechanism for making medium- to long-term commitments to Smart Cities is established.</p> <ul style="list-style-type: none"> Political commitments, legal frameworks, and ecosystem linkages are in place to sustain SC. Tech companies, including IT and utility companies and other start-ups, that share the vision of the city and are committed to the development of the area are involved.

Source: JICA Study Team

Reference: Review of the advanced cases based on the framework

For the purpose of confirming the Smart city framework mentioned above, the information of the advanced cases was reorganized in chronological order based on the framework. The following 3 cities are the targets for further examination: Barcelona (Spain), Copenhagen (Denmark), and Helsinki (Finland), where site visits and interviews were conducted for the sake of detail and certainty of information.

(1) History of the Smart City initiative in Barcelona

Vision & Policy

- The concept of “City of Knowledge” was launched in the early 2000s with the overall goal of strengthening competitiveness through the promotion of the knowledge industry, developing culture by incorporating new values, and strengthening social cohesion.
- The Digital City Plan, established in 2015, set the direction of using the digital technology to improve the quality of life of citizens and to realize a citizen-centred society, aiming to improve public services for the national and local governments, private companies, and citizens respectively, support digital businesses and entrepreneurs, empower the citizens and achieve an inclusive society.

Organizations and Promotion Structure

- Instituto Municipal de Informática de Barcelona (IMI), which oversees the city's digital sector, is the lead agency and responsible for cross-ministry coordination regarding the implementation of smart city policies.
- Since the establishment in 1990, IMI has promoted ICT development in Barcelona and the digitization of public administration. Since about 2011, promotion of the Smart City initiative has become IMI's main task.

System (Institution)

- Barcelona has been attracting the information industry since the time of the City of Knowledge, which has led to the formation of an ecosystem involving start-ups and tech companies.
- Decidim, a participatory platform introduced in 2018, has encouraged residents' participation in the direction of the public policy.

Technology

- New technologies are being added to existing infrastructure, such as Sentilo, using sensor systems to improve the efficiency of the city management, and Superblock, making effective use of existing urban space.

Operation

- Barcelona has established itself as a model city in Europe by being one of the first to take on and take advantage of smart city initiatives, and is now actively working to deploy and share its knowledge and technology with other cities.

(2) History of Smart Cities in Copenhagen

Vision & Policy

- At the national level, Denmark has positioned smart cities as part of its green transition. Its Smart Cities White Paper stated that, throughout the smart city initiative, problems should be solved from the perspective of the people, not in a technology-driven manner.
- Smart city initiatives in Copenhagen are also not technology-driven but focus on using technology to improve people's quality of life (QoL), economic growth, and sustainability. Specific plans and initiatives in the areas of environment and climate change are described in the Copenhagen Climate Plan 2025, while urban data infrastructure and data utilization are defined in the Copenhagen Connecting Project.

Organizations and Promotion Structure

- Copenhagen Solutions Lab (established in 2014) is the City of Copenhagen's incubator for smart city initiatives, developing and coordinating the city-wide smart city establishment. and serves as the hub that connects the Quadruple Helix.

System (Institution)

- At the national level in Denmark, Cluster Organization in each field (cluster), such as mobility, energy, and construction environment, serves as a hub of the smart city ecosystem, acting as an intermediary among the stakeholders including municipalities, private companies, research institutions to provide services of business matching, business development, financial support, and human resource mediation, etc. Cluster Organizations play an important role to ensure the cross-disciplinary and inclusiveness in the process of the smart city development.
- A “living laboratory” is established as a centre of activity and a place for open innovation to explore avenues for problem-solving through the co-creation and proactive involvement of government, business, and citizens in the process of developing new technologies and services, aiming to build a partnership to share experience and expertise with overseas cities.

Technology

- Projects are being promoted where Copenhagen Connecting and Copenhagen Intelligent Traffic Solutions, among others, analyze data collected through sensors and IoT devices and communication networks within the city to utilize this information to improve services in areas such as citizen health, mobility, energy and environment, and education.

Operation

- Copenhagen Capacity, a public agency that aims to attract foreign investment and financing activities and to capture business opportunities, also plays a role in attracting foreign investment to promote smart cities.

(3) History of Smart Cities in Helsinki

Vision & Policy

- The City of Helsinki's vision in its City Strategy (2017-2021) is to be “the most functional city in the world” and aims to be fair, tolerant, open and inclusive.
- The strategy stipulates that the city of Helsinki will be a platform for pilot projects and innovation businesses, and that the city will be carbon neutral by 2035, and smart city initiatives are also being promoted under these visions and policies.

Organizations and Promotion Structure

- Forum Virium Helsinki (established in 2005), a non-profit corporation that promotes digital services and innovation and is positioned as the Innovation Unit of the City of Helsinki, plays a central role in bridging and coordinating the various actors in industry, government, academia and the private sector.
- Other major players include Helsinki Partners, a public corporation that markets and promotes investment in the city of Helsinki.

System (Institution)

- The City of Helsinki and public corporations and institutions in the city are taking the initiative to create a platform for co-creation of new technologies and services with diverse actors such as local companies, citizens, communities, universities, and research institutions.
- An Agile Piloting Programme has been devised and introduced to implement pilot projects in a short period of time, reliably and effectively, and with the involvement of citizens.

Technology

- In order to demonstrate new technologies and services, the Kalasatama and Jätkäsaari districts have been used as smart city testbeds since the early 2010s, to promote new lifestyle proposals that utilize technology, including advanced mobility technologies and services such as MaaS and automated driving, smart grids and other initiatives toward a decarbonized society, and IoT.
- Efforts toward individualized and convenient administrative services using personal information (e.g., MYDATA) are in the process of being carefully promoted through demonstration projects involving citizens, etc., while obtaining their understanding and consent.

Operation

- In the demonstration projects, Helsinki is trying to co-create technologies and services by bringing together many private companies that share the same values and vision, and also involving citizens. In addition, data and findings are shared widely to maximize effectiveness and benefits through co-learning.

(4) Implications based on analysis of the process to a smart city

The suggestions obtained through the analysis of the process of the three cities of Barcelona, Copenhagen, and Helsinki, are described below.

Smart city initiatives that are consistent with the city's challenges and vision

For example, Barcelona's smart city initiatives are centred on the Knowledge City concept, which was established as a post-Barcelona Olympic policy agenda to create new industries, including attracting and fostering start-up companies. In Copenhagen, carbon neutrality is an important national policy issue in terms of energy security and is at the centre of the smart city policy. It is important that strategies and visions for smart city initiatives be established in accordance with the issues and agendas of each city, and that they be shared with all concerned parties.

Policy continuity and administrative commitment

Although there are differences in the history of smart city initiatives in European cities, policies and organizations have been formed roughly over the past 15 to 20 years since the 2000s. As the case of the Barcelona IMI shows, the initiatives have been promoted with the active involvement of public entities such as local governments and the securing of ongoing budgets. Therefore, when embarking on a smart city initiative, it is important to be committed while looking toward the mid-to long-term future, rather than taking a stance of jumping ahead and aiming for a cutting-edge smart city and seeking short-term payoffs.

Utilization of existing organizational and institutional frameworks

In the Barcelona, Copenhagen, and Helsinki cases, there has been little establishment of organizations dedicated to smart cities or new institutions (incentives, deregulation, etc.) dedicated to smart city promotion purposes. Rather, the smart city initiatives have been promoted under existing frameworks and organizations. For example, the Barcelona IMI plays a central role in the implementation of the city's smart city projects, but it is responsible for the entire information and communication sector. The cluster organizations in Denmark and Forum Virium in Helsinki are also enabler organizations that are responsible for incubating advanced solutions and matching companies with each other. They were originally established to support the creation of new industries and were not established specifically for smart cities. Therefore, in order to ensure the effectiveness and feasibility of a smart city initiative when it is launched, a perspective that makes good use of existing organizations and frameworks is also important.

Social Implementation through demonstration experiments

In Barcelona, Copenhagen, and Helsinki, many long-term experiments with the implementation of new technologies and services have been conducted in real-world implementation environments such as the "living laboratory." In many cases, citizens and users are involved in the co-creation process through their participation in planning and evaluation. It is important to verify the applicability of the technology and its acceptability to society through effective use of demonstration experiments.

4. Information Collection and Analysis of Smart Cities in ASEAN

In Chapter 4, information on smart city initiatives at the country and city level in ASEAN is collected and analyzed. This chapter also provides an overview of the general situation and urban challenges in each ASEAN city, whereby classifying the cities by economic scale and urban character, and also examines the direction of the Smart City concept according to the classification of each city.

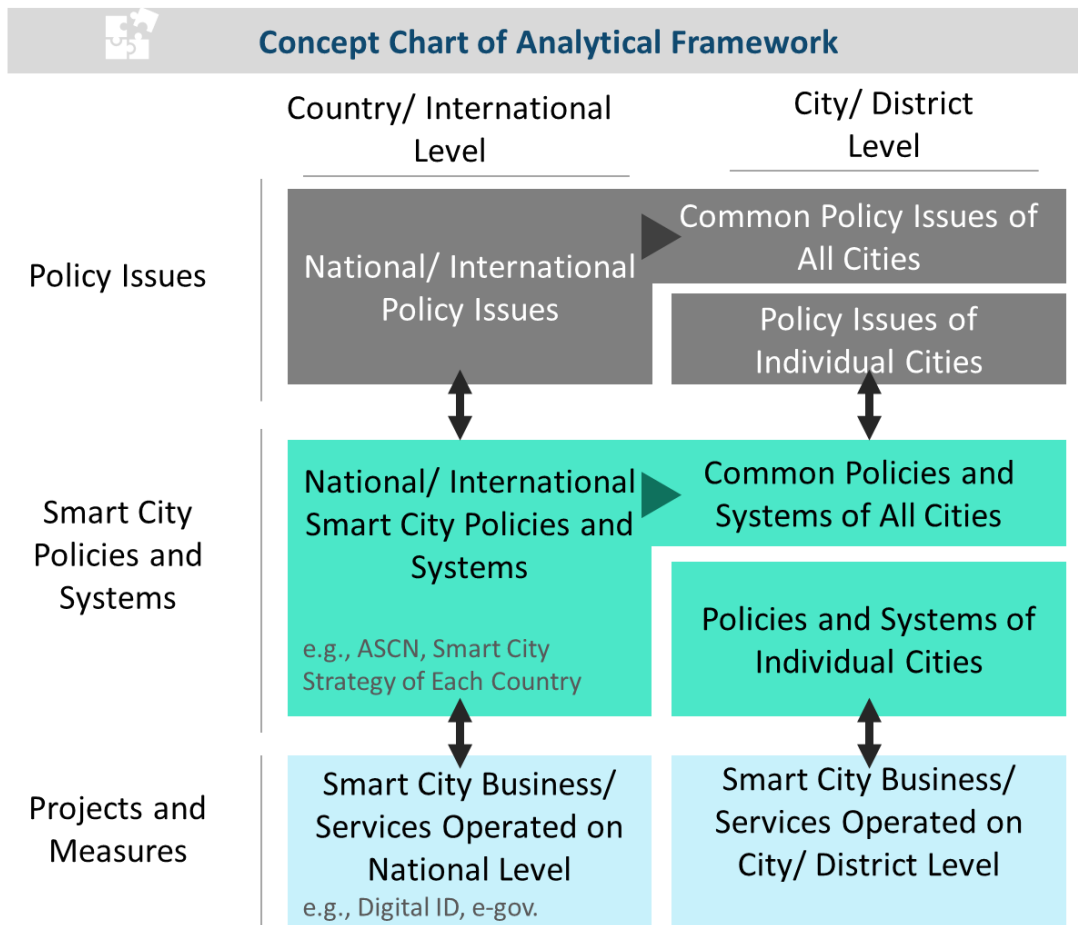
4-1. Collecting Case Studies in ASEAN Cities

4-1-1 Viewpoint of Information-Gathering on Cases of ASEAN Cities

In carrying out case studies of individual smart city projects, scope of the analysis includes urban challenges that the smart city project tackles, as well as national and urban policies and systems upon which the project is based.

- With regard to smart city projects and services, the background of the project will be organized by focusing on the implementing entities (public, private, research institutions, etc.) based on the scale of implementation (country, city, area).
- It is worth noting that some of the countries and cities may have no smart city plans or otherwise the relationships with higher-level and lower-level plans could be less significant than others.

The conceptual diagram of the analysis framework is as shown in Figure 4-1 below.

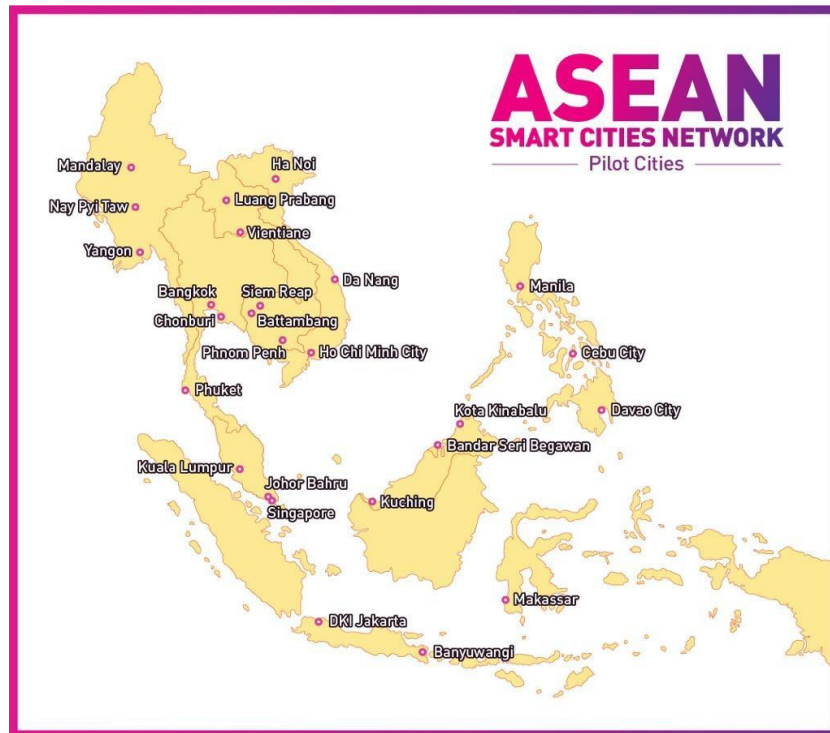


Source: JICA Study Team

Figure 4-1 Conceptual Diagram of The Analytical Framework

4-1-2 Target Countries, Cities and Projects

Cities participating in ASEAN Smart City Network (ASCN) were focused on as the target for smart cities in ASEAN countries.



Source: ASCN Webpage: <https://asean.org/asean/asean-smart-cities-network/>

Figure 4-2 Map of Cities and Regions Subject to ASCN

Seven countries were identified as the target for information gathering, considering the possibility for JICA cooperation activities. These countries were: Malaysia, Thailand, Indonesia, Philippines, Vietnam, Lao PDR, and Cambodia. The 26 cities in ASCN are shown in Table 4-1 following, in which the target cities are underlined.

Table 4-1 Cities subject to ASCN

Country name	City name (underlined cities subject to information gathering)
Singapore	<u>Singapore</u>
Malaysia	<u>Kuala Lumpur</u> , <u>Johor Bahru</u> , <u>Kota Kinabalu</u> , <u>Kuching</u>
Thailand	<u>Bangkok</u> , <u>Chonburi</u> , <u>Phuket</u>
Indonesia	<u>Jakarta</u> , <u>Makassar</u> , <u>Banyuwangi</u>
Philippines	<u>Manila</u> , <u>Cebu</u> , <u>Davao</u>
Vietnam	<u>Ho Chi Minh City</u> , <u>Hanoi</u> , <u>Da Nang</u>
Laos	<u>Luang Prabang</u> , <u>Vientiane</u>
Cambodia	<u>Phnom Penh</u> , <u>Siem Reap</u> , <u>Battambang</u>
Myanmar	Yangon, Mandalay, Nay Pyi Taw
Brunei	Bandar Seri Begawan

Source: JICA Study Team

Reference: ASEAN Smart City Network Framework

Outline of ASEAN Smart City Network

The ASEAN Smart City Network (ASCN) is a network for smart cities in 10 ASEAN countries. The first annual meeting was held in July 2018 under the lead of Singapore and promoted by ASEAN countries, and formally started as a project at ASEAN Summit in November 2018, as a framework for among cities toward realizing the specified projects.

26 cities are currently selected as pilot cities, and each city has formulated an action plan that includes the smart city content to be promoted from 2018 to 2025.

The Smart City Vision of ASCN

ASCN utilizes smart city-related technologies in a comprehensive way.

Its primary goal is to improve the lives of ASEAN citizens while respecting human rights and fundamental freedoms through inclusive approaches.

The three objectives are set out as follows:

- Promoting cooperation in smart city development: exploring the possibility of mutual cooperation, sharing knowledge of best practices that are suitable for ASEAN.
- Promoting projects in collaboration with the private sector: linking urban and private technologies (solutions) to promote commercially viable projects.
- Promoting coordination with ASEAN external partners: to call for assistance, such as funding for countries/cities from inside and outside ASEAN, and international agencies.

ASCN's Smart City Framework

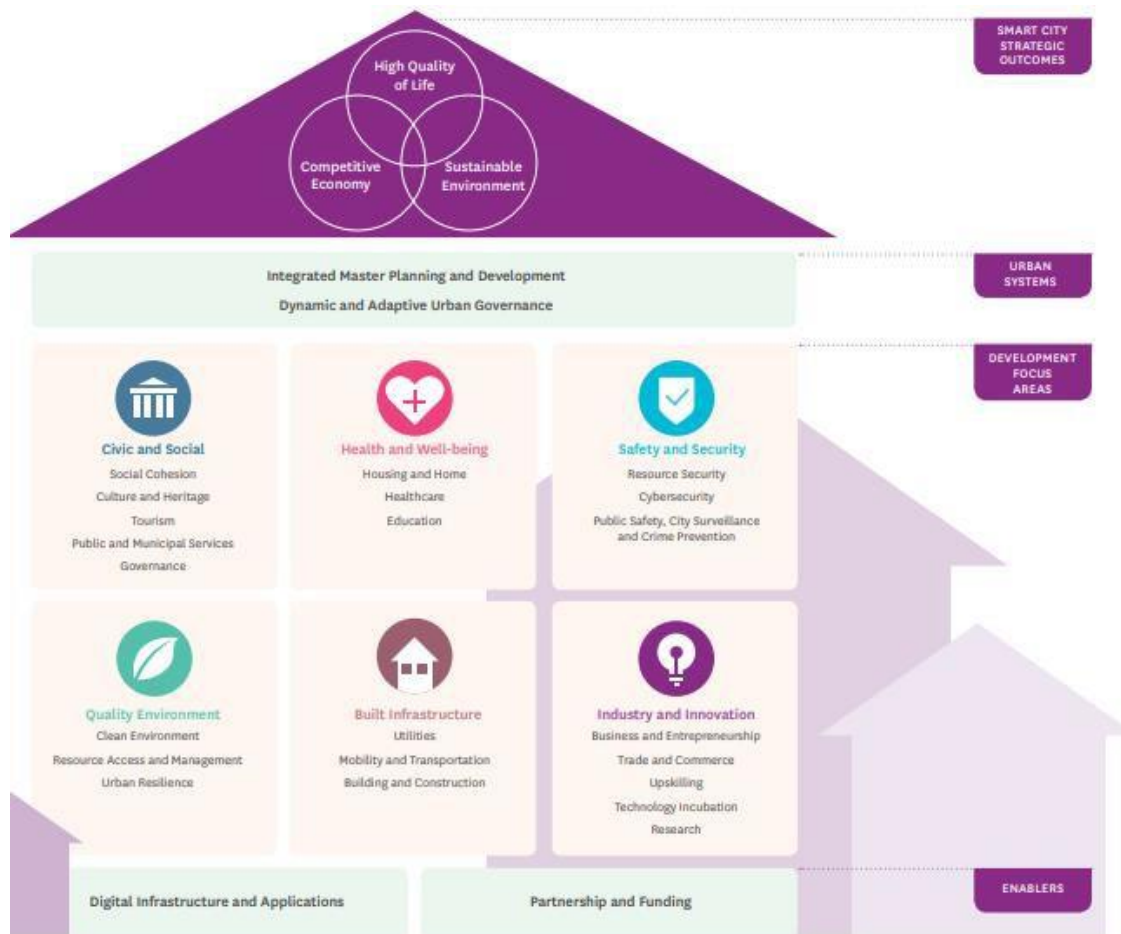
ASCN defines smart city development based on a four-tier model of:

1) Utility (Strategic Outcomes), 2) Function (Urban Systems), 3) Action (Focus Areas), and 4) Promotion element (Enablers).

1. **Utility (Strategic Outcomes):** Aiming to enhance these while achieving a balance between higher QoLs, economic efficiency, and a sustaining environment
2. **Function (Urban Systems):** Comprehensive master plan creation and development, and flexible urban administration to optimize and maximize the previously listed utility
3. **Initiatives (Focus Areas):** Smart City business and services can be organized according to the six areas listed as follows:
 - **Civic and Social:** Efforts that contribute to social harmony, cultural diversity, and community formation (Specific examples: cultural conservation, tourism promotion, and streamlining of government administration, etc.)
 - **Health and Well-being:** Efforts to promote the physical and mental health and welfare of citizens (Examples: health, education, improvement of residential environment, etc.)
 - **Safety and Security:** Initiatives that contribute to urban security and security of living (e.g., crime prevention, cyber security, etc.)
 - **Quality Environment:** Initiatives to improve urban environments (e.g., environmental conservation, securing natural resources and biodiversity, mitigating and adapting to climate change, etc.)
 - **Built Infrastructure:** Development of infrastructures that contribute to the

creation of a foundation for living and industrial infrastructure (e.g., energy-related, water supply and sewerage, transportation, etc.)

- **Industry and Innovation:** Efforts to improve efficiency and enhance competitiveness in production activities (e.g., support for SMEs and start-ups, commercial reforms, human resource development, R&D enhancement, etc.)
4. **Factors for Promotion (Enablers):** Promote the sharing of knowledge and development of financial support systems in digital infrastructure and applications (e.g., geospatial databases and systems, urban data analysis tools, ICT infrastructures, e-commerce platforms, etc.) and partnerships involving cities and private enterprises as factors that promote and accelerate smart city initiatives.



Source: ASCN, “e-book”

Figure 4-3 ASCN's Smart City System

Action Plans for Each City Based on A Framework

The 26 cities selected as pilot cities have organized their action plans up to 2025 under the common formats of “Smart City Vision,” “Focus Area,” “Strategic Targets,” and “Projects.”

Example: Da Nang (Vietnam)

Vision	Aiming to realize economic growth while improving quality of life based on a citizen-centered approach
Focus area	Governance, living, mobility, and environment

Target	2025 Smart Apps in 16 key areas by year 2030 Using ICT in all administrative areas by the year,
Project 1	Efficient traffic control by introducing ITS and alleviating traffic congestion
Project 2	For improvement of water quality and water resource management by improving the efficiency of water supply and sewage systems

4-2. Case Study in ASEAN Cities

4-2-1 Overview of Smart City in ASEAN

Information gathering focused on visions and smart city (or related) policies at the national level, implementing entities and related organizations, and specific projects at the city level. The information is outlined in the following sections, and a summary table is provided below as a key point on the status of smart city initiatives in each country.

Table 4-2 Summary of Smart City initiatives in ASEAN

Country	Overview	Vision and policies	Organizational structure	Projects, etc.
Malaysia	<ul style="list-style-type: none"> The Malaysia Smart City Framework (MSCF) has been established and is working on seven areas of governance, mobility, economy, infrastructure, citizens, and livelihoods through IoT. Smart city projects differ depending on the project, such as government-led projects and private sector-led development projects. 	<ul style="list-style-type: none"> The 11th Malaysia Plan (2016-2020), a national growth plan, positions smart cities under Strategy C4 “Strengthening infrastructure for smart cities” in Focus Area C “Improving the scope and quality of digital infrastructure” of “Strengthening infrastructure to support economic development.” Currently, the 12th Malaysia Plan (2021-2025) is being formulated. 	<ul style="list-style-type: none"> Within the MSCF, the establishment of a committee (Smart City Council) with the participation of various governmental organizations is being considered. In 2018, the Malaysia Smart Cities Alliance (MSCA), a platform for industry, government, and academia, was established to facilitate networking among stakeholders. 	<ul style="list-style-type: none"> Kuala Lumpur: Aiming for low-carbon, environmentally conscious urban development in transportation systems, social infrastructure development, and disaster prevention. Iskandar: Promoting initiatives around industry, healthcare, finance, and education. Kota Kinabalu: Promoting smart development with a focus on infrastructure.
Thailand	<ul style="list-style-type: none"> Thailand has established certification criteria called Smart City Criteria, which promote smart city projects proposed by cities and businesses in seven areas: transportation, energy, environment, living, administration, economy, and education and welfare. The goal is to identify 100 cities in Thailand to become smart cities by 2022. 	<ul style="list-style-type: none"> Smart city development is positioned as an important policy pillar in Thailand 4.0, the country's top-tier national strategy for long-term socio-economic growth. The goal is to overcome stagnant economic growth through sustained value-added growth with the keywords “technological innovation,” “productivity,” and “increased value of traded goods.” 	<ul style="list-style-type: none"> The National Steering Committee, an inter-agency organization chaired by the Deputy Prime Minister, was established to lead the smart city development based on the criteria system and to coordinate policies. A secretariat (Smart City Thailand Office) and sub-committees responsible for practical business for various fields have been established under the committee. 	<ul style="list-style-type: none"> Bangkok: Implementation of smart services integrated with urban development in the Bang Sue district Chonburi: Smart grid project, energy reuse of waste disposal, etc. Phuket: Improvement of urban data infrastructure, improvement of public security through data utilization, etc.
Indonesia	<ul style="list-style-type: none"> Under the Smart Cities Policy (“Movement Towards Smart Cities”), financial and technical assistance is provided to each city based on a master plan developed by the certified cities. In the development of smart cities in Indonesia, the autonomy of each city is emphasized. 	<ul style="list-style-type: none"> Smart city development is one of the goals of urban development in the Indonesian National Medium-Term Development Plan RPJMN (2020-2024). 	<ul style="list-style-type: none"> There is no organization dedicated to smart cities, and at the national level, KOMINFO (Ministry of Communications and Technology) plays a central role in collaboration with related ministries and agencies. However, decentralization is underway, and project implementation is largely left to the initiative of each local government. 	<ul style="list-style-type: none"> Jakarta: Focused on initiatives in the transportation sector Makassar: Introduced smart cards and implemented initiatives centered on medical services. Banyuwangi: Efforts focused on the tourism sector
Philippines	<ul style="list-style-type: none"> There is no development plan for smart cities at the national level, and planning and implementation are being done on a project basis. 	<ul style="list-style-type: none"> There is no systematic strategy or vision for smart cities as a country, which is encapsulated in the E-government Plan 2022 and the e-commerce roadmap, an industrial policy. 	<ul style="list-style-type: none"> DICT is the main coordinator for ICT-related policies, while NEDA is the main coordinator for industrial promotion and urban development. 	<ul style="list-style-type: none"> Manila: Implementing a large-scale development project in New Clark City Cebu: Promoting development as a model for IT-intensive industries
Vietnam	<ul style="list-style-type: none"> Planning and implementation are being done on a project basis. 	<ul style="list-style-type: none"> In the 2018 Prime Minister's Decision, the policy for smart city development aims at efficient management of urban administration, efficient use of resources such as land and energy, improved quality of life, and socioeconomic development through the use of ICT. 	<ul style="list-style-type: none"> The central government is in charge of developing the legal system and formulating policies, and local governments either implement the projects themselves or promote them with the involvement and investment of qualified private companies. 	<ul style="list-style-type: none"> Hanoi: Promoting ITS, urban control, and other projects Ho Chi Minh City: e-government, transportation, flood control, etc.
Laos	<ul style="list-style-type: none"> The national and local governments are promoting e-government and data digitization. 	<ul style="list-style-type: none"> Smart city policies are encompassed in the National Digital Economy Development Plan. 	<ul style="list-style-type: none"> There is no organization dedicated to smart cities, and each project is handled by a competent ministry. 	<ul style="list-style-type: none"> Promoting initiatives in transportation and e-government in Vientiane and Luang Prabang
Cambodia	<ul style="list-style-type: none"> The national and local governments are taking initiatives in basic infrastructure areas such as transportation, waste and wastewater treatment, etc. 	<ul style="list-style-type: none"> In the “Cambodia Digital Economy and Society Policy Framework 2021-2035,” Cambodia has laid out its long-term vision for the digital economy and society. 	<ul style="list-style-type: none"> There is no organization dedicated to smart cities, and each project is handled by a competent ministry. 	<ul style="list-style-type: none"> Phnom Penh: Public transport project Siem Reap: Promoting initiatives centered on the tourism sector

Source: JICA Study Team

4-2-2 Case Study in ASEAN Cities: Malaysia

(1) Smart City Initiatives as A Country

1) Overview

Although Malaysia has not formulated an integral strategy for smart cities as a government, it does have a policy of promoting smart cities based on urban development for the growth and development of the nation. In addition to simply focusing on the sophistication of urban infrastructure, Malaysia is also engaged in investment and human resource development aspects, and urban development is moving forward in Kuala Lumpur, Johor Bahru (Iskandar), Cyberjaya, Kota Kinabalu, and Kuching.

The Malaysian government's urban development strategy is laid out in the 12th Malaysia Plan 2021-2025 announced by Prime Minister Ismail Sabri Yaakob at Parliament on September 27, 2021. On the other hand, the 11th Malaysia Plan 2016-2020, which has begun to include smart advances, will also be helpful as a reference, so the main points will be introduced as follows.

The 11th Malaysia Plan states that the government will strengthen its commitment to prioritize the civil economy and enrich the people. In order to become a developed country, it is necessary to enjoy economic prosperity in all segments of society, and for the first time in the history of Malaysia, the national growth target includes not only the economic growth rate and per capita income, but also the Malaysian Happiness Index is being introduced to assess the impact of economic growth on household income and the happiness of the people. In addition to (1) growth in the transportation and logistics sectors, (2) digital connections including broadband infrastructure strengthened in both cities and suburbs, (3) it is said that Malaysia will promote projects targeting social infrastructure in general, including sewerage systems and energy systems such as power supply, and the importance of smart city digital infrastructure is emphasized in this process.



Source: The 11th Malaysia Plan

Figure 4-4 Focus Areas of the 11th Plan

The position of smart cities in the 11th Malaysia Plan is defined in the six strategic driving forces, “strengthening infrastructure to support economic expansion.” This focus area is further divided into four domains, and smart city-related topics are positioned as “strengthening infrastructure for smart cities”, which is one of the strategies in Focus Area C: Improvement of coverage, quality and affordability in digital infrastructure.



Source: The 11th Malaysia Plan
 Figure 4-5 Focus Areas for Strengthening Infrastructure to Support Economic Expansion

In this manner, one can say that in the 11th Malaysia Plan, the Malaysian government is not only focusing on smart cities, but also aiming to strategically utilize smart cities to promote urban development and strengthened infrastructure.

2) National Strategy, Economic Policy

12th Malaysia Plan: National Strategy announced by the Malaysian government on September 27, 2021.



Source: The 12th Malaysia Plan (Twelfth Malaysia Plan 2021-2025 Pamphlet)
 Figure 4-6 13 Focus Areas

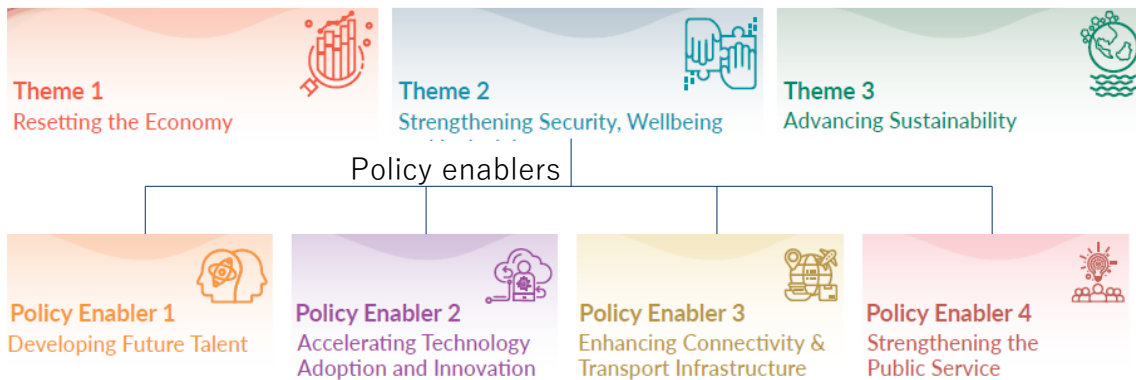
The plan contains three major themes.

Table 4-3 Three Themes of the 12th Malaysia Plan

Theme 1 Economic reset	<ul style="list-style-type: none"> Focus on recovering growth and developing sustainable growth not only from major economic sectors and strategic industries, but also from small to medium-sized enterprises, and making Malaysia a high-income nation by achieving a high value-added society and through advanced economic activities.
Theme 2 Enhanced security, happiness and inclusiveness	<ul style="list-style-type: none"> Focus on strengthening security, welfare, and inclusiveness. National security, increased crime prevention, rehabilitation, and emergency responsiveness will be strengthened. Strengthening security governance is a high priority, and the provision of healthcare services will continue to be a focal point.
Theme 3 Improving sustainability	<ul style="list-style-type: none"> Promote green growth, increase energy sustainability and revolutionize the water sector. Over the next five years, Malaysia will transition to a lifestyle that values sustainable economic activities at the national level, the natural environment, and health.

Source: JICA Study Team

Three main themes in the 12th Malaysia Plan



Source: The 12th Malaysia Plan (Twelfth Malaysia Plan 2021-2025 Pamphlet)

Figure 4-7 Three Main Themes and Four Policy Enablers

The three themes are implemented in the following policies.

Table 4-4 Policy on Three Themes

Policy enabler 1: Nurturing future human resources	<ul style="list-style-type: none"> Develop highly skilled human resources needed to support a growing economy, reorganize the labor market, and strengthen education and training.
Policy enabler 2: Adopting technology and promoting innovation	<ul style="list-style-type: none"> Fourth Industrial Revolution (4IR) technology is being promoted to achieve an advanced technology-based economy. Malaysia will address inadequate digital infrastructure and services, fragmented governance, the expanding digital divide, poor research capabilities, and delays in adopting technology.
Policy enabler 3: Strengthen connectivity and transportation infrastructure	<ul style="list-style-type: none"> Strengthening accessibility, especially improving first mile and last mile connectivity, improving industry competitiveness, and strengthening governance will be important from an infrastructure perspective. Transition to public transport, improve trade facilitation, and strengthen institutional and regulatory frameworks. Last one mile connectivity improvements will be made through the integration of rail and road networks between airports, ports, industrial areas and cities.

<p>Policy enabler 4. Strengthen public services</p>	<ul style="list-style-type: none"> It is important not only to ensure the continuous socio-economic development of Malaysia, but also to promote happiness. The public sector will strengthen digitization, citizen-centric decision-making processes and project implementation, and three levels of intergovernmental collaboration and coordination. Recognizing the current gaps in human resources, governance ecosystems and project management, the public sector will be strengthened with an emphasis on integrity and transparency.
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Source: JICA Study Team

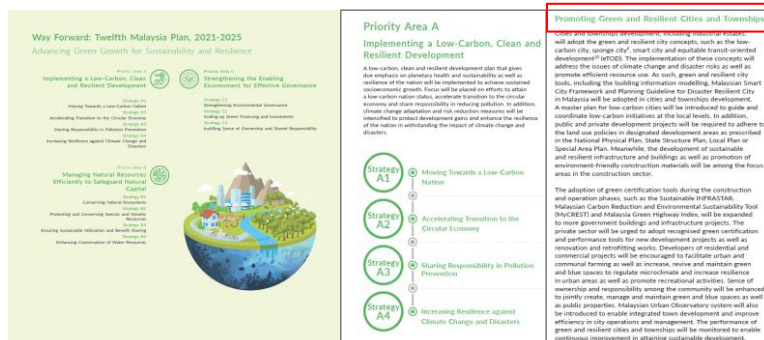
3) National Land Plan

The Malaysian land plan is established in the 12th Malaysia Plan. In it, content related to cities is touched upon in Chapter 6: Improving Regional Balance and Inclusion. In particular, it is stipulated as “Developing Sustainable Cities” in Priority Area B. From an environmental and energy perspective, Chapter 8: Advancing Green Growth for Sustainability and Resilience, proposes the promotion of “green and resilient cities and townships” in Priority Area A: Implementing a Low-Carbon, Clean and Resilient Development.

12th Malaysia Plan: Chapter6 Improving Regional Balance and Inclusion



Chapter8 Advancing Green Growth for Sustainability and Resilience



Source: The 12th Malaysia Plan (Twelfth Malaysia Plan 2021-2025 Pamphlet)

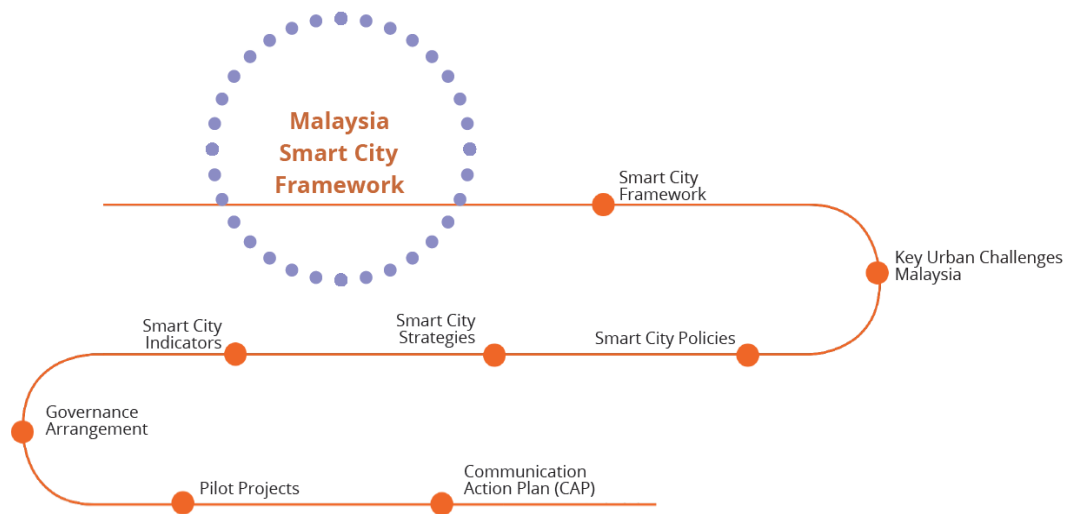
Figure 4-8 Positioning of Smart Cities in the 12th Malaysia Plan

4) Smart City Policies

Although there are policies related to smart cities as a Malaysian state, they have not been established in the form of clear measures.

5) Smart City Framework, Organization, Etc.

The MSCF was developed in consideration of the importance of developing and achieving smart cities in Malaysia. The government views smart cities as a future approach to urban planning, development, and management, solving urban issues such as inefficient urban services, environmental pollution and traffic congestion, and improving quality of life of in cities. The MSCF was established to deal with national and global agendas in meeting Sustainable Development Goals (SDGs), and to keep Malaysia in line with global urban development trends.



Source: Malaysia Smart City Framework

Figure 4-9 MSCF System

URBAN CHALLENGES	POLICIES	STRATEGIES
The proposed smart city strategies and initiatives in MSCF are aimed at addressing these key urban challenges	16 cross-cutting policies are formulated to spearhead the smart city development in Malaysia	36 strategies are proposed under the 7 smart city components in line with smart city policy directions
INITIATIVES	INDICATORS	BENCHMARK
Each strategy is supported by one or more initiatives to solve the urban challenges	The proposed 92 indicators can measure the achievements and impact of smart city implementation	Global best practices and good examples of smart city initiatives are included for reference and benchmarking

Source: Malaysia MYGOV Homepage

Figure 4-10 MSCF Content



Source: Malaysia Smart City Framework

Figure 4-11 Components of A Smart City

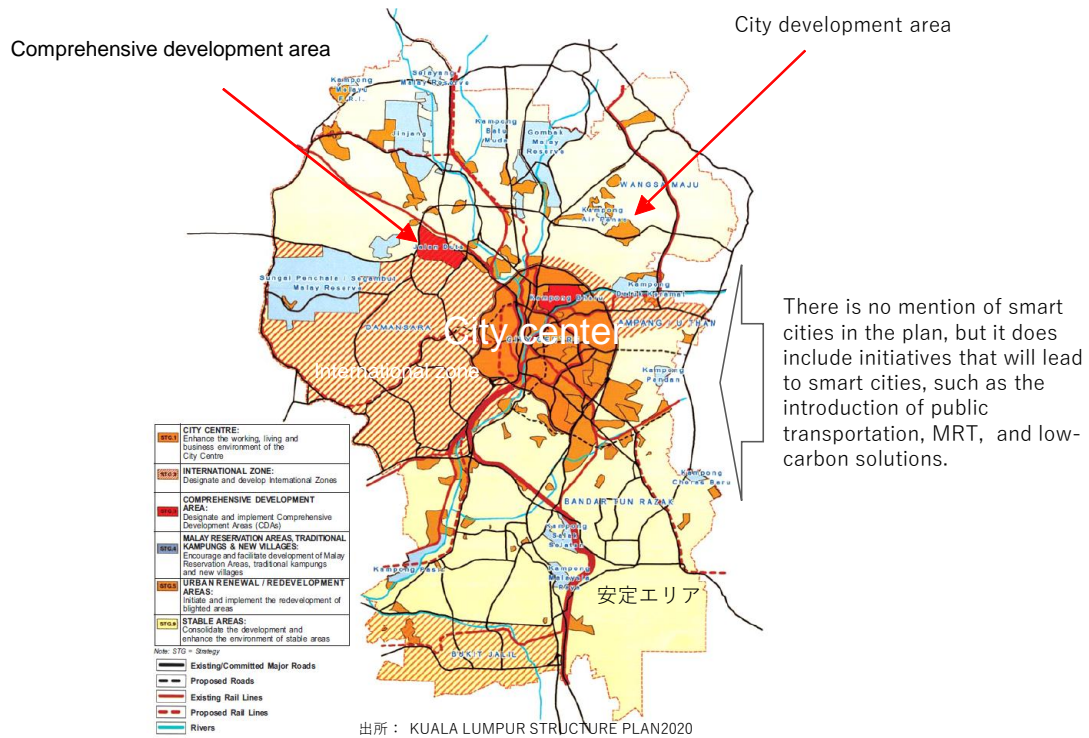
(2) Kuala Lumpur

1) Kuala Lumpur: Smart City Strategy in City Planning

Kuala Lumpur City Planning Outline and History

Kuala Lumpur's city plan states that it will be a world-class city in the Draft Kuala Lumpur City Plan 2020. Kuala Lumpur aims to provide distribution, social sustainability, economic legitimacy, a fair and efficient government, public facilities, and achieve a knowledgeable society.

Kuala Lumpur City Development Plan



Source: Kuala Lumpur Structure 2020

Figure 4-12 Kuala Lumpur Development Strategic Plan

2) Kuala Lumpur's Smart City Vision

Kuala Lumpur has set five city development goals to make it a world-class city by improving its financial and living environment, forming its own identity, and establishing governance.

Goal 1

To enhance the role of Kuala Lumpur as an international commercial and financial centre.

Goal 2

To create an efficient and equitable city structure.

Goal 3

To enhance the city living environment.

Goal 4

To create a distinctive city identity and image.

Goal 5

To have an efficient and effective governance.

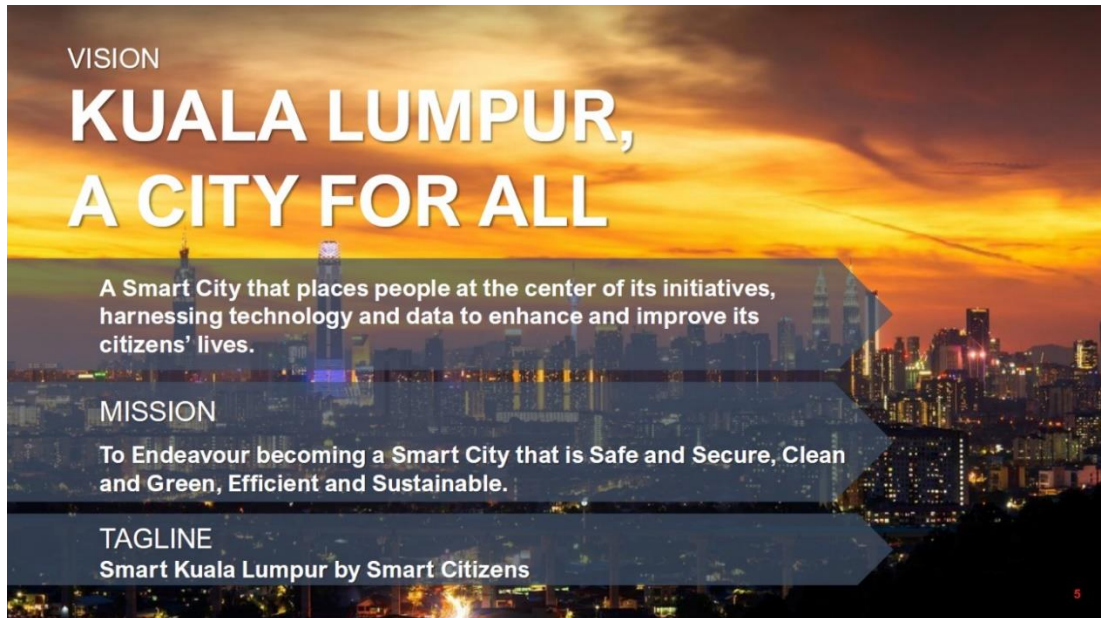
Source: Kuala Lumpur Structure 2020

Figure 4-13 Kuala Lumpur Development Strategic Plan

A vision is also detailed in the Kuala Lumpur smart city plan.

Vision: Kuala Lumpur, a City for All

- A human-centered smart city. Utilize technology and data to achieve a better society.
- Mission: Aim for an efficient, sustainable, safe and secure, clean smart city.
- Smart Kuala Lumpur by smart citizens.

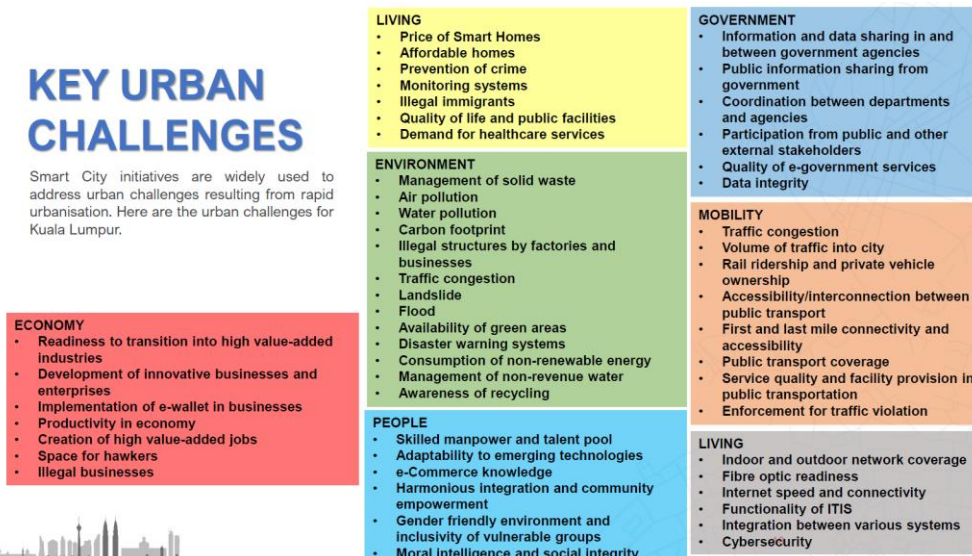


Source: Kuala Lumpur Smart City Plan 2021-2025 Presentation Materials

Figure 4-14 Kuala Lumpur Smart City Vision

3) Kuala Lumpur's Smart City Policy

Kuala Lumpur is establishing the Kuala Lumpur Smart City Plan 2020. It consolidates the main issues of Kuala Lumpur, where rapid urbanization is progressing, and positions smart cities as a means to solve these issues.



Source: Kuala Lumpur Smart City Plan 2021-2025 Presentation Materials

Figure 4-15 Social issues in Kuala Lumpur

Kuala Lumpur's smart city strategy is set in the following seven areas. A total of 350 initiatives were established before (and during the execution of) the Master Plan. Among them, 28 initiatives were selected to create KLSCMP2025 (Kuala Lumpur Smart City Master Plan 2025) for strengthening the Kuala Lumpur smart vision.

- Smart economy
- Smart living
- Smart environment
- Smart citizens
- Smart government
- Smart mobility
- Smart digital infrastructure

STRATEGIES & INITIATIVES

Kuala Lumpur has confirmed, developed or deployed over 350 initiatives prior to or during the development of this Master Plan. The initiatives below are proposed to further enhance Kuala Lumpur's vision to become a City for All. KLSCMP2025 has listed 28 proposed initiatives.

Smart Economy	Smart Living	Smart Environment	Smart People	Smart Government	Smart Mobility	Smart Digital Infrastructure
1. Kolabora-C	1. Smart Home Ready for People	1. Smart Waste Management	1. KL Digital Community	1. My Opinion (Co-Creation Platform)	1. Smart Traffic Management	1. KL City Data Analytics Programme
2. Tourism Destination: Experience Through Technology	2. Safe City	2. Smart Pollution Control	2. DBKL e-Library	2. KLCARES App/iSPAAA Enhancement		
3. Kuala Lumpur Tourism Product Online Store	3. Enhanced Bodycam for Enforcement Officers	3. Smart Disaster Prediction & Resilience	3. Duta e-Commerce	3. Improve KL City-Wide Collaboration		
4. e-Channel		4. Climate Action Plan		4. KLUO – Urban Observatory		
		5. Smart Renewable Energy		5. Collaboration with Telcos		
		6. Smart Energy Street		6. Cashless Society		
		7. Smart Green Building		7. Smart KL Division		
		8. Enhanced Tree Inventory Management				
		9. Smart Landscape Management				



Source: Kuala Lumpur Smart City Plan 2021-2025 Presentation Materials

Figure 4-16 Kuala Lumpur's Smart City Strategy

4) Kuala Lumpur's Smart City Project

The Malaysia City Brain Project is related to smart cities. It is an ET City Brain utilizing Alibaba Cloud, which has already been introduced in 23 cities throughout Asia (as of September 2019). City Brain achieves smarter cities via Alibaba Cloud. This solution provides 48 applications in 11 fields related to urban life such as transportation, electronic government, cultural tourism, and health. In Kuala Lumpur, in collaboration with MDEC (Malaysia Digital Economy Corporation), support for Malaysia's digital transformation will focus mainly on video and image recognition solutions, urban open data and data mining, and the use of artificial intelligence.

Malaysia City Brain Project



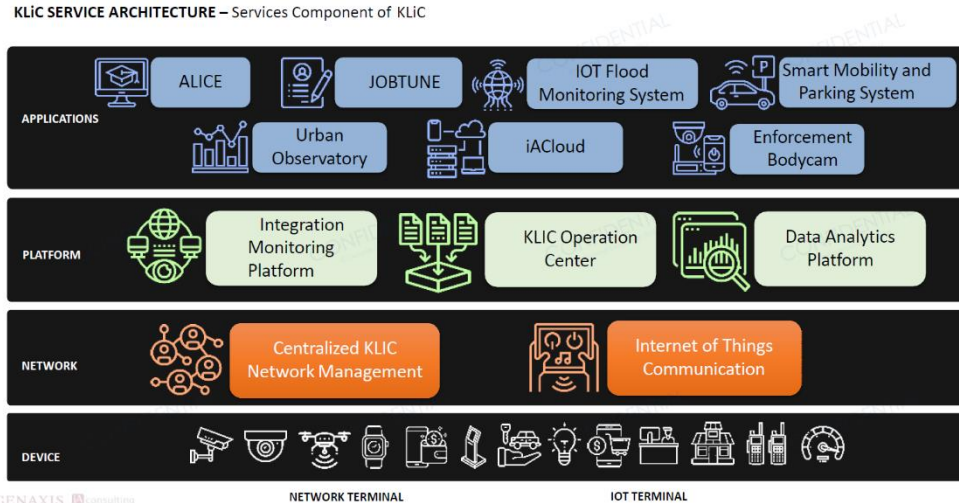
- Video and Image Recognition
 - Data mining
 - Machine Learning (AI)
- }
- Supporting DX Promotion in Malaysia

However, in the future, the "hidden hand" may increase the invisible risks in smart social infrastructure.

Source: JICA Study Team

Figure 4-17 Overview of the Malaysia City Brain Project

Kuala Lumpur is building a single platform called KLiC (Kuala Lumpur Intelligent City). KLiC serves as the brain of Kuala Lumpur and functions to integrate internal systems and data through the utilization of artificial intelligence, IoT, big data analysis, etc. in order to optimize urban services.



Source: Kuala Lumpur Smart City Plan 2021-2025 Presentation Materials

Figure 4-18 KLiC Service Architecture

(3) Iskandar (Johor Bahru)

1) Iskandar: Smart City Strategy in City Planning

Smart City Iskandar Malaysia is an initiative to promote the realization of added value with the aim of making it easier to do business and improving quality of life in Iskandar. The Smart City Iskandar system focuses on the three areas of economy, environment, and society, and plans to promote a smart economy, smart governance, smart environment, smart mobility, smart people, and smart living.



Source: Smart City Iskandar Malaysia

Figure 4-19 Positioning of Smart City Iskandar Malaysia

Iskandar Malaysia has set specific numerical targets for smart transformation, with the goal of achieving a GDP RM120 billion, a growth rate of 7.8%, employment of 1.3 million and investment of RM383 billion by 2025. In Europe, targets are sometimes established in smart cities and city planning, however in Asia, setting gradual numerical targets is helping the number of committed cities to grow.

	(CDPI) ACHIEVEMENTS AS AT 2012	CDPI 2025 TARGET
Estimated GDP (At a constant 2005 price)	RM 52 Bil (Year 2013)	RM 120 Bil
GDP Per Capita	RM27,025	RM 42,631
Growth Rate	6.8 % (2010-2012)	7.8 % (2005-2025)
Population	1.7 Mil (58% of Target)	3.0 Mil
Employment	0.8 Mil (56% of Target)	1.31 Mil
Investment Achieved	06.31 Bil (RM237.26 Bil as at 30 June 2017)	RM383 Bil

Source: Smart City Iskandar Malaysia

Figure 4-20 Targets for Smart City Iskandar Malaysia 2025

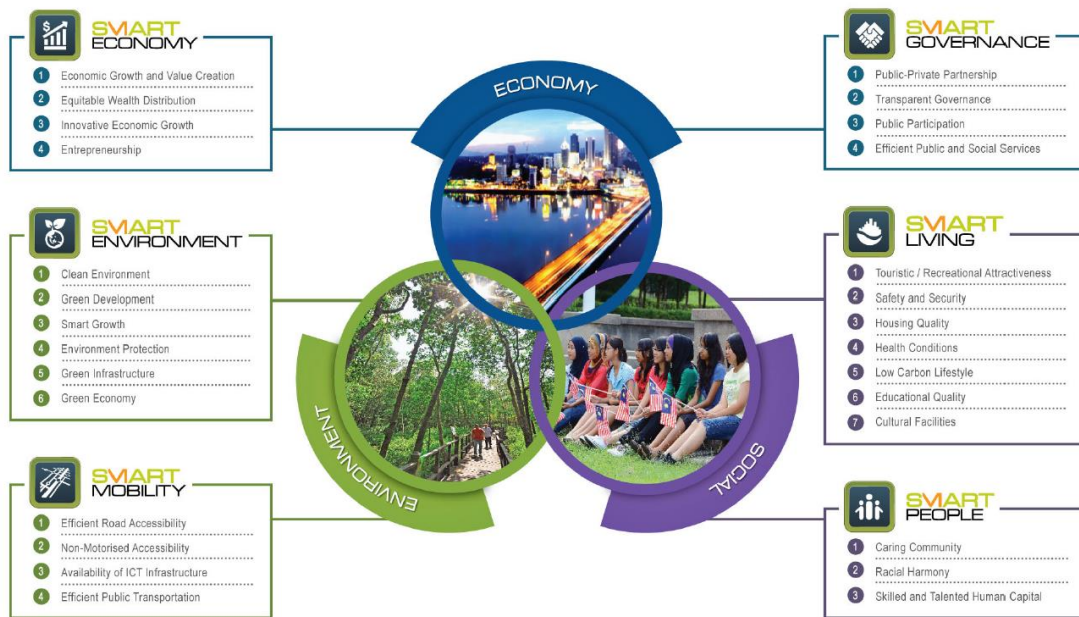


Source: Smart City Iskandar Malaysia

Figure 4-21 Smart City Iskandar Malaysia Flagship Development Zone

2) Iskandar Smart City Vision

Smart City Iskandar is expected to bring new enablers who create value, especially in making it easier to do business and improving quality of life. The three areas of focus are: 1) economy, 2) environment, and 3) society. There are also six programs: 1) smart economy, 2) smart environment, 3) smart mobility, 4) smart governance, 5) smart living, and 6) smart people. Smart City Iskandar is unique in that it actually introduces these areas in society in consideration of smart methods.

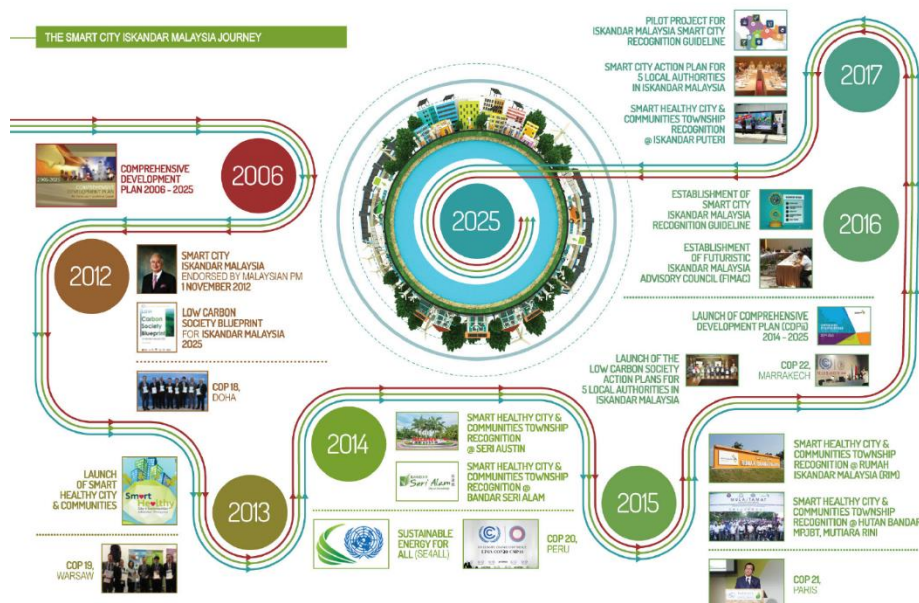


Source: Smart City Iskandar Malaysia

Figure 4-22 Smart City Iskandar Malaysia: Six Programs

3) Iskandar Smart City Policy

With Smart City Iskandar, the emphasis is not on ending the policy as a one-off event, but on drafting a roadmap and gradually promoting the project for 2025. This process is normally executed in major European cities, and it can be seen that Malaysia is actively emulating the successful knowledge of smart cities in developed countries.



Source: Smart City Iskandar Malaysia

Figure 4-23 Smart City Iskandar Malaysia Journey

4) Iskandar Smart City Project

The Smart City Iskandar project covers a wide range of areas such as energy, ICT, and

human capital, and currently has 35 programs.



Source: Smart City Iskandar Malaysia

Figure 4-24 Smart City Iskandar Malaysia Program

1. Government/advanced electronic transformation
2. IM as a secondary Malaysian ICT hub
3. IM One Stop Center
4. Integrated REITS program
5. Integrated and centralized professional retail
6. Integrated entrepreneurial development program
7. Personalized concierge services
8. Urban village economic transformation
9. Energy efficiency program
10. Green smart development facilities
11. IM green economic program
12. Key renewable energy program
13. Scenario planning in decision making
14. Smart land management program
15. Strategic area improvement program
16. Human capital program
17. ICT literacy program in rural areas
18. Innovative ethnicity proliferation program and policy
19. Poverty alleviation program
20. Online IM information
21. Citizen participation platform
22. PPP facility for innovative projects
23. Improvement of public and social services
24. Improvement of ICT infrastructure
25. Mobility and public transportation
26. Expansion of non-motorized facilities
27. Road efficiency program
28. Healthy lifestyles
29. Housing upgradation
30. PR activities for innovative tourism, rest and recuperation
31. Integrated ICT programs at public schools

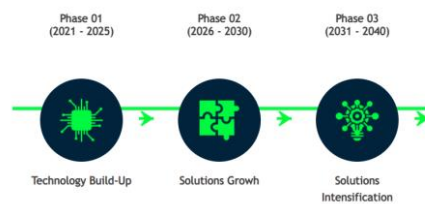
- 32. Improving integrated health facilities
- 33. Low carbon lifestyle program
- 34. Promoting appreciation of artistic heritage and culture
- 35. Security and safety program

(4) Cyberjaya

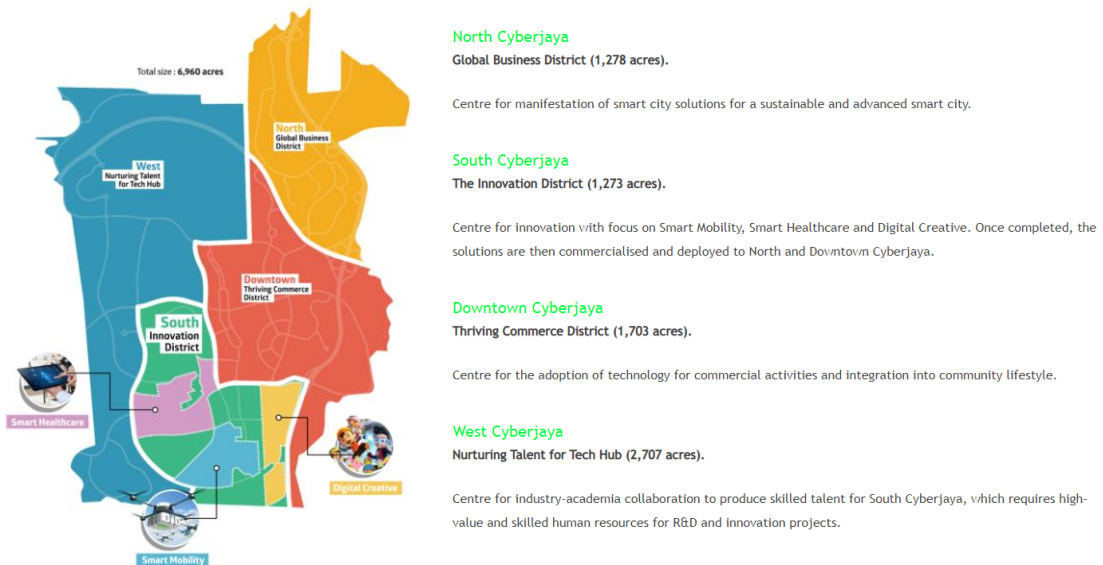
1) Cyberjaya: Smart City Strategy in City Planning

Cyberjaya is a strategic special economic zone aimed at promoting sustainable cities with smart infrastructure to meet the needs of the economy, society, environment and communities.

Cyberjaya Smart City Roadmap



For zone of Cyberjaya



Source: Cyberview

Figure 4-25 Cyberjaya City Plan

The Ministry of Finance Malaysia, a company with the goal of comprehensive development of Cyberjaya, holds a 92.24% stake, and a state-owned asset management agency (Permodalan Nasional Berhad) holds a 2.59% stake. Established in 1996.

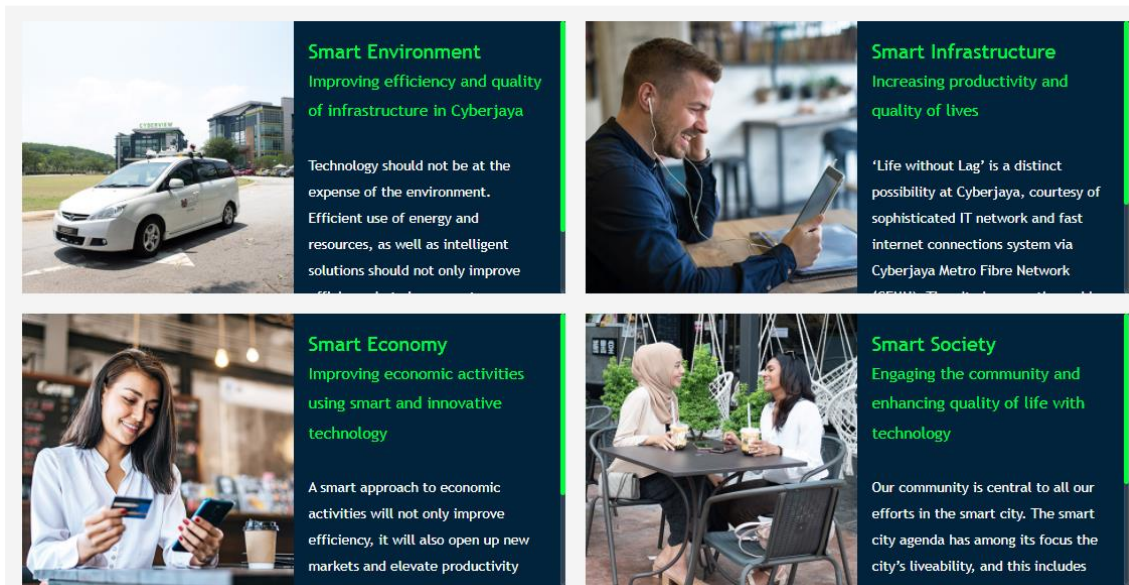


Source: Cyberview

Figure 4-26 Cyberjaya Special Economic Zone

2) Smart City Vision

Under the vision of becoming a technology hub, cyber views and smart city action plans form the core of the initiative, with a focus on building resilient infrastructure, promoting inclusiveness, and facilitating innovation in line with SDGs. It also works in collaboration with MSCF and Cyberjaya's low-carbon urban framework.



Source: Cyberview

Figure 4-27 Cyberjaya Smart City Framework

Cyberjaya Smart City Initiatives

Built Environment as a Service
Accelerating Cutting Edge Innovations & Research
Awareness Outreach Programme with Local Authorities
Social (Smart Public Services - Safety/ Health)
Cyberjaya Integrated Common Platform (ICP)

Source: Cyberview

Figure 4-28 Cyberjaya Smart City Initiative

3) Smart City Policies

Features of the three clusters in Cyberjaya

Smart Mobility

- Testbed for mobility solution development: Sustainable smart mobility services such as MaaS, on-demand mobility, autonomous driving, ITS (Intelligent Transport Systems), and drones will be developed.

Smart Healthcare

- Hub of smart, new innovative healthcare solutions: Data and medical information integration, remote medical applications, IoT medical devices, preventive medicine, etc., will be developed.

Digital Creativity

- One-stop center for creating the latest content in a digital environment: Digital web analysis, a creative workplace, prototype lab, digital experience center, on-demand services, virtual reality (AR/VR/MR) and wide range of technology development such as e-sports is possible.



Source: Cyberview

Figure 4-29 Cyberjaya Smart City Cluster

(5) Kota Kinabalu

1) Smart City Strategy

Kota Kinabalu is the capital of Sabah, East Malaysia, and a metropolitan area called Greater Kota Kinabalu has developed with a population of nearly 640,000. Kota Kinabalu is known as a tourist destination. With the support of the ASEAN Smart Cities Network, Kota Kinabalu has started initiatives to transform into a smart city. The city's economy is industrial against a background of natural resources in addition to the tourism industry, and is based on industrial complexes such as Likas, Kolombong, and Inanam.

2) Smart City Vision

Transform Kota Kinabalu into a clean, green, livable city.

3) Smart City Policies

Kota Kinabalu Industrial Park has a plan as a digital free trade area, in which there are plans to carry out development that incorporates smart city planning. There are strategies that guide the city's development, such as the Sabah Development Corridor Plan 2008-2025 and the Sabah Structural Plan 2033. Additionally, the city of Kota Kinabalu has formulated the Green City Action Plan 2018-2019 to guide city resilience in the goal of achieving a nature resort city, as well as actions for sustainable growth. Sabah will establish a smart city unit to plan and execute smart city development. Digital transformation is an activity that focuses on smart agriculture in addition to digital infrastructure, data sharing and cybersecurity.

<Main smart city focusses areas>

- E-government
- Transportation
- Environment
- Smart water and waste management
- City upgrades

- Smart tourism
- Social order and security
- Flood countermeasures

Kota Kinabalu has a higher poverty rate than other Malaysian states (19.5%). On the other hand, it is also a relatively prosperous region in Sabah as an engine for regional growth. With this in mind, the development of Kota Kinabalu is expected to be a good example for other regions in tackling urban issues while achieving sustainable growth. In that sense, smart cities could provide a means to solve such social issues.

4) Smart City Project

Kota Kinabalu	Water Supply Distribution Monitoring System	Smart Environment	Project
	Bus Rapid Transit (BRT) Rapid Planning based on Mobile Data Analytics	Smart Mobility	Project
	Sanitary Landfill Development Prioritisation	Smart Environment	Project

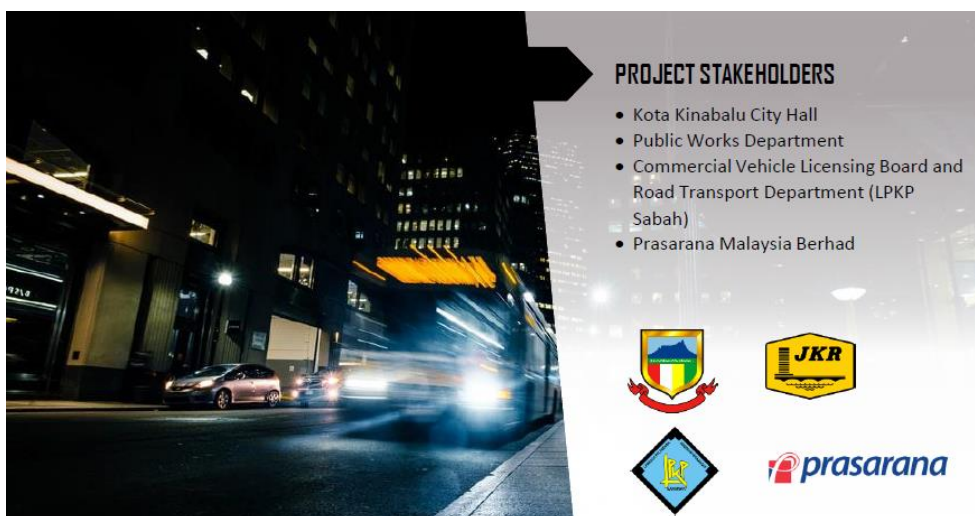
Source: Framework Smart City Executive Summary

Figure 4-30 Smart City Project in Konakitabalu

Advanced Transportation Systems: Integrated BRT System

Project period: 2016-2020

Project scale: RM 1 billion



Source: Smart City Handbook Malaysia

Figure 4-31 Stakeholders Involved in The BRT System Project

The city of Kota Kinabalu has set a goal of becoming a more livable Malaysian city by

2022. This goal is promoted by the Kota Kinabalu Public Transport Master Plan and the Traffic Improvement and Urban Transport Master Plan for Kota Kinabalu Central Business District. BRT buses are battery-powered, environmentally friendly, and can reduce travel time by half compared to existing transportation systems. RM 1 billion was allocated to this project for introduction by 2020 in the 2016 budget. It is currently waiting for the federal government to approve the budget for the 12th Malaysia Plan (2021-2025). This BRT system will enable affordable travel by rebuilding existing bus services. It runs from neighboring areas such as Penampang, Tuaran and Papar. The BRT system project has plans for four integrated bus terminals. There are currently two locations in operation: The Northern Inanan Integrated Bus Terminal and the Kota Kinabalu Central Terminal.

Integrated Waste Treatment System

Project period: 2018-2048

Project scale: RM 130 M



Source: Smart City Handbook Malaysia

Figure 4-32 Stakeholders Involved in The Integrated Waste Management System Project

The MLGH (The Ministry of Public Health, Housing and Local Government) is drafting a bill for the construction of waste management facilities to make public cleaning and waste disposal in Sabah sustainable. (As of June 2021) Currently, there are plans to develop two landfill sites to increase waste treatment capacity and install dedicated trashcans in the city. With this plan, the waste treatment plant will ensure a maximum treatment capacity of 800 tons per day. Plastic, paper, metal, organic fertilizer, and bottled CNG will be collected from Kota Kinabalu and four cities. It is said that recycling can avoid disposing of 800,000 PET bottles originally destined for landfills.

(6) Kuching

1) Smart City Strategy

Kuching is the largest city in Sarawak and also its capital. Located at the mouth of the Sarawak River, it is also a base for sightseeing in Borneo. It has a population of about

710,000 (2021). Kuching has become an important growth engine for the eastern part of Malaysia. The highly productive manufacturing cluster and low-priced electricity thanks to hydroelectric power generation using abundant water resources makes it an attractive factory location for the chemical and metal processing industries. Based on these industries, digital transformation and smart cities are positioned as important initiatives for future growth. Kuching is run by three municipalities: Kuching North City Hall (DBKU), Kuching South City Hall (DBKS), and Padawan City Hall (MPP). Because Kuching is the state capital, several state-level institutions are involved in the development and growth of the city.

2) Smart City Vision

Improve quality of life and gain status as a smart city through digital transformation and the Sarawak Digital Economy Strategy 2018-2022.

3) Smart City Policies

The state has plans to transition to a digital economy and sustainable domains, such as the use of renewable energy. In line with this, the goal is to develop Kuching as a smart city by 2030. The overall direction of development in Kuching is established in multiple documents such as the Master Plan for Strengthening Competitiveness in Kuching City and the Greater Kuching Regional Development Plan. The Sarawak Digital Economy Strategy, which leads the development of smart initiatives and the digital economy, is being developed by two state-owned agencies, the Sarawak Multimedia Authority (SMA) and the Sarawak Digital Economy Corporation (SDEC).

Main Smart City Focus Areas

- E-government
- Transportation
- Environment
- Open data
- City upgrades
- Smart tourism
- Flood countermeasures
- Social order and security

The state government is actively nurturing high value-added industries and implementing policies that provide generous and detailed incentives for investment in downstream manufacturing. The digital economy is seen as a tool to improve the sustainability of the economy. The region, which has only recently promoted digital transformation, fosters an ecosystem of innovation and builds talent and skillsets. Enablers are needed to improve the market. Therefore, SMA and SDEC play a central role in developing initiatives to promote research and innovation, and are making efforts toward implementation, such as providing opportunities for testbeds. Despite being a small city, Kuching faces a variety of challenges, and smart city efforts have helped to address and manage those issues. An integrated implementation and capacity-building approach helps harness the economic, natural and cultural strengths of Kuching.

4) Smart City Project

Integrated Flood Mitigation System

Project period: 2014-2022

Key technologies: Digital mapping, sensors & IoT, emergency response & early warning systems



Source: Smart City Handbook Malaysia

Figure 4-33 Stakeholders Involved in The Integrated Flood Mitigation System Project

Flash floods that accompany regular flooding occur instantaneously. Therefore, prompt responses make it possible to warn and evacuate residents and manage floodgates appropriately. The response system planned in Kuching will use more than 300 telemetry stations to inform local authorities at the right time and provide early warnings to residents. In Kuching, four intelligent gauges (IGs) are installed in flood-prone areas. These are part of a flood detection and warning system that measures water levels and provides early flood warnings to local residents via audio and visual signals. The system sounds an alarm when the water level reaches a preset alarm level. The existing IG data is displayed on the iHydro website and used for flood monitoring.

Kuching City Transportation System

Project period: 2018-2025

Project scale: RM 6 billion

Key technologies: trackless trams, hydrogen fuel, intelligent transportation systems



Source: Smart City Handbook Malaysia

Figure 4-34 Stakeholders Involved in The Kuching Urban Transport System Project

The railway transportation system (ART: autonomous railway) for municipalities in and around Kuching will be funded in the 12th Malaysia Plan. The project is in line with the goal of Sarawak becoming an advanced and high-income state by 2030. The Kuching Urban Transportation System (KUTS) is a government-led project on the ART system carried out by Sarawak Metro, and as the first phase of construction, two urban lines (total length of about 50 km) will be constructed. It is a trackless tram, most of which runs on the ground except for some elevated sections. ART vehicles will be powered by hydrogen fuel cell technology, and the first mile and last mile connections will be provided with a hydrogen-powered feeder bus in line with the needs of the state's hydrogen economy. Sarawak Metro aims for low-carbon and sustainable mobility, and also implements socio-economic strengthening and development programs, with R & D, human capital development and employment between local and overseas partners, creating opportunities for cooperation and growth.

4-2-3 Case Study in ASEAN Cities: Thailand

(1) Initiatives for Smart Cities as a Country

1) Overview

Efforts are being promoted in Thailand with the goal of making 100 cities smarter by 2022. Especially, the smart city criteria are formulated as a framework for promoting and evaluating the smart city initiative of each city. This framework is applied to provide incentives to cities that satisfy the criteria.

In addition, the Smart City Committee, which has a cross-ministry structure, has been established and efforts are being made to coordinate policies across ministries and agencies related to smart city projects.

Table 4-5 Smart City Framework in Thailand

Positioning of Smart City Policies in Country Strategies	<ul style="list-style-type: none"> - Smart City development is positioned as one of the key pillars of the policies for “Thailand 4.0,” the highest national strategy for the long-term socio-economic growth of Thailand. - Thailand 4.0 aims to overcome the stagnant economic growth (Middle income trap) situation by continuously improving added value with the keywords of “innovation,” “productivity,” and “value improvement in trade”.
Vision for smart cities	<ul style="list-style-type: none"> - The Digital Economy Promotion Agency (DEPA), which is the main promoting agency for Thailand’s smart city policy, defines smart cities as follows: “Smart cities are cities that improve the efficiency of urban services and urban management by incorporating advanced technologies and innovations into cities and optimize cost and resource use. Under proper design in urban development, they aim to encourage participation with business areas and people and improve the quality of life of urban residents and realize sustained happiness.” - DEPA has set out to identify 100 cities in Thailand to be smart cities by 2022. 40 cities are now identified by DEPA as smart city promotion cities (as of March 2021).
Framework of policies and systems related to smart city promotion	<ul style="list-style-type: none"> - Thailand has established a certification standard called Smart City Criteria, which provides incentives and deregulation for city and businesses that meet these criteria. - The content of smart cities proposed by cities and businesses is evaluated in seven areas: mobility, energy, environment, living, government, economy, and people. If the standards are met, the city is certified as a Smart City under the Thai system and would be eligible for tax exemption.

Smart City Promotion System and Organization	<p>- A cross-agency national committee (National Steering Committee) was established to lead the development of smart cities based on the previously mentioned Smart City Criteria system and to chair it as an organization for policy coordination. The Secretariat (Smart City Thailand Office) and subcommittees responsible for practical work in various fields are established under this committee.</p>
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Source: JICA Study Team

2) National Strategy and Economic Policy

The Thai economy, which has been driven by the export-oriented manufacturing industry as a growth engine, has recently been faced with serious social problems such as a stagnation of economic growth and an increase of economic inequality as the result of the “middle-income country’s trap.” It is also facing the arrival of an aging society. To grow out of these structural development issues, a long-term socio-economic policy and strategy aimed at raising the national incomes level through the improvement of value added by the upgrading of industries had been an important national policy agenda.

In 2016, the Prayut Administration formulated a long-term vision called Thailand 4.0. Thailand 4.0 classifies the economic and socioeconomic development of Thailand into three stages and shows the future target to be aimed at as the fourth stage (4.0).

Stage 1.0: The pre-industrialization stage with rural society and cottage industry as keywords.

Stage 2.0: The development stage until approximately the 1980s, with light industry, import substitution, natural resources and labor-intensive industries as keywords.

Stage 3.0: The stage of development up to the present with the keywords of heavy industry, export orientation, and foreign capital guidance.

Stage 4.0: In the maturity phase that Thailand is aiming for in the next 20 years, the keywords are innovation, productivity, and value enhancement in trade.

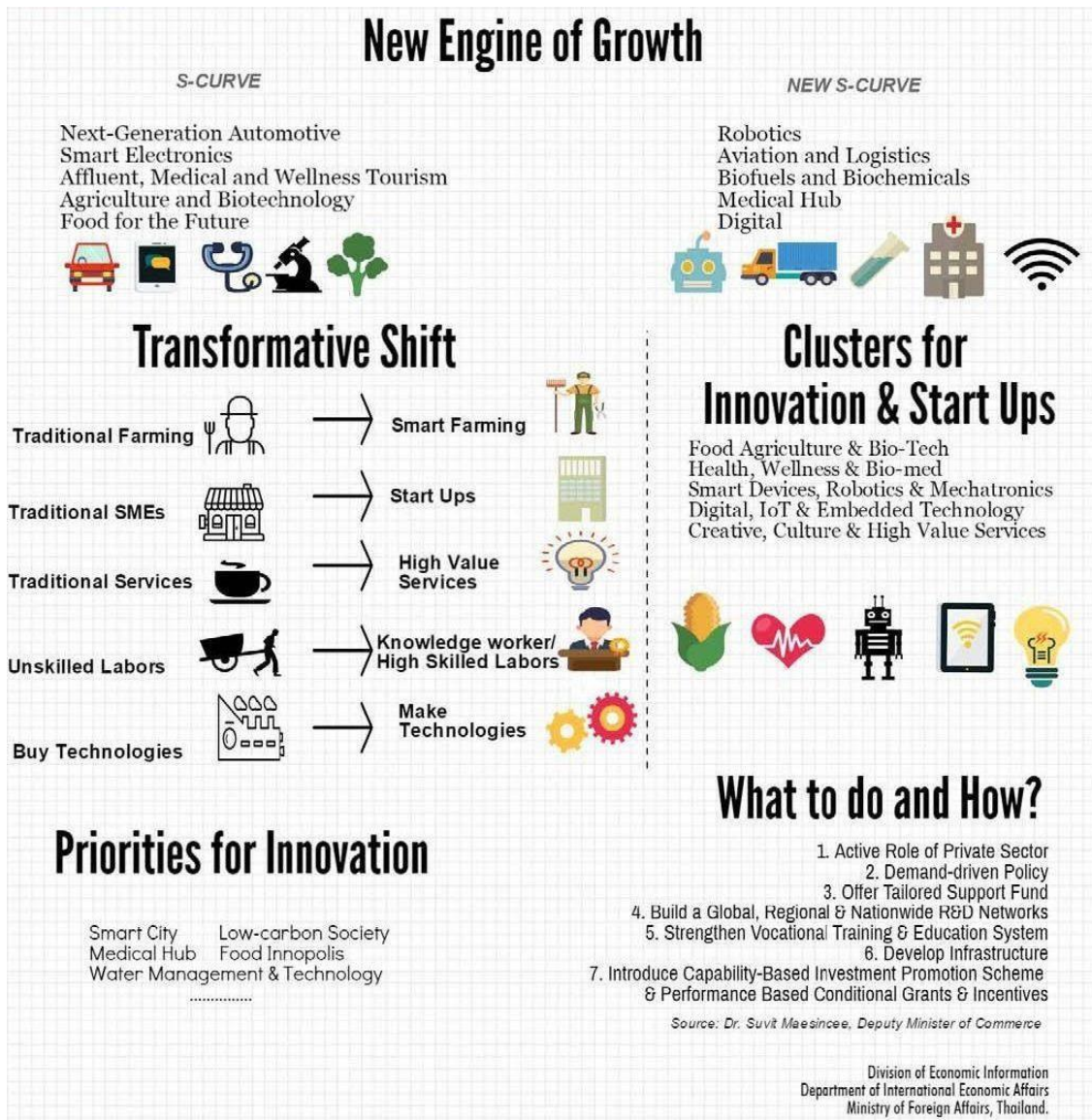


Source: Royal Embassy of Thai <https://thaiembdc.org/thailand-4-0-2/>

Figure 4-35 Vision for Industrial Development in Thailand 4.0

The 10 key industries to achieve Thailand 4.0 are: 1) next-generation vehicles; 2) smart electronics; 3) medical and health tourism; 4) agriculture and biotechnology; 5) future food; 6) robots; 7) aviation and logistics; 8) biofuels and biochemistry; 9) digital industry; and 10) medical hubs.

Of these, steps 1) through 5) are aimed at enhancing competitiveness based on existing industries, while 6) through 10) are aimed at fostering industries from a mid- to long-term viewpoint as new industries. The digital industry is positioned as a cross-sectional industry that spans these existing and new industries.



Source: Royal Embassy of Thai <https://thaiembdc.org/thailand-4-0-2/>

Figure 4-36 Overview of Strategy and Prioritized Areas of Thailand 4.0

While Thailand 4.0 has been presented as an industrial development strategy with emphasis on enhancing the competitiveness of existing industries and fostering new industries, “smart cities” are positioned as a priority area in innovation, alongside “realizing a low-carbon society” in terms of improving people's livelihood and ensuring sustainability.

In urban development, the development of the Eastern Economic Corridor (EEC) region is positioned under the national strategy. Between 2016 and 2020, a total of 1.5 trillion baht was invested in infrastructure development (railways, ports, etc.), tourism development, and new urban development. The development of Chonburi and Rayong, which are target cities for urban development in the EEC, is currently being promoted as smart city development.

3) Spatial plan: National Spatial Development Plan 2057

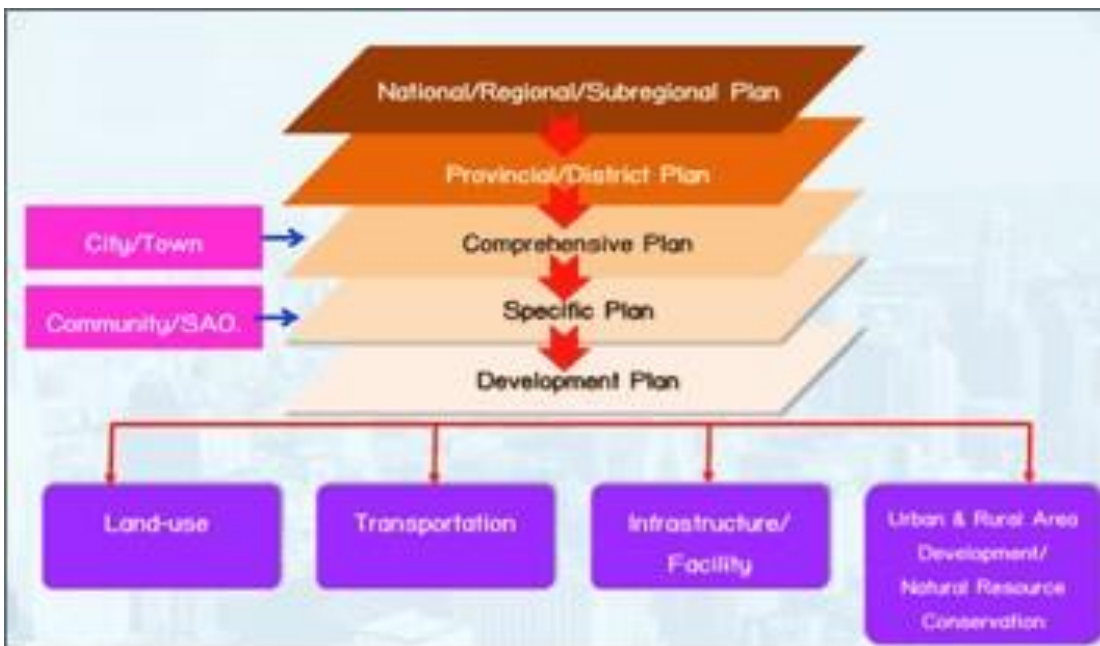
Under a cabinet directive dated July 9, 2002, the Ministry of Interior's Department of Public Works and Town & Country Planning (DPT) led the development of National Spatial Development Plan 2057 covering the whole of Thailand until year 2057. The national spatial

development policy has a 50-year plan, with a strategic plan on a 5-year, 10-year, and 15-year timescale.

The vision is “to lead the world in the industries which have competitive advantage, to realize a good urban environment and high quality of life, and to realize sustainable growth.”

National Spatial Development Plan 2057 Planning Framework

The National Spatial Development Policy for the next 50 years consists of the National Plan, and its composition including both the wide area region (national-local plan), and the wide area district divisions that are six regions: Bangkok and its surrounding region, and the eastern region, central region, northeastern region, northern region and southern region.



Source: Royal Embassy of Thai <https://thaiembdc.org/thailand-4-0-2/>

Figure 4-37 National Spatial Development Plan 2057 Planning System

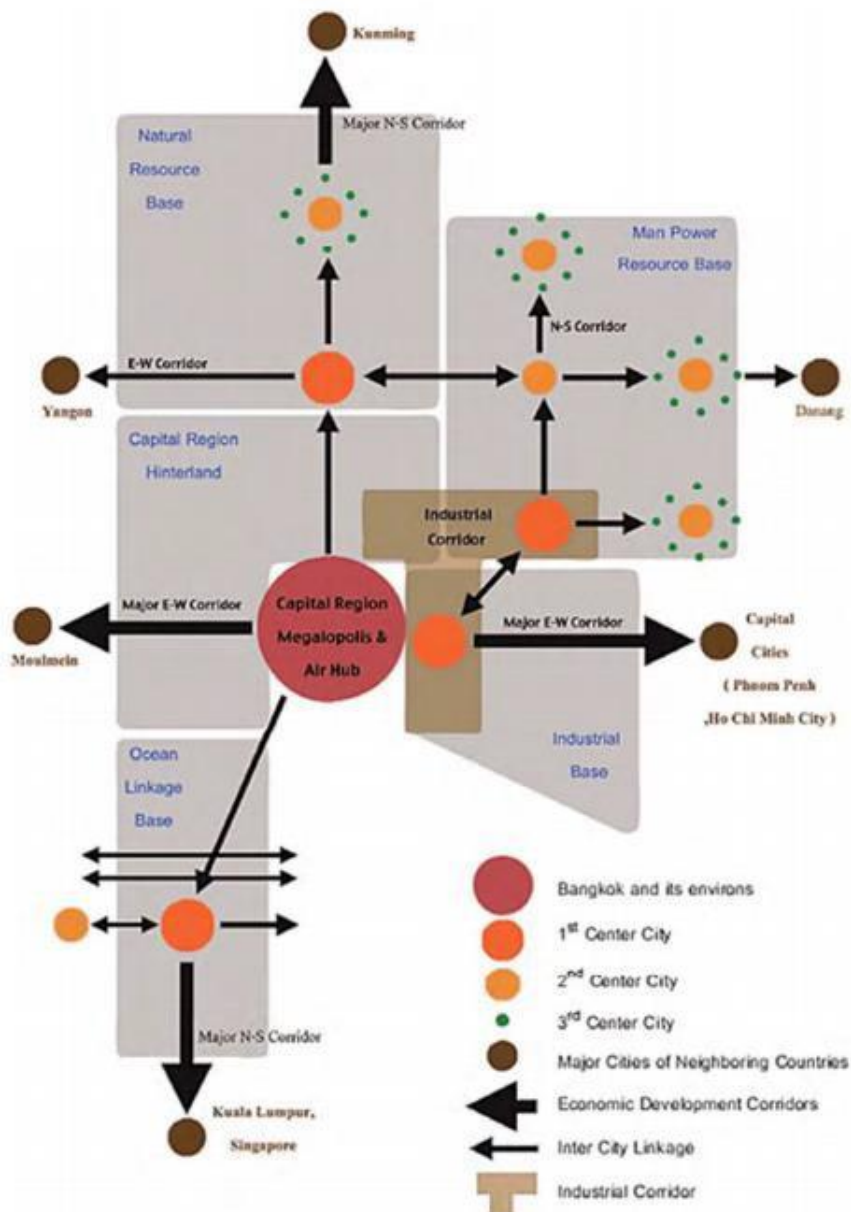
The areas covered by this policy are: 1) land use development; 2) agricultural development, 3) urban and rural development, 4) industrial development, 5) tourism, 6) social services, 7) traffic, energy, IT and communication, and 8) natural disaster prevention.

National Spatial Structure in National Spatial Development Plan 2057

Regarding the development of the wide-area region, the development framework of each district division region is set as follows so that all regions in the country can support each other and make full use of their delegating power in a cooperative manner, and so that the implementation of the national plan can achieve the goals.

- **Bangkok Area (Bangkok and its vicinity):** Promote the Bangkok area to maintain and strengthen its position as an international city center and serve as a national center as a base for air traffic and other transport and connecting with Southeast Asia, East Asia and Southeast Asia. Bangkok will also develop urban areas in a way that will provide better density, orderly growth, quality of the environment, and enhance the integrity of people's lives, making it comfortable for both residents and visitors.

- **Eastern Region:** The eastern region is the foundation for the development of major domestic and large-scale import and export industries that accept surplus labor from other regions while receiving employment allocations from Bangkok in the industrial and service sectors. On the other hand, this district requires area management related to environmental conservation to positively play a role in domestic agriculture and natural tourism. Therefore, thorough stringent policies for land use are required.
- **Central Region:** The central region, which has a rich agricultural area surrounding the Bangkok area, serves as an important nodal point to the metropolitan environment-conservation zone and the main domestic economic sector, thereby allocating growth nationwide. Therefore, the central region has various roles and functions such as development of cities and industries, research and development of agriculture, promotion of tourism, and establishing communication channels to neighboring countries.
- **Northeastern Region:** The region has a large domestic workforce and is rich in natural resources and cultural heritage related to Lao PDR and Cambodia.
- **Northern Region:** The region has rural areas where it is important to conserve and manage the abundant and diverse natural resources. The plan envisages that development shall be promoted leveraging the proximity to China and the business opportunity this presents.
- **Southern Region:** The Southern region has the prominent potential to connect with ASEAN countries through the sea route. However, the development should take into account the need to conserve and manage valuable natural resources and the characteristic and traditional cultural attributes.



Source: DPT (2009) "Thailand National Spatial Development Plan 2057"

Figure 4-38 National Spatial Development Plan 2057 National Land Structural Program

4) Smart City Policy: Thailand 4.0

Thailand has established a certification standard called the Smart City Criteria, which provides incentives and deregulation for cities and business proposals that meet this certification standard.

Though no cities have already obtained smart city certification under this system, 40 cities have been certified as candidate cities (Smart City Promotion Certificate) by DEPA (as of March 2021).

5) Proposal and Review Process under the Smart City Criteria System

In order to acquire a smart city certificate in Thailand, cities and businesses shall submit a proposal to the Smart City Thailand Office, which will then be reviewed and screened. Subsequently, the proposal would undergo respectively an evaluation process by the National

Smart City Subcommittee, and then an approval process by the National Smart City Committee.

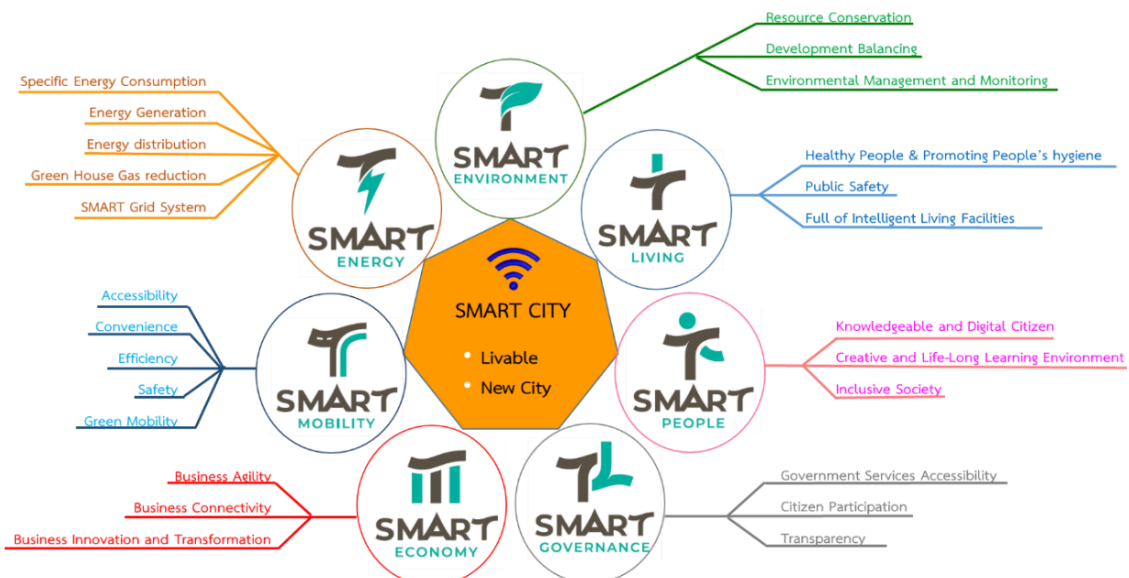
This smart city proposal will be reviewed in accordance with the five items listed as follows.

- **Definitions and objectives:** Define characteristics related to vision, goals, objectives, types, and smart cities, and specify the target areas for smart city development clearly and concretely.
- **Infrastructure development, etc.:** Development of digital infrastructure, transport and energy infrastructure, and public facilities according to the vision, goals, objectives, types, and characteristics of the proposed smart cities.
- **Data Platform:** Developing a City Data Platform for integration and use of data in management and services in the smart city, along with guidelines for managing cyber security and protecting personal data.
- **Seven Smart domains (described in the following section):** Define detailed activities and solutions for the development of smart domains.
- **Investment and sustainable management:** The smart city's investment approach and mechanisms for investment and management as sustainable management by the public sector, public-private partnerships, and the private sector.

7 Smart City Domains

Major evaluation items for Thailand's Smart City Criteria are the following seven areas: 1) Environment; 2) Energy; 3) Mobility; 4) Living; 5) Government; 6) Economy; and 7) People.

Of these seven smart areas, 1) Environment is a mandatory item, and one or more other smart areas need to be selected and proposed based on this. If the standards for all 7 smart criteria are met, they will be eligible to better conditions.



Source: OTP (2019) Published Materials

Figure 4-39 Seven Smart Zones in the Criteria

Incentives Under the Smart City Certification System

Under the Thai investment law B.E. 2520, investment in smart city projects certified by smart cities may be exempted as an incentive by Board of Investment (BOI).

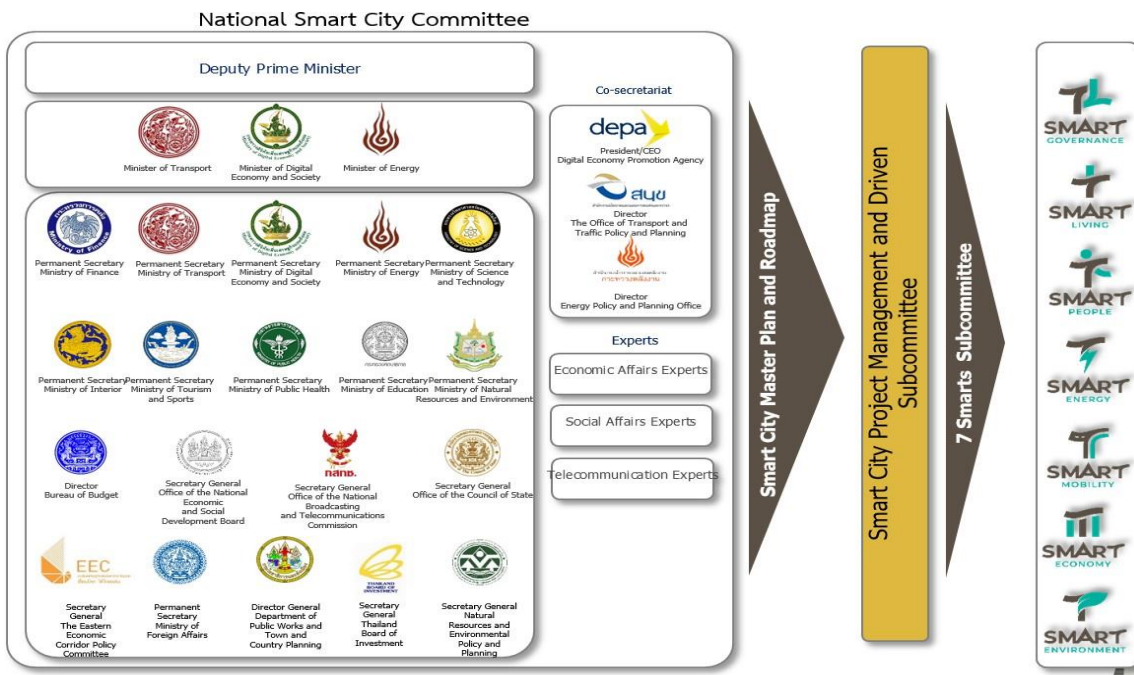
The tax exemptions according to the type of smart city certification are as follows:

- **Smart cities that meet all the standards for all seven smart domains:** Investors and businesses can enjoy an 8-year corporate tax exemption.
- Smart cities that meet standards for one or more domains in addition to environment (mandatory): Investors and businesses can enjoy a five-year corporate tax exemption.

6) Smart City Related Organizations: Smart City Committee

In parallel with the formulation of the previously mentioned smart city criteria, the Thai government established the “Smart City Committee” as a cross-disciplinary government organization with the Vice-Minister of Transport as the chairperson. Also, the Thai government established a mechanism for policy coordination with each related government agency, with the purpose of promoting and managing the efforts of cities in each smart city. Cross-disciplinary policy coordination will be carried out by this Smart City Committee, and reviews and evaluations of individual urban initiatives will be discussed and examined by subcommittees and sector-specific subcommittees established thereunder.

It is stipulated that deregulation measures for smart cities will be discussed and coordinated among the relevant authorities within the framework of these Smart City Committees.



Source: OTP (2019) Published Materials

Figure 4-40 Organizational Structure for the Smart City Committee and Sub Committees

(2) Bangkok

1) Urban Challenges and Urban Planning in Bangkok

Outline and History of Urban Planning in Bangkok

Until now, various urban development and measures such as infrastructure development and provision of social services, and the induction of business and investment have been deployed in concentration to promote economic activities in Bangkok. Thus, the city has flourished as a central city for administrative, culture and economic activities.

On the other hand, the concentration of such development has led to an expansion of a gap with other regions in terms of employment opportunities and incomes, which has further accelerated the attraction of population, and urbanization has progressed more rapidly since 1980 in particular.

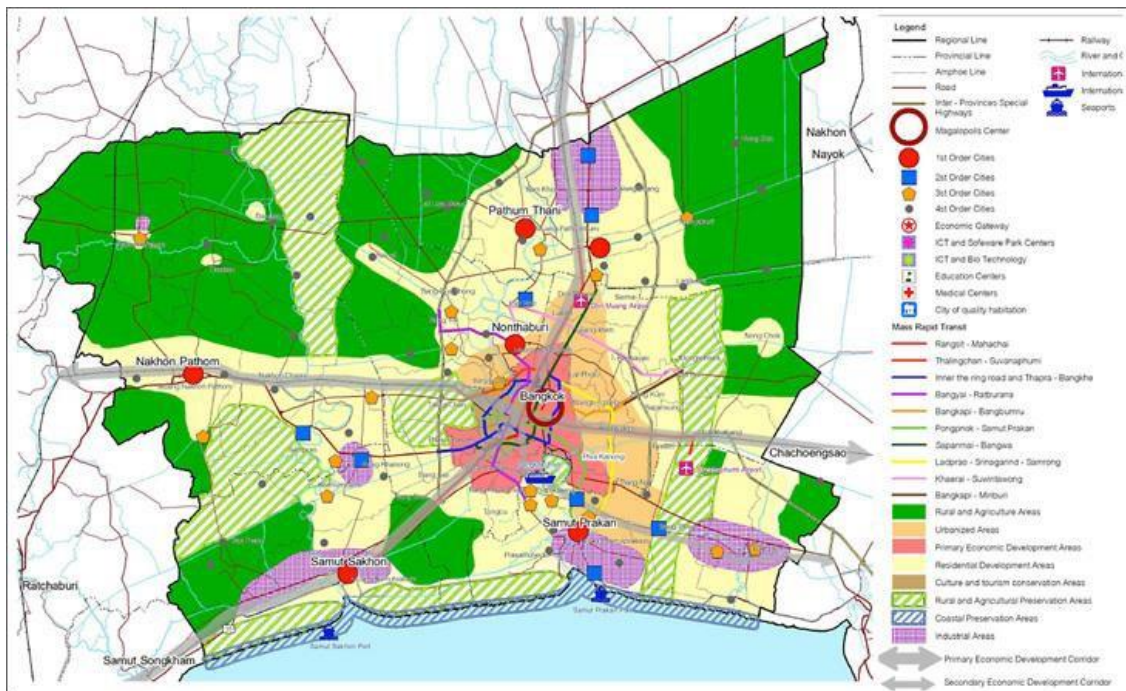
The speed of population growth in Bangkok outpaced the development of social infrastructure and services as well as the provision of urban housing, causing problems such as urban sprawl and inappropriate land use.

Urban sprawl and inappropriate land use have become root causes of various urban problems such as urban environmental problems, transportation problems, disordered urban development, diversion of agricultural land to residential land, and disparity between urban residents. These should be considered as constraint conditions for future measures as they are expected to continue to affect the pattern of urban growth.

Spatial Planning in Bangkok

In the Bangkok metropolitan area and its surroundings, the plan aims to maintain Bangkok's position as an international city and to play a central role as the capital and in nation as a base for air traffic and other transportation and connection to Central Asia, East Asia, Southeast Asia and Southern Asia.

In addition, the government intends to develop urban areas that will be more efficient in terms of land use, with balance and order, and provided with a quality environment. Thus, the plan envisages to enhance the quality of people's lives so that both residents and visitors will be comfortable.



Source: DPT (2009) "Thailand National Spatial Development Plan 2057"

Figure 4-41 Spatial Planning in National Spatial Development Plan 2057 Bangkok

2) Smart City-Related Plans in Bangkok

Although there is no clear smart city strategy or plan at present at the level of the Bangkok metropolitan government, development is proceeding on an area-by-area basis in accordance with the previously mentioned smart city policy of the central government. In addition, several initiatives are ongoing at project-level to improve urban management by utilizing ICT and digital technologies.

3) Smart City Vision

There is no clear strategy or vision for smart cities at the level of the Bangkok Metropolitan Administration. However, the 20-year (~2032) growth strategy of the Bangkok Metropolitan Administration, developed by the Strategy and Evaluation Department of the Bangkok Metropolitan Administration in collaboration with Chulalongkorn University, could serve as a reference for interpreting the general direction. This is a strategy under the six axes with the keywords of safety, green, inclusive, compact city, governance, economics, learning, etc.

- **Safe city:** To reduce environmental pollution, improve security, reduce accidents, and create safe and secure cities through disaster prevention, etc.
- **Green and convenient city:** Securing green spaces, ensuring good landscape, ensuring inexpensive and comprehensive public transport, etc.
- **City for all:** Realize inclusive cities by expanding facilities for the disabled and the elderly, supporting poverty, enhancing educational skills, and ensuring diversity.
- **Compact city:** Organically connect urban sub-bases under proper land-use planning and management.
- **Democratic city:** Strengthen administrative reform, governance, decentralization, ensuring transparency of administration, participation of residents, etc.
- **Economic and learning center:** Enhance the economic foundation and enhance the attractiveness of international cities by enhancing industrial, promoting investment, encouraging tourism, forming and disseminating culture, and establishing a position as a place for exhibitions and conferences.

In line with the direction described in the previous strategy, various projects have been formulated according to theme, and the utilization of ICT and digital technologies is also expected.

Table 4-6 20 Projects in the Growth Strategy for the Year (up to 2032)

Strategic axis	Theme	Description of business
Safe city	Reduction of environmental pollution Improvement of security	Maintenance and dissemination of household wastewater and waste treatment facilities. Installation of CCTV and streetlights and strengthening monitoring.
Green city	Good landscape and environmental convenience	Underground electric wires and greenery formation projects. Extending metro lines, improving bicycle roads, and expanding parking lots.
City for all	Education and welfare for the vulnerable	Establishment of funding to support the vulnerable and expansion of financial support. Development of educational and welfare facilities etc.

Strategic axis	Theme	Description of business
Compact city	Appropriate land-use urban management	Urban planning and land use planning and management. Management and operation of data on geographic information for urban development.
Democratic city	Governance	Public comments on administrative budget planning and execution To investigate the public's trust in administrative and their opinions.

Source: JICA Study Team

4) Smart City Policy

At the Bangkok metropolitan level, there is no policy specialized for smart cities, and it is carried out according to the national policy or under the leadership of the private sector in area development.

5) Smart City Project

In Bangkok, there are many projects being promoted in the context of private-sector-driven area development, such as smart city development projects on the premises of Chulalongkorn University and One Bangkok projects undertaken by major real estate companies. In the ASEAN Smart City Network, Bangkok is also working to develop smart cities in the Bang Sue area, where Bang Sue Grand Station is located and is developing a project.

Table 4-7 following is an overview of the Bang Sue area development project.

Table 4-7 Overview of The Bang Sue Area Development Project

Outline of smart city initiatives	<ul style="list-style-type: none"> - As a ASCN pilot project, the development of smart cities is being promoted in the Bang Sue area with the basic policy of public Transit-Oriented Development (TOD). - In the Bang Sue area, the construction of the Grand station is ongoing, and it is planned to become a transport hub connecting public transportation systems such as the newly opened red line, high-speed railway, and airport connecting line besides the existing metro line. - With the development area of over 300ha, Bang Sue Grand Station area development projects is being promoted as smart city development project.
Expected benefits and vision	<ul style="list-style-type: none"> - It aims to propose an area to promote a new lifestyle for residents and visitors by making the most of its convenient locational setting. - In addition to creating a comfortable urban environment through the development of high-quality infrastructure and urban facilities, smart technology helps to address traffic congestion and environmental problems, which are the major urban issues in Bangkok.
Components (Technologies)	<ul style="list-style-type: none"> - It is proposed that the area will focus on three Smart domains: Energy, Mobility, and the Environment.

	<ul style="list-style-type: none"> • Energy: Establishment of energy and heat source supply system by independent and distributed power sources • Mobility: Establishment of public transportation system by small EV • Environment: Monitoring and Communicating environmental indicators Communication system
Tools	<ul style="list-style-type: none"> - Smart city incentives, such as tax exemption, could be applied if it becomes certified under the Criteria System.
Approach	<ul style="list-style-type: none"> - Area-based approach, involving area development over 300 ha (real estate development business and infrastructure development)
Players and propulsion entities	<ul style="list-style-type: none"> - The landowner, the Thai State Railways Company (SRT) and the Office for Transport and Traffic Policy Planning (OTP) under the Thai Ministry of Transport, are responsible for infrastructure development projects in the planning and initial development. - Implementation structure including collaboration with private businesses is currently under consideration.
Cost sharing between the public and private sectors	<ul style="list-style-type: none"> - The development of basic infrastructures in the early stages is expected to be carried out under cooperation between the Thai Central Government, the Bangkok Metropolitan Government, and the landowner, SRT. - On the flow of funds and the business model (including the cost-and profit-sharing structure) is now under consideration.
Framework of Resident Participation	<ul style="list-style-type: none"> - The concrete processes, concrete mechanisms, etc. are currently being discussed.

Source: JICA Study Team

(3) Phuket

1) Urban Challenges and Urban Planning in Phuket

Urban Issues in Phuket Province

Phuket Province grew as a tourist hub against the background of good marine resources and abundant cultural resources. The challenge is to improve the attractiveness to visitors and consumers while ensuring the sustainability of the environment. In particular, the following issues are listed in the Phuket Prefectural Development Plan (2018-2022):

- Excessive number of visitors, environmentally friendly tourism industry, and destruction of natural and marine resources through inadequate waste management.
- Traffic accidents caused by traffic violations by visitors, illegal dumping of garbage, and other manners violated, and the image as a sightseeing center due to worsening security.
- Citizens' interest in tourism or city projects, and low level of participation in community and volunteer activities.
- The regional economy in Phuket Province is overly dependent on the tourism industry, and the regional economic structure is vulnerable to changes in conditions and shocks.
- Low productivity due to lack of human resources and capacity. Products and services that do not meet international standards. Spread of screws, etc.
- Inadequate systems and systems for integrated data collection and utilization for policy analysis and evaluation.

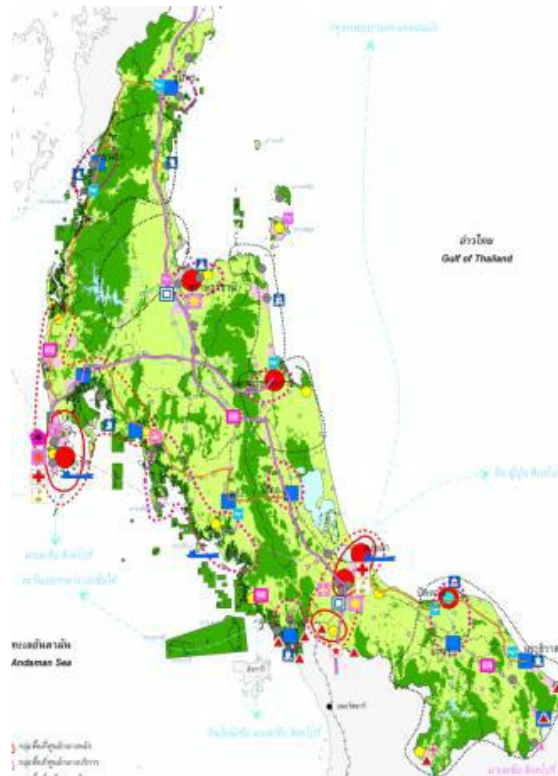
Spatial Plan in Phuket Province: “National Spatial Development Program 2057”

Thailand's southern region has a policy of forming a growth axis by making use of its connectivity with ASEAN countries through the Andaman Sea or the South China Sea.

In Phuket, efforts are being made to strengthen connectivity with the world and attract international tourists through the upgrades to international airports.

In urban development planning, the Province aims to invite health/welfare facilities, rehabilitation centers and ICT centers.

On the other hand, development must conserve the natural resources, cultural resources, and climate unique to the southern region.



Source: DPT (2009) “Thailand National Spatial Development Plan 2057”

Figure 4-42 Spatial Plan in National Spatial Development Plan 2057 Phuket Prefecture

2) Policies Related to Smart Cities in Phuket: Five-Year Development Plan (2018-2022)

Phuket Province's five-year development plan will strengthen the tourism industry, education and innovation. Its top priority is to establish its position as an international tourist city and to ensure environmental sustainability.

- “International Education City”: Providing international-level educational services to enhance the capacities of civilian societies and communities, as well as to reinforce human resources as the foundation for sustainable growth in the region.
- “Innovation for international service”: Aiming to become a model in Thailand by promoting smart city initiatives and the use of digital technologies in the fields of tourism, medical, environmental, and educational fields, and by creating innovative services.
- “Sustainable Development”: Maintain and improve environmental sustainability while properly managing agricultural, industrial and tourism industries and harmonizing local natural resources toward the creation of a locally independent ecosystem.

In addition, the following policies on the utilization of digital technology have been formulated in the development plan.

- Promoting SMEs and Startups: Promoting match making and marketing through Digital Platforms.
- Development of convenient services for tourists: Improvement of Wi-Fi conditions in the city, promotion of digitalization of tourist information media, public transport information, restaurant menus, etc., and multilingual support.

3) Smart City Vision in Phuket City

Phuket City developed the Phuket Smart City Road Map (2015-2020) based on the Smart City Criteria of the Country. In this project, digital infrastructure development and service provision are planned under the vision of “The Tourism Island of Sustainable growth by enhancing Creative Economy to provide Happiness for all.”

It also indicates the direction of the development of infrastructure and facilities as follows.

- Digital Infrastructure: Wi-Fi, CCTV, Sensors, Platform development.
- Smart City Facilities: Development of Incubation Centers, Smart City Labs, etc.

4) Smart City Policy

Initiatives Linked with the Country's Smart City Criteria

Phuket City is nominated as an ASCN26 City and is also positioned as a Smart City Pilot City designated by the government (certified as a Smart City Promotion Area in January 2018 by the National Smart City Committee).

The Smart City in Phuket City is being promoted in cooperation with the Digital Economic Development Agency of Thailand (DEPA).

Smart Phuket was formulated (published in 2017) and various initiatives are being implemented to promote the tourism industry and realize the well-being of citizens.

In addition to the smart areas defined in Thailand's Smart City Criteria, Phuket City has established its own plans for tourism and other initiatives.

Table 4-8 List of Smart Phuket Initiatives

Smart environment	- A system for monitoring and managing atmospheric, water, and oceanographic data using sensors and IoT devices.
Smart tourism	- Establish high-speed communications with Wi-Fi networks in public spaces to provide Internet access to everyone, including tourists. - GPS located along the coast with many tourists. - Introduction of a bus system equipped with a system that allows users to know arrival and departure times with apps.
Smart Economy	- Establishment of Innovation Incubation Center.
Smart Safety	- Detection of crime by introducing CCTV and facial recognition. - Monitoring of people and ensuring maritime safety.
Smart healthcare	- Establishment of collaboration among 8 hospitals and smart devices in the city.
Smart governance	- Administrative efficiency with Data Platforms. - Ensuring Equality and Transparency.
Smart Education	- Promote lifelong learning in Phuket City. - Construct facilities.

Source: JICA Study Team



Source: Phuket City (2017) "Smart Phuket"

Figure 4-43 Schematic Diagram of Smart Phuket

Administrative Budget for Smart Cities

Central agency budgets for the development of the digital infrastructure in Phuket City are planned to be invested (*Phuket City Smart City Roadmap (2017). The budget is planned for 2020).

- Ministry of Digital Economy (MDES): Development of public high-speed communication Wi-Fi (approximately 240 million THB)
- Software Industry Promotion Agency (SIPA): Development of digital human resources and promotion of digitalization (approximately 8 million THB)
- National Science and Technology Development Bureau (NSTDA): CCTV Systems, Traffic Management Systems) (approximately 7 million THB)

5) Major Players in The Smart City of Phuket

In addition to prefectures and cities, the Phuket Smart City has support from national organizations (DEPA, NSTDA, NECTEC, CAT, etc.) and alliances with private companies. Other key players include:

- Phuket City Development Co., Ltd. (PCKD): A private company established by a private organization in Phuket Province. It is a major private partner of smart city. For the development of Phuket as a sightseeing city, smart bus operation, development of sightseeing apps, and support of renewable energy are carried out.
- Huawei: The company is involved in the development of smart cities for Phuket City, and in 2019 it released Phuket Smart City Development Program created with Roland Berger. Smart meters, streetlights, public transport, waste control, CCTV, tourism, are included in the program. 6 Strategies and projects in several areas are presented. A total of 39 projects have been proposed as projects to be addressed by the year 2023.

6) Summary of Phuket Smart City

Table 4-9 following is an outline of the smart city project in Phuket.

Table 4-9 Outline of The Smart City Project in The Phuket

Outline of smart city initiatives	<ul style="list-style-type: none"> - In addition to being selected as one of the ASCN 26 cities, Phuket is positioned as a smart city pilot designated by the government and is working on a smart city with a focus on digital technology under the support of the government. - The characteristics of the smart city initiatives include providing smart services to promote the tourist industry and improve the convenience of tourists and implementing initiatives to manage the unique natural environment.
Expected benefits and vision	<ul style="list-style-type: none"> - Under the vision: “The Tourism Island of Sustainable growth by enhancing Creative Economy to provide Happiness for all,” various initiatives are being implemented with the aim of promoting the tourism industry and realizing the happiness of citizens. - It particularly focuses on the fields of tourism, medical care, environment and education, and tourism industry. - It aims mainly to improve productivity and added value, and to achieve sustainable and autonomous growth.
Components (Technologies)	<ul style="list-style-type: none"> - City data platform is being developed aiming at the collection and advanced use of urban data. - In the area of smart city, in addition to the smart domain set by the country, tourism and security is set as the focus area.
Tools	<ul style="list-style-type: none"> - It is promoted as a Smart City Promotion Area in Thailand’s Smart City Strategy. Preferential treatment, such as tax exemption, could be applied if certified under the Smart City Criteria System.
Approach	<ul style="list-style-type: none"> - It could be characterized as administration-driven development focusing on information and communication infrastructure, and data. - Improving the efficiency of industrial development and urban services through the use of sophisticated data using data platform.
Players and promoting entities	<ul style="list-style-type: none"> - Ministry of Information and Communications (MICT), Thailand Digital Economic Promotion Agency (DEPA), Thailand Software Industry Promotion Agency (SIPA), and other government agencies related to information technology and science and technology such as the National Science and Technology Development Agency (NSTDA) lead the development. - There are a number of private partners involved.
Cost sharing between the public and private sectors	<ul style="list-style-type: none"> - The development of information and digital infrastructures was implemented with the support from government agencies related to information and technology, such as the Ministry of Information and Communications (MICT), the Digital Economic Promotion Agency (DEPA), the Software Industry Promotion Agency (SIPA), and the National Science and Technology Development Agency (NSTDA)
Framework for citizen participation	<ul style="list-style-type: none"> - Participation in the development process is unknown.

Source: JICA Study Team

(4) Chonburi

1) Urban Challenges and Development Plan in Chonburi Province

Urban Issues in Chonburi Province

Chonburi could be categorized as an industrial city with an accumulation of heavy chemical industries and machinery manufacturing industries due to geographic factors such as access to the capital city of Bangkok and accessibility to Laem Chabang Port, together with policy factors such as infrastructure development and active foreign capital guidance.

Development of Laem Chabang Port in 1980s could be seen as an important milestone in Thailand's development process of shifting from an import-alternative economy to an export-oriented economy by industrialization and inviting foreign enterprises. Large-scale developments, such as industrial estate was promoted at the eastern coastal regions together with the development of the Port, which is now known as Eastern Seaboard Development Project.

In Chonburi Province, there is the agglomeration of the manufacturing industry, including Japanese machinery and automotive industries, and hence the Province's Gross Regional Domestic Produce (GRDP) is ranked third in Thailand.

On the other hand, in order to grow out from the recent economic stagnation in Thailand ("The trap of middle-income countries"), development of Eastern Economic Corridor (EEC) has been set out as a priority policy to promote the development of the coastal region, including Chonburi. The EEC strategy aims to restructure the industry and formulate a new pole of economic growth.

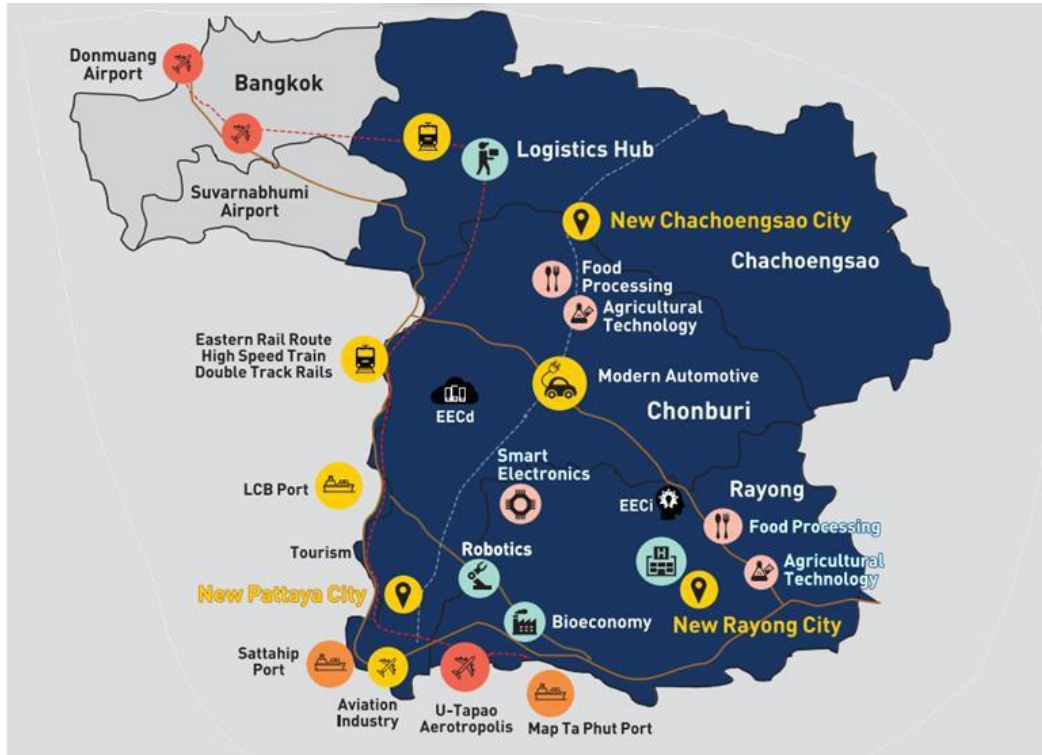
Development Strategy of Chonburi: Eastern Economic Corridor (EEC) Strategy

EEC is incorporated in Thailand's 20-Year National Plan (National Strategy) and is a core measure in the conversion of Thailand's economic and industrial structure. Twelve industries have been designated as priority industries, including the next-generation automobile industry, the electronic industry, biotechnology, and the automated and robotic machinery industry, and investment is promoted under the special incentive system. The following are the twelve industries that are promoted in EEC:

1. Next-generation Automotive
2. Intelligent Electronics (Next Generation Electronics Industry)
3. Advanced Agriculture & Biotechnology
4. Food for the Future (Food Tech)
5. High-value and Medical Tourism (medical tourism)
6. Automation and Robotics
7. Aviation and Logistics (Aeronautical and physical distribution technology)
8. Medical and Comprehensive Healthcare
9. Biofuel and Biochemical
10. Digital Technology
11. Defense
12. Education and Human Resource Development

Originally, in the 2009 National Spatial Program "Thailand's National Spatial Development Program 2057," the eastern region of Bangkok, including Chonburi, emphasized economic exchange through people and goods exchange through spatial connections with Bangkok.

In EEC project, the three provinces of Chachoengsao, Chonburi and Rayong are planned to promote urban development based on high-speed railroads, airports and other transportation infrastructures to create a new dynamism and to promote Transit-Oriented Development (TOD) as a guideline.



Source: EECO (2018) “EEC Development Plan”

Figure 4-44 EEC Program

Currently there are plans to construct a high-speed railway line in EEC area that connects three airports: Donmuang, Suvarnabhumi, and Utao. The new industry and economic activities are being strengthened by enhancing transportation connectivity and logistics.

By adopting an urban development model of TOD and consolidating urban functions, mainly in railway stations, the formation of convenient and comfortable urban spaces is being pursued. By promoting and strengthening the new industries and technologies listed previously in these newly developed cities, the Province is expected to grow as a smart city that realizes affluent lifestyles and creates new economic value.

2) Policy on the Development of Smart Cities in EEC (Visions)

The Annual National Plan (National Strategy) defines the following six EEC planning guidelines. Smart City development, promoted with the key words “livable” and “financial center,” is supported by the development of high-quality infrastructure and digital infrastructures.

1. Development of basic infrastructure
2. Development of digital infrastructure
3. Development of livable smart cities and financial centers
4. Development of targeted industries that utilize advanced technology
5. Development and promotion of tourism
6. Development of human resources, education, research, and technology

3) Smart City Promotion System

The following tax and deregulation incentives can be applied in accordance with EEC Law (2019) when developing smart cities in the EEC Promotion Area. These are not limited to smart city development projects and applied to the certified projects and investments.

- Tax exemptions and preferential treatment
- Preferential tariff treatment
- Deregulation of land ownership
- Deregulation of Entry and Stay Visas

Under the EEC Law, the EECO (EEC Office) may also grant the right to operate or concession the project. This enables the project to be promoted more quickly and smoothly than the conventional procedure based on the laws and regulations.

4) Smart City Project

Smart City Project in Chonburi Prefecture

Budgets from the central government, as well as private funds, are allocated for the development of the infrastructure.

Table 4-10 An Example of a Project in Chonburi Prefecture

Project		Details of initiatives
ASCN	AMATA Smart City	<ul style="list-style-type: none"> • Smart Grid business • Energy reuse of waste treatment, etc.
Other than ASCN	EECd (Digital Park)	<ul style="list-style-type: none"> • Development of data centers • Development of a digital business hub, etc.
	EECmd (Medical Hub)	<ul style="list-style-type: none"> • Establishment of bases for health promotion and medical services
	Pattaya MICE City	<ul style="list-style-type: none"> • Expansion and promotion of MICE functions
	Laem Chabang Port City	<ul style="list-style-type: none"> • Industrial promotion and materials based on Lemchavan Port strengthening of flow function

Source: JICA Study Team

ASCN Projects: AMATA Smart City

In 2017, a MOU was signed by the Ministry of Energy and AMATA, and it was decided to promote the development of AMATA Smart City as a model area for smart city in EEC. After the initial smart city concept was formulated, various surveys and pilot projects related to Smart Energy have been implemented since 2018, as well as studies to formulate Smart City development plans. Following is an outline of AMATA Smart City project in Chonburi.

Table 4-11 Chonburi's AMATA Smart City Project-Summary

Outline of smart city initiatives	<ul style="list-style-type: none"> • AMATA, the largest industrial park developer and operator in Thailand, is developing AMATA City Chonburi to promote projects such as the introduction of renewable energy and energy management systems. It also promotes the development of residential environments and the creation of R&D industries by implementing urban infrastructure development projects aimed at creating a favorable environment.
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Expected benefits and vision	<ul style="list-style-type: none"> Realization of self-sufficient and energy-efficient cities (self-reliant, energy efficient cities with renewable energy sources) through the use of renewable energy and sustainable environmental management.
Components (Technologies)	<ul style="list-style-type: none"> Focusing on the energy, the company is taking the lead in implementing energy recovery (waste to energy) projects from waste and smart-grid business.
Tools	<ul style="list-style-type: none"> The project is recognized as a project in the EEC promotion area, and tax preferential treatment and the incentive system of deregulation are applicable. It is also promoted as a Smart City Promotion Area in Thailand's Smart City Strategy. Under the Smart City Criteria system, tax exemptions and other preferential measures could also be applied.
Approach	<ul style="list-style-type: none"> Smart technology and services are promoted by providing a preferable environment with quality infrastructures.
Player	<ul style="list-style-type: none"> AMATA, as landowner and developer and operator.
Promoting organizations	<ul style="list-style-type: none"> AMATA is responsible for planning and infrastructure development projects related to the smart project. The Ministry of Energy, the main agency in Chonburi, also promotes projects and promotes smart cities in the area.
Cost sharing scheme	<ul style="list-style-type: none"> For infrastructure-development and smart city projects, AMATA, as a landowner and developer/operator, is basically responsible.

Source: JICA Study Team

4-2-4 Case Study in ASEAN Cities: Indonesia

(1) Initiatives for Smart Cities as a Country

1) Overview

In Indonesia, Smart City Development is positioned as one of the goals of urban development in the Indonesian National Medium-Term Development Plan (RPJMN 2020-24, and thereafter the Medium-Term Development Plan).

Especially in Indonesia, the Ministry of Communications and Information (KOMINFO) is promoting “Movement Towards Smart Cities” as a program to promote smart cities in various cities in cooperation with eight other ministries and agencies.

Table 4-12 Overview of Smart City Policy in Indonesia

Positioning of Smart City Policies in Country Strategies	<ul style="list-style-type: none"> - In Indonesia, smart city development is positioned as one of the targets of urban development in the mid-term development plan. On the other hand, there are few cities that have adopted smart technology, such as a low percentage of Indonesian-wide infrastructures that utilize ICT
Vision for smart cities	<ul style="list-style-type: none"> - The Indonesian government has implemented the “Movement Towards Smart Cities” as a part of the smart city policy, led by the Ministry of Communications and Information. Since 2017, this program has been carried over to the “100 Smart City” promoted mainly by the Ministry of Communications and Information. - “Movement Towards Smart cities” refers to the dispatch of experts and budgetary subsidies for the implementation of master plans for smart cities in various cities. It is a program to carry out communications information since the year 2017.
Framework of policies and systems related to smart city promotion	<ul style="list-style-type: none"> - In the Movement Towards Smart Cities, authorized cities will develop a master plan for smart cities, which will be able to receive assistance from the national government, including the dispatch of funding and experts, if they meet the standards. - On the other hand, there is no national regulation or platform for smart city development. Smart city development is being carried out in each city by establishing frameworks, etc.
Smart City Promotion System and Organization	<ul style="list-style-type: none"> - In Indonesia, the Ministry of Communications and Informatics and other related ministries and agencies such as the Ministry of Finance and the State Development Planning Agency collaborate with eight ministries and agencies to establish the “Movement Towards Smart Cities” program.

Source: JICA Study Team

2) National Strategy and Economic Policy

The Indonesian government has a commitment to prioritize the reduction and decentralization of economic disparities in the eastern islands, where economic development is backward, from the viewpoint of enhancing the social stability as a group island state consisting of multiple races. Another priority is to eliminate the friction between urban and rural areas over the deterioration of living standards in urban areas and the widening gap between urban and rural areas, such as the upheaval of slums caused by rapid urbanization, the decline of road traffic functions, and the decline of the rural economy.

The Medium-Term Development Plan aims to “realize a self-sustaining, fair and affluent Indonesian nation by accelerating development in various fields, with an emphasis on developing high-quality competitive human resources and building a robust economic structure based on competitiveness in each region.”

Joko Widodo, the 7th and current president of Indonesia, set a long-term goal of making Indonesia an industrialized nation by 2045 in his inaugural speech during his second term.

In response, a concrete target created by National Development Planning Agency (hereinafter called Bappenas) is “Vision of Indonesia 2045.”

Specifically, the following two goals have been set. The first, high scenario aims to become the world's fifth largest economy in 2045; GDP is \$7 trillion, GDP per capita is \$23,199. The second, base scenario aims to become the world's fifth largest economy; GDP is \$6.3 trillion, GDP per capita is \$19,794 in 2045.

“Vision of Indonesia 2045” lists nine items for the missions. It follows nine hopes (Nawa Cita, named during the first term of President Jokowi) and changes the order and wording of the items and uses them. The third item, “Equal and Fair Development,” and the fourth item, “Building Indonesia from Sustainable Environment Frontiers,” were not specified in the first term. This indicates that attention is also focused on the balance between development and the environment and the correction of local disparities

Table 4-13 9 Missions of “Vision of Indonesia 2045”

Priority	Content
1	Improvement of human quality
2	Productive, autonomous and competitive economic structure
3	Equal and fair development
4	Building Indonesia from a Sustainable Environment Frontier
5	To develop a culture that reflects the individuality of the public
6	Corruption-free, dignified and trusted politics
7	Protecting the public, improving the productivity of all residents, and enhancing competitiveness in the international market to provide a sense of security
8	Operation of an affordable, effective and reliable administration
9	Synergies of local governments within a single national framework

Source: JICA Study Team

3) National Land Planning

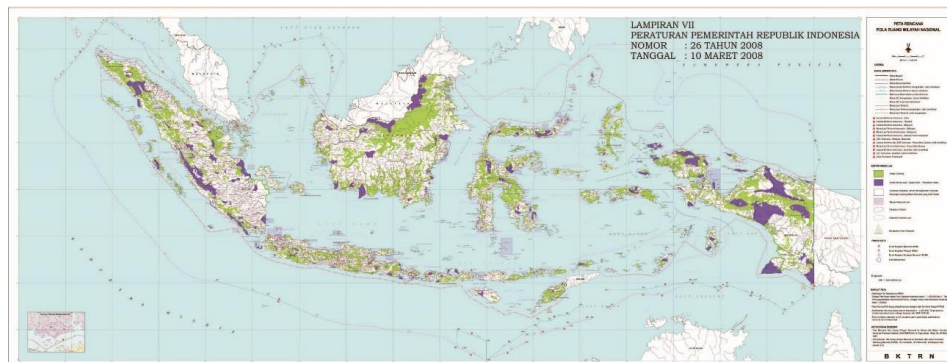
The current national spatial plan enacted as a National Spatial Plan (Law No. 26/2008) is for 20 years and is reviewed every five years. The purpose is to exist in order to construct national land strategy, and to realize safety, profitability and persistence in space utilization as an archipelago state, and to secure a sense of unity and stability as a state.

If the spatial planning actually follows the guiding direction of the zoning regulations regulated by this governmental regulation, Local governments will receive incentives.

Since the enactment of National Spatial Plan, more detailed indicators such as transportation planning, green space planning, and promotion of community involvement have been included in spatial planning at the municipal level in Indonesia. This shows that the National Spatial Plan serves as a guideline for local governments to prepare spatial plans for provinces, prefectures, and cities.

The National Spatial Plan classifies each city into 1) a country-centered city (PKN), 2) a wide-area-centered city (PKW), 3) a region-centered city (PKL), 4) a national strategy-centered city (PKSN).

Jakarta (Jabodetabek: urban area centered on Jakarta) and Makassar are designated as 1) national center cities (PKNs) and are positioned as urban areas that improve existing urban functions at the same time. Banyuwangi is a 3) regional center city (PKL) and is positioned as a city introducing a new urban function at the same time.



Source: BAPPENAS (2008) "RTRWN"

Figure 4-45. Indonesian Spatial Plan

4) Smart City Policy

In Indonesia, KOMINFO is taking the lead in promoting the "Movement Towards Smart Cities" program.

This program was launched by KOMINFO in 2017 to take over the "100 Smart City." One hundred cities and counties (2017: 25 regions, 2018: 50 regions, 2019: 25 regions) out of 546 Indonesian cities and counties are selected under the "100 Smart City," but today the name "Movement Towards Smart Cities" has been changed in line with the expansion of the size, such as targeting 126 cities. As of December 2021, 141 cities are covered. The selected cities are expected to become a role model for smart cities in other areas that are not selected. Plans in each city have many plans related to health and education.

The program contents are as follows: The KOMINFO will dispatch experts and provide budget assistance for the formulation of master plans for smart cities in each city. The KOMINFO conducts assessments twice a year, and if the standards are not met, the plan is operated strictly, such as by cutting subsidies.

5) Smart City System, Organization, etc.

Quick-Win Program

As part of the Movement Towards Smart Cities by KOMINFO, the “Quick-win Program” is implemented. This is a program in which each city launches a program within one year from the preparation of the master plan and provides support for achievements in the short term.

As a concrete support scheme, the KOMINFO basically only gives advice and evaluations to each program, and the budget of each city is used. Projects are also successful in the Quick-win Program and are qualified during the review process. Budgeting for scaling up the reality can be supported by Ministry of Finance. The size of the budget for additional support is determined by the project.

In the evaluation process, the evaluation is carried out by the review committee. There are some people from private enterprises, and 28 experts, mainly from universities, and human selection is carried out in ad hoc manner. Before the COVID-19 pandemic, there were two evaluation processes in a year. However, the fiscal situation was slightly compressed by the COVID-19 pandemic, and the evaluation process is conducted once a year.

System Based on Movement Towards Smart Cities, Etc.

Since the KOMINFO and each city have signed an MOU (Memorandum of understanding), the master plan of each city and the program being implemented cannot be disclosed by the KOMINFO. At the same time, there are no regulations by “Movement Towards Smart Cities” in the institutional aspect, and regulations on smart city development are established in each city.

The basic promotion body of “Movement Towards Smart Cities” is the KOMINFO, but it will collaborate with eight related ministries and agencies according to the master plan of every city; (1) Ministry of Public Works and Housing, (2) Ministry of Home Affairs, (3) Coordinating Ministry of Maritime and Investment, (4) Ministry of Finance, (5) Ministry of Finance, (6) Ministry of Tourism, (7) Executive Office of President: Kantor Staf Kepresidenan, and (8) Bappenas.

(2) Jakarta

1) Outline and History of Urban Planning in Jakarta

Urban Issues in Jakarta

The economic zone centered on Jakarta, Indonesia's capital city, is seeing rapid growth, and the construction of high-rise buildings and shopping centers has increased rapidly, making it a city of worldwide interest.

Urban issues in Jakarta include the overcrowding of the population due to the population concentration near Jakarta and the associated urban challenges. Especially, traffic improvement does not catch up and serious traffic congestion is occurring daily due to the lack of traffic infrastructure. At the same time, sea level rise caused by long-term climate change, such as global warming, and ground subsidence caused by disordered groundwater pumping are also becoming major urban issues. More than 60% of northern Jakarta, where urban poverties are forming dense and informal residential areas, are particularly worried about the expansion of flood damage, as the altitude is below sea level

Jabodetabek Spatial Planning

The Jabodetabekpunjur Spatial Plan (Presidential Decree No. 54/2008) was formulated in 2008 under the modified Spatial Program (RTRWN). This urban area spatial plan aims at the coexistence of economic development and environmental preservation. Its strategy, the following three points are cited.

1. Promoting integrated development in urban areas as an integral planning area.
2. Water and soil, ensuring the use of groundwater and surface water, and overcoming floods while considering sustainable environmental capacity.
3. Promoting productive, effective and efficient regional economic development that utilizes regional characteristics while considering public welfare and sustainable development.

Regarding the urban area structure, satellite cities such as Bogor, Depok, Tangerang, and Bekasi will be deployed centering on Jakarta. The New Jakarta Orbital Highway will be constructed 20 to 30 kilometers from the central part of Jakarta, along which development of the suburban sub-center will be promoted.

2) Smart City-Related Policies in Jakarta

There are no smart city-specific policies in urban units in Jakarta.

3) Smart City Vision in Jakarta

“Jakarta Smart City (hereinafter called JSC)” aims to solve urban problems in Jakarta and at the same time to make it a safe, comfortable, productive, sustainable, and globally competitive city. JSC is a program that Jakarta Communication, Informatics and Statistics Department is working on as part of Jakarta City 4.0 initiative.

4) Smart City Project in Jakarta

The JSC is an effort to solve traffic congestion and flooding problems in Jakarta using technologies such as ICT.

Working with the partner private sector, JSC is developing programs on six indicators: Smart Governance, Smart Mobility, Smart Environment, Smart Economy, Smart People, Smart Living. Residents have access to services provided by JSC and partner private companies through the Jakarta Smart City Portal (portal site) and Jaki (application).

There is resident participation in which residents can provide information and share it with themselves and governments through Portal sites and the Jaki application. At the same time, the data analysis unit analyzes the information collected by resident participation and utilizes it for future policy and application development.

It is characterized by its utilization as a data driven system. e-government is also being promoted, such as by opening the Jakarta Local Administrative Function.

Residents use portal sites and apps to upload information on the surroundings (traffic information, flood information, etc.) to each application and share it with residents and the government. The inhabitants grasp the information of each place based on the information uploaded by other residents.

On the other hand, some residents have problems such as lack of confidence in the government on the use of data so that there are not a few voices that are raised in distrust about how the government manages the information they have uploaded.

(3) Makassar

1) Outline and Background of Urban Planning in Makassar

The city of Makassar is the largest urban center in the eastern Indonesia region located in the southwestern part of South Sulawesi Province, called the Mamminasata Metropolitan Area. The National Medium-Term Development Plan defines the area as an intensified area for the creative and digital economy, as well as an important area for the development of large-scale public transport facilities. The National Spatial Plan designates them as special regions (areas where social and cultural conservation, economic development, natural resource development, and environmental conservation should be specially promoted).

The development of the South Sulawesi State, centered on Mamminasata, is important from the standpoint of rectifying the gap across Indonesia as a whole. Urban issues include traffic congestion due to population concentration and increased use of automobiles and motorcycles.

2) Smart City-Related Policies in Makassar

There are no smart city-specific policies in urban units in Makassar.

3) Smart City Vision in Makassar

In the “Makassar Smart City Program,” the vision of “Smart and Sombre city” is raised. The specifics are to combine smart technology with local wisdom to provide social and technological solutions to urban development and structural problems to make Makassar a world-class city that is livable for all.

4) Smart City Project in Makassar

From 2015, the aforementioned “Makassar Smart City Program” has been implemented, mainly by the Communication and Information Agency of Makassar City Governance. Not only is this smart, but it is also characterized by the aim of “Smart and Sombre city” (“sombre” is a local traditional word that is translated as “kind-hearted”).

There are three Missions, five elements and three drivers under the vision of “Smart and Sombre city.”

The Makassar Livable City Plan (MLCP) is planned as a framework that adapts present spatial planning and smart citing to integrate strategies for smart and sustainable development.

(4) Banyuwangi

1) Outline and History of Urban Planning in Banyuwangi

Banyuwangi is located on the border with Bali Island, at the eastern end of Java Island, and is called “The Sunrise of Java.” Because it is located on the border with Bali Island, a unique differentiation is formed which is a mixture of Java culture and Bali culture. It is famous for being a tourist spot, rich in natural resources such as volcanoes and beaches, and for holding many festivals and other events throughout the year.

As the first national broadband project by the central government, the Palapa Ring project, optical fiber was laid ahead of other prefectures. Banyuwangi is also focusing on improving its attractiveness as an investment destination.

Banyuwangi is composed of 25 districts, 189 villages and is eight times larger than Jakarta. In addition, the population distribution is biased; for example, population is concentrated in Banyuwangi district. Therefore, it is cited as an urban issue that administrative services are not evenly delivered to the whole of Banyuwangi. On the other hand, compared to the challenges faced by other cities in Indonesia, such as congestion problems and residential environment problems, the issues are not so serious.

In the regional medium-term development plan, Banyuwangi mentions to focus on improvement as an agricultural region, a fishery region, and a tourism region.

One of the development issues is the expansion of the scope of administrative services utilizing ICT. Banyuwangi is very large, and most of the residents live in rural areas. Therefore, human resource development in rural areas is also very important to enhance regional competitiveness. The Banyuwangi government presents the need to pursue improvements in basic services, particularly on an IT basis, to expand the scope of administrative services to carry out the potential development of villages.

2) Smart City-Related Policies in Banyuwangi

There are no publicly available smart city-specific policies in Banyuwangi Prefecture

3) Smart City Vision in Banyuwangi

“Banyuwangi Smart Kampung” is promoted mainly by the Communication, Informatics and Encryption Department of Banyuwangi. This program aims to reduce poverty, improve educational and welfare services through the smartening of administrative services, and at the same time, eventually empower residents.

4) Smart City Project in Banyuwangi

The Informatics and Encryption Department of Banyuwangi created the “Banyuwangi Smart Kampung Master Plan 2017” with the assistance of the KOMINFO: “Movement Towards Smart Cities.” This master plan has developed strategies for each of the six areas. Programs related to “Banyuwangi Smart Kampung” are established for each strategy and road maps are established for the short, medium, and long term.

In Banyuwangi, the bias in the whole prefecture was a problem, such as that the administrative servicing concentrates in the central part. By using smart technology, the main objective is to ensure that services are available to residents throughout Banyuwangi.

Priorities of “Banyuwangi Smart Kampung” include:

- 1) Encouraging citizens to acquire IT skills to strengthen the induction of industry growth, and
- 2) Improving citizens' access to public amenities and information services to develop local tourism industries.

Also, the term of “Smart Kampung” is used rather than “Smart City,” because “Smart Kampung” is based on the characteristics of the Banyuwangi region. The same word is used for both for the principle of utilizing technology as part of a solution to regional challenges. On the other hand, “Smart Kampung” is also critical to penetrate to villagers who are not necessarily familiar with the use of technology. This is because the aspect that emphasizes the participation of inhabitants is reflected in smartening.

4-2-5 Case Study in ASEAN Cities: Philippines

(1) Initiatives for Smart Cities as a Country

1) Overview

In the Philippines, there is no national-level development plan for smart cities, and master plans are being created on a per-project basis. The national level “Philippine Development Plan (PDP) 2017-2022” that was updated in February 2021 does not contain any details about the country’s position on smart cities or any development plans for them, but it does show that the policy is to pursue and apply the principles of smart cities in areas such as urban mobility, green cities, sustainable energy.

Table 4-14 Overview of Smart City Policy in the Philippines

Positioning of Smart City Policies in Country Strategies	<ul style="list-style-type: none"> • There is no national-level development plan for smart cities, and master plans are being created on a per-project basis. The national-level development plan includes the “Philippine Development Plan (PDP) 2017-2022” formulated by the National Economic and Development Authority (NEDA) in 2017. • The PDP is the initial plan for the 4th term of the 25-year long-term vision titled “AmBisyon Natin 2040” created in 2016 and defines three pillars of “building a high-trust society”, “transforming towards equity and resiliency”, and “increasing growth potential”. • The updated version of the PDP was released in February 2021 with details that are conscious of the New Normal and based on the conditions of the three years of the plan, but there is no description of the country’s position on or development plans for smart cities.
Vision for smart cities	<ul style="list-style-type: none"> • AmBisyon Natin 2040 does not contain a vision of smart cities, but it presents the image of the country it wants to become by 2040 as: • (1) “building a prosperous, predominantly middle-class society where no one is poor”, (2) “promoting a long and healthy life”, (3) “being smarter and more innovative”, and (4) “building a high-trust society”
Framework of policies and systems related to smart city promotion	<ul style="list-style-type: none"> • Although it is not positioned as a framework for a smart city policy or system, the updated version of the PDP contains the following mentions of smart cities. <ul style="list-style-type: none"> ➢ The national policy is to pursue and apply smart city principles in areas such as urban mobility, green cities and sustainable energy. ➢ It recognizes that this requires a high level of technology, execution and financial management by ministries and cities, and the necessity of partnerships with research institutes, enterprises and international development institutions. • The vision of a “better, greener, smarter urban systems in a more inclusive Philippines” was presented in the National Urban Development and Housing Framework (NUDHF) 2017-2022 that

	was published by the Department of Human Settlements and Urban Development (DHSUD) in 2017, and it mentions aiming for smart urban systems in which the real and digital worlds are connected.
Smart City Promotion System and Organization	<ul style="list-style-type: none"> • A format of building a promotion system at the Local Government Units (LGU) project level. • The Department of the Interior and Local Government (DILG) is responsible for the nation’s LGUs. It gives authority to and manages the LGUs • The NEDA secretariat cooperates with implementing agencies to prioritize and monitor the overall PDP. • The third pillar of the PDP, “increasing growth potential,” is monitored by the Science and Technology Coordinating Council.

Source: JICA Study Team

2) Long-Term Vision: Ambisyon Natin 2040

In 2016, NEDA formulated the AmBisyon Natin 2040, which summarizes the long-term vision and aspiration for Filipinos for the next 25 years. It sets targets for the people and the nation to attain by 2040 and describes “the kind of life people want to live” and “the kind of country they want it to become”. It is said that more than 300 people participated in debates and nearly 10,000 responded to a national survey during its preparation.

The Kind of Life People Want To Live:

- All citizens can enjoy a stable and comfortable life, have the knowledge to respond to their daily needs and to sudden expenses, and prepare for their own and their children’s future.
- A clean and fair government makes it possible for families to have the freedom to live together and travel freely

The Kind of Country They Want It to Become:

- Build a prosperous, predominantly middle-class society where no one is poor.
- Promote a long and healthy life.
- Be smarter and more innovative.
- Build a high-trust society.

RESULTS

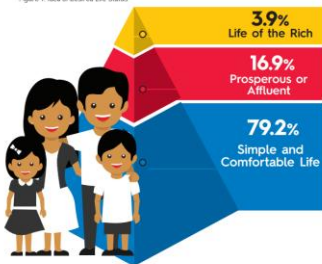
1 What do the Filipinos want to achieve for themselves in 2040?

Vision of Filipinos for self:
"In 2040, all Filipinos will enjoy a stable and comfortable lifestyle, secure in the knowledge that we have enough for our daily needs and unexpected expenses, that we can plan and prepare for our own and our children's futures. Our families live together in a place of our own, yet we have the freedom to go where we desire, protected and enabled by a clean, efficient, and fair government."

An overwhelming majority of Filipinos aspire for a simple and comfortable life (79%), followed by a smaller segment of the population who want an affluent life (16.9%) while a very small portion aspires for the life of the rich (3.9%).

For Filipinos, a simple and comfortable life is described as having a medium-sized home, having enough earnings to support everyday needs, owning at least one car/vehicle, having the capacity to provide their children college education, and going on local trips for vacation.

Figure 1: Idea of Desired Life Status



2 What should the country have achieved by 2040?

Vision of Filipinos for country:
"By 2040, the Philippines shall be a prosperous, predominantly middle-class society where no one is poor. Our peoples will enjoy long and healthy lives, are smart and innovative, and will live in a high-trust society"



Three-fourths of Filipinos (72.1%) believed that by 2040, the standard of living for all is having a simple and comfortable life while one fourth (25%) indicated that all Filipinos should have a prosperous and affluent life. Nonetheless, confidence in achieving the desired goals is lower among the poor. In fact, among those who want a comfortable life, 48.5 percent are not fully confident that they can reach their goals.

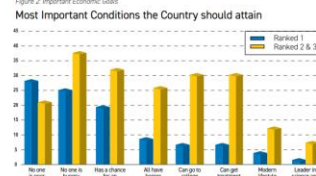
For the Filipinos in general, the most important economic goal is the eradication of poverty (Ranked 1: 28.7%; Ranked 2 & 3: 21.4%), hunger (Ranked 1: 25.7%; Ranked 2 & 3: 38.2%), and adequate jobs (Ranked 1: 18%; Ranked 2 & 3: 33%). Moreover, identified as second and/or third most important goals are housing (24.4%), education (30.8%) and health (30.3%). The survey results also indicated modern lifestyle and leader in science and technology as among the least important goals (Refer to Figure 2).

In the case of jobs, a prevailing sentiment is that jobs should be located in the Philippines and that Filipinos should have options for good quality employment that supports a comfortable life in the country. Eighty eight percent (88%) agree that in the year 2040, it will be good for the country if citizens will stay in the Philippines instead of going abroad to work. More than 69 percent would choose a job at home instead of a job abroad if given a choice.

The desire to have a decent job (marangal o maayos na trabaho) features prominently in the consultations. Among the important characteristics of a decent job is a good salary that would support a comfortable life and paid

Major Goals:
By 2040, the Philippines will be a predominantly middle-class society. Poverty and hunger will have been eradicated. There will be sufficient good quality local jobs available.

Figure 2: Important Economic Goals



on a regular basis; some would refer to having a business where the revenue is high. Second most frequently mentioned is job stability or job security. Next are benefits and incentives, followed closely by the type of work.

3 In terms of good governance, Filipinos believe in eliminating corruption as important to achieving a better future.

Most Filipinos expressed the need to eliminate corruption to achieve a better future. Based on the FGDs, it should be noted that corruption is interpreted as petty corruption (like extra charge to facilitate transactions) that ordinary Filipinos directly encounter. Ease and efficiency of government transactions is the second-most-frequently named as most important, followed in distant third by affordable government services. Ranked number 2 or 3 most important by most Filipinos is having polite, helpful, and knowledgeable government employees.

4 Filipinos believe that peace and security are important in achieving personal and national prosperity.

Achieving peace and security is considered imperative for both the development of the country as a whole (77.7%), and for the improvement of every Filipino's own standard of living (75.2%). Residents of certain regions (1, 6, 9, 10) seem to feel particularly vulnerable to peace and security issues in their communities.

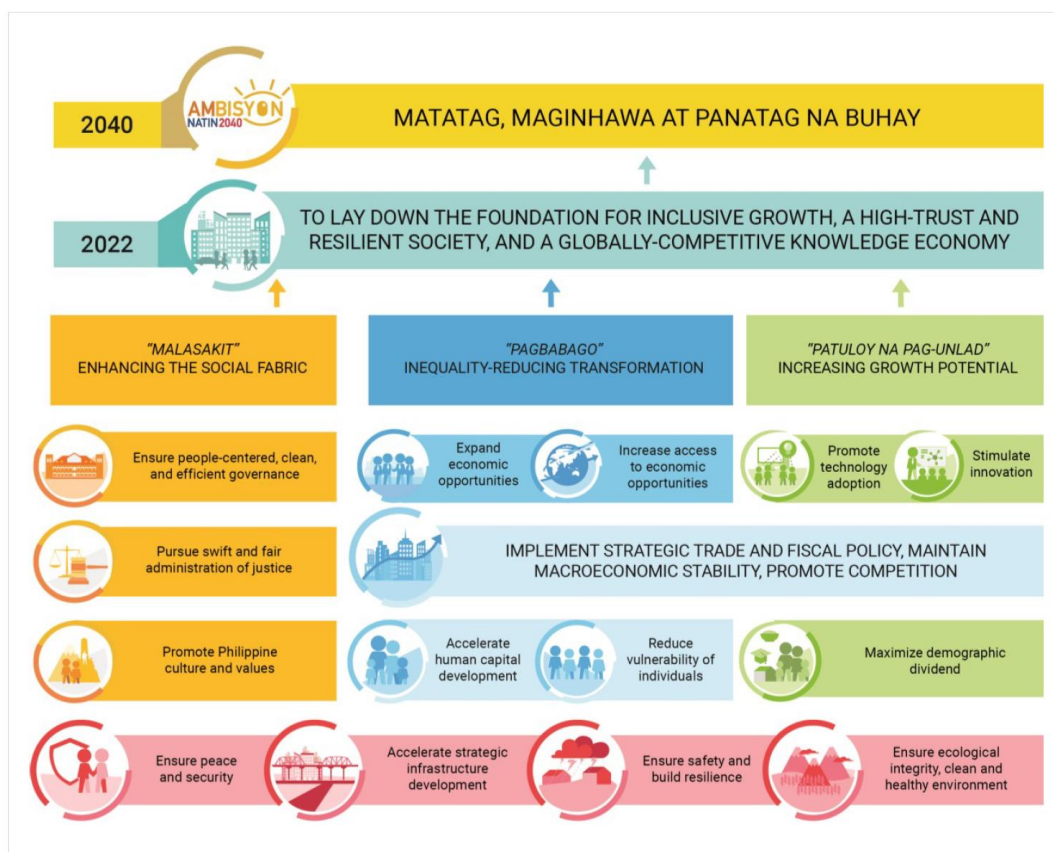
Source: NEDA <http://2040.neda.gov.ph/wp-content/uploads/2016/10/AmbisyonHighlightsBrochure-rev2.pdf>
 Figure 4-46 Overview of AmBisyon Natin 2040

3) National Development Plan: Philippine Development Plan 2017-2022

The Philippine Development Plan (PDP) 2017-2022 is the initial plan of the 4th term of the AmBisyon Natin 2040, and the initial version was formulated by NEDA in 2017. The PDP is a national development plan formulated according to the president's term and is a comprehensive national development plan that includes matters such as infrastructure development, macroeconomic policies, and financial system policies. The PDP also includes contents from the National Spatial Strategy, which defines the direction of the physical development of the country. The updated version of the PDP was released in February 2021 with contents that are conscious of the New Normal and based on the conditions of the three years of the plan.

Initial Version of The PDP (Formulated In 2017)

Three pillars are defined, namely: "building a high-trust society," "transforming towards equity and resiliency," and "increasing growth potential".



Source: NEDA <http://pdp.neda.gov.ph/>

Figure 4-47 Framework for PDP (initial version)

In addition, under “increasing growth potential”, acceleration strategies are defined in five fields for infrastructure development that are closely related to smart cities.

Table 4-15 Infrastructure Development Acceleration Strategies for Increasing Growth Potential

Field	Details of Acceleration Strategy
Transportation	<ul style="list-style-type: none"> Improving the transportation sector’s efficiency by providing accessible, reliable and safe access Improving road-based transportation and upgrading the road network to the highest quality standards in order to relieve traffic congestion Encouraging the transition from private to public transport in mass transit Improving airport operational efficiency and addressing constraints on optimal capacity usage Improving port facilities to ensure that inter-island transportation remains a viable option for transporting people and cargo
Water resources	<ul style="list-style-type: none"> Pursuing institutional reforms such as encouraging investment in water, sewage and sanitation facilities and streamlining the processes of related organizations Developing an irrigation master plan to establish the direction of irrigation development and the framework for the capital, operational and maintenance funding of irrigation projects Continuing flood management initiatives

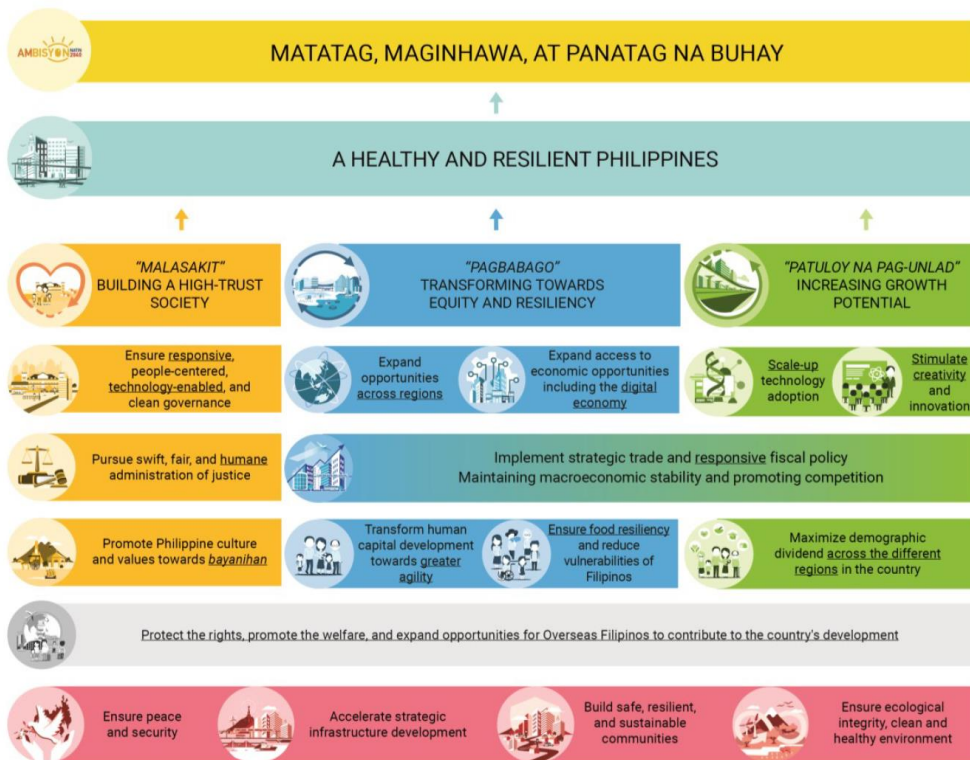
Energy	<ul style="list-style-type: none"> • Supporting large-scale investment and tracking the implementation of infrastructure projects to improve power generation • Encouraging competition to reduce electricity costs • Aiming for the development of the natural gas industry in addition to renewable energies such as wind and solar
ICT infrastructure	<ul style="list-style-type: none"> • Expanding the deployment of ICT infrastructure to address digital connectivity gaps • Continuing to strengthen the country's e-government system as a governance tool
Social infrastructure	<ul style="list-style-type: none"> • Expanding the deployment of ICT infrastructure to address digital connectivity gaps • Continuing to strengthen the country's e-government system as a governance tool

Source: JICA Study Team

Updated Version of the PDP (formulated in 2021)

The contents were updated with an awareness of the New Normal and based on the conditions of the three years of the plan. The three pillars are “building a high-trust society,” “transforming towards equity and resiliency” and “increasing growth potential”. There are some minor changes from the initial version in the expression of the first and second pillars, but there are no major changes to the aims. On the other hand, the updated version includes the following five new programs to build the resilience of the people, enterprises, the government and society in the New Normal.

- Improvement of the medical system
- Food security and resilience
- Continuity of learning
- Digital transformation
- Regional development



Source: NEDA http://www.neda.gov.ph/wp-content/uploads/2017/12/Abridged-PDP-2017-2022_Final.pdf
 Figure 4-48 Framework for PDP (updated version)

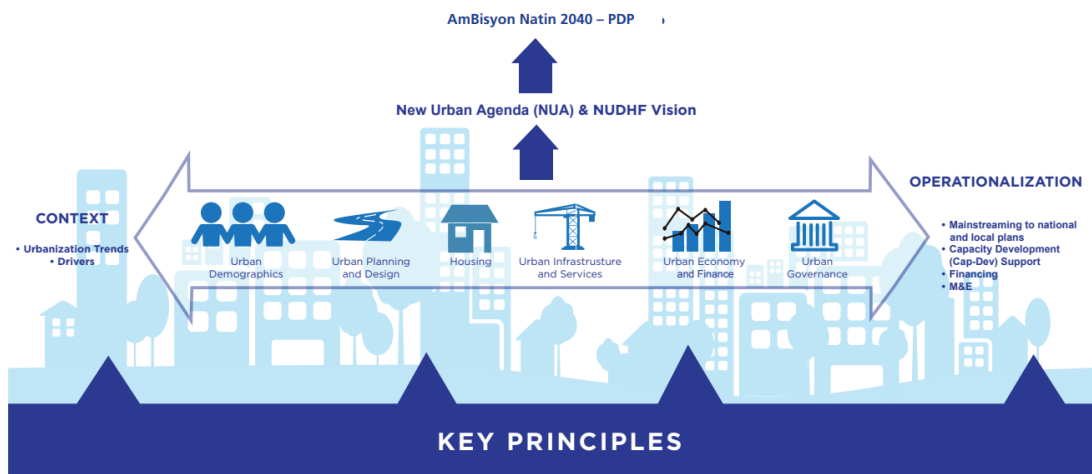
The Philippines has continued to invest in accordance with the Build Build Build Program since 2017, but has reviewed its infrastructure development strategy, investment strategy and targets in light of the New Normal and has positioned healthcare and resilience as important themes. This is expected to slow down the speed of infrastructure development that was described in the initial version.



Source: NEDA http://www.neda.gov.ph/wp-content/uploads/2017/12/Abridged-PDP-2017-2022_Final.pdf
 Figure 4-49 Strategies for Accelerating Infrastructure Development

4) The National Urban Development and Housing Framework (NUDHF) 2017-2022

The National Urban Development and Housing Framework (NUDHF) 2017-2022 is an urban development and housing framework published by the Department of Human Settlements and Urban Development (DHSUD) in 2017 and consists of a vision, policies, strategies, development sectors and space. It is a guide for the Philippine government, private enterprises and other stakeholders to help improve the efficiency and performance of urban systems. It presents a “better, greener, smarter urban systems in a more inclusive Philippines” as its vision and mentions aiming for smart urban systems in which the real and digital worlds are connected.



Source: DHSUD https://hlurb.gov.ph/wp-content/uploads/services/Igu/clup-guidebook/NUDHF_2017_2022%20_Abridged_Version.pdf

Figure 4-50 Overall Framework of NUDHF

(2) Manila

1) Urban Development Plan for Metro Manila

Metro Manila, which consists of the 17 neighboring municipalities centered on the city of Manila, is a public corporation established under the President in 1975, and is a special development and management area, as well as the center of the Philippines’ politics, economy, culture, transportation and information. As the population density is high and the population is expected to increase in the future, the region faces serious problems such as lack of residential space, supply of affordable housing which does not pose a disaster risk, and traffic congestion. As the urban infrastructure needs to be improved in response to these issues, in 2014 NEDA formulated a transportation infrastructure development roadmap for Metro Manila with the support of JICA. This development roadmap is positioned in the PDP as adopting the principles of smart cities, from the viewpoint of urban mobility, the natural environment, sustainability, etc. The roadmap was updated from 2017 to 2019, but the vision follows the initial version, and it is thought that there is no major change in the direction.

Project		Cost (Php mil.)	Status ¹⁾	Project	Cost (Php mil.)	Status ¹⁾	
Railway				Expressway			
Sub-urban line	Mega Manila North-South Commuter Railway (Malolos – Calamba, <i>Elevated</i>)	24,800	P	SEG 9 & 10/ connection to R10	8,600	C	
	Malolos-Clark & Calamba-Batangas	47,680	P	NLEX-SLEX Connector	25,556	C	
Primary Lines	Line_1-3	Upgrades Existing Lines	16,422	P	Skyway Stage 3	26,500	C
	LRT 1	North (to Malabon)	9,960	P	NAIA Expressway, Phase II	15,860	C
		South (to Dasmarinas)	100,204	C/P	Pasay - Makati – BGC	24,180	P
	LRT 2	East (to Antipolo)	59,086	C/P	Sta. Mesa - Pasig (Shaw Boulevard)	23,430	P
		West (to MM North Harbor)	30,840	P	Cavite Laguna Expressway (Bacoor - Sta. Rosa)	35,426	C
	MRT 3	Ext. (to Malabon & MoA)	68,600	P	Other Expressways	196,733	C/P
	MRT-7 (Recto-Comm. Av.- Banaba)	180,230	C	Expressways Upgrade	33,040	P	
	Mega Manila Subway	514,160	P	Sub-total (Expressway)	399,325	-	
Total Primary (Incl. Upgrade)	1,002,302	-	Road-based Public Transport				
Total Main (Suburban and Primary)		1,051,982	-	Integrated Provincial Bus Terminal System	6,300	C	
Secondary Lines	Ortigas - Angono	31,720	P	2-BRT Lines in Metro Manila (Ortigas, C5 or R7)	7,000	P	
	Marikina - Katipunan	31,480	P	Jeepney Fleet Modernization	30,000	P	
	Alabang - Zapote	26,800	P	Urban Bus Fleet Modernization	25,000	P	
	Zapote – Cavite – Gen Trias	25,560	P	Road-based Public Transport Reform Study	60	P	
	Study on Secondary Lines	38,703	P	Sub-total (Road-based Public Transport)	68,360	-	
	Total Secondary	154,263	-	Traffic Management			
Sub-total (Rail: Main and secondary)		1,206,245	-	Modernization of traffic signaling system	3,309	C	
Road				ITS & Other Road safety Interventions			
C3 Missing Link (San Juan - Makati)		24,000	P	Comprehensive Traffic Management Study	50	P	
C5 Missing Link Southern Section		696	C/P	Sub-total (Traffic Management)	6,109	-	
Global City to Ortigas Center Link Road		8,120	P	Airports			
Skyway-FTI-C5 Connector		17,880	C	NAIA	4,249	a. NAIA Improvement – airside package	C
Other Interchanges/Flyovers		7,953	C			b. NAIA improvements – landside package	C
Other Urban Roads		4,644	C	Clark	7,070	a. Construction of a Budget/LCC Terminal	C
Mega Manila (Secondary Roads Package)		180,180	P			b. Clark Future Development	P
Region III (Sec Roads - Approx.)		46,000	P	New NAIA	435,900	P	
Region IV-A (Sec Roads – Approx.)		96,360	P	Sub-total (Airports)	486,951	-	
Preparatory Study		5274	P	Ports			
Sub-total (Road)		391,107	-	Replacement of North Harbor	40,075	P	
Source: JICA Study Team				Other regional Ports			
1) C = committed project, P = proposed by JICA Study Team				Other Port Program			
				Sub-total (Ports)			
				52,085			
				2,610,450			
				-			

Source: NEDA <https://neda.gov.ph/wp-content/uploads/2015/03/FR-SUMMARY.-12149597.pdf>

Figure 4-51 Major Projects Included in The Metro Manila Transportation Infrastructure Development Roadmap

2) Issues

As mentioned in the previous section, the following issues are faced, starting with population growth and a high-density urban area.

Table 4-16 Metro Manila's Main Issues

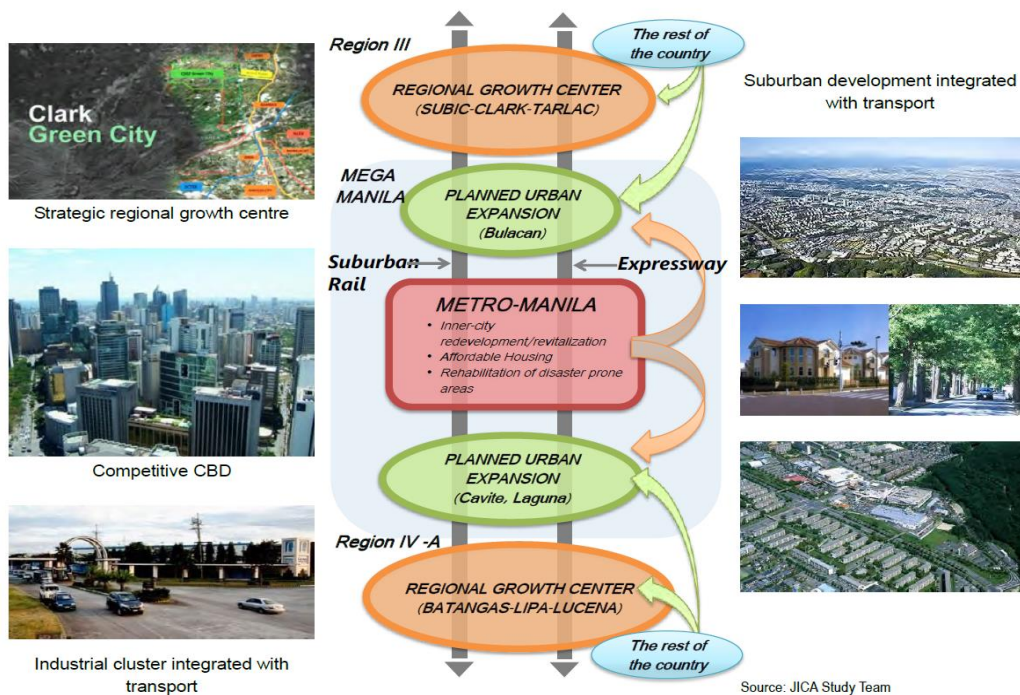
Field	Issues
Population growth and high-density urban area	<ul style="list-style-type: none"> The population density (191 people/ha) is high, and the future population growth rate (1.8%/year) is also high. There is no residential space for the increasing population. The promotion of suburban development and expansion of the urban area in using sustainable methods is a central issue for addressing the congestion, land use, transportation and environmental development that arises from population growth.
Disaster risks	<ul style="list-style-type: none"> Flooding, earthquakes, tsunami, and multiple-disaster risks
Providing affordable housing which does not pose a disaster	<ul style="list-style-type: none"> Due to the lack of affordable housing and poverty, there are areas with a poor environment and high risk of disaster, and citizens being

risk	<p>driven to homelessness.</p> <ul style="list-style-type: none"> In particular, it is estimated that there are 500,000 unofficial residents (2010). There are also many citizens living in areas with high disaster risk. There is a need to decide upon the direction and extent of urban expansion.
Direction of urban expansion	<ul style="list-style-type: none"> There is a great need for affordable housing with low disaster risk, but it is difficult to address because there is no space to increase residential areas within the region. Urban expansion towards the north and south where there is low to moderate hazard risk is required. There is a large amount of private land along the major north and south transportation routes, and it will be possible to meet the demand in a cost-effective manner if this private land is developed in combination with mass transit.
Traffic congestion	<ul style="list-style-type: none"> Traffic already exceeds road capacity in most road sections of the urban area. Not only does it slow down road users, but it is also increasing discrimination.

Source: JICA Study Team

3) Urban Development Strategies

In order to address the above issues, there is a strategy aimed at the planning of the classification of five regional clusters that are connected by a strong transportation axis centered on Metro Manila and expanding the city into these regional clusters in order to eliminate congestion in Metro Manila and expand sustainably.



Source: NEDA <https://neda.gov.ph/wp-content/uploads/2015/03/FR-SUMMARY.-12149597.pdf>

Figure 4-52 Urban Development Strategy for The Wider Area Centered on Metro Manila

The position and current status of each regional cluster are as follows.

- Metro Manila will continue to be positioned centrally, and regional growth centers in the north and south will be developed independently from Metro Manila
- New Clark City in the north has an international airport and a port, and is a core development area for the promotion of an international hub, urbanization and industrialization
- Batangas and Lipa are being developed in the south as the domestic gateway
- Bulacan, Cavite and Laguna are positioned as suburban areas and buffers between the regional clusters.
- The development of New Clark, Subic and Tarlac in the north is progressing, but the other areas are in the initial stages

Five goals have been set for transit and transportation, and the measures to address them are defined as the (1) construction of urban roads, (2) construction of highways between cities, (3) construction of railways between urban and suburban areas, (4) improving buses and (5) traffic management. Among these, traffic management is given the most importance.

Transport Sector Goals with 5 NOs

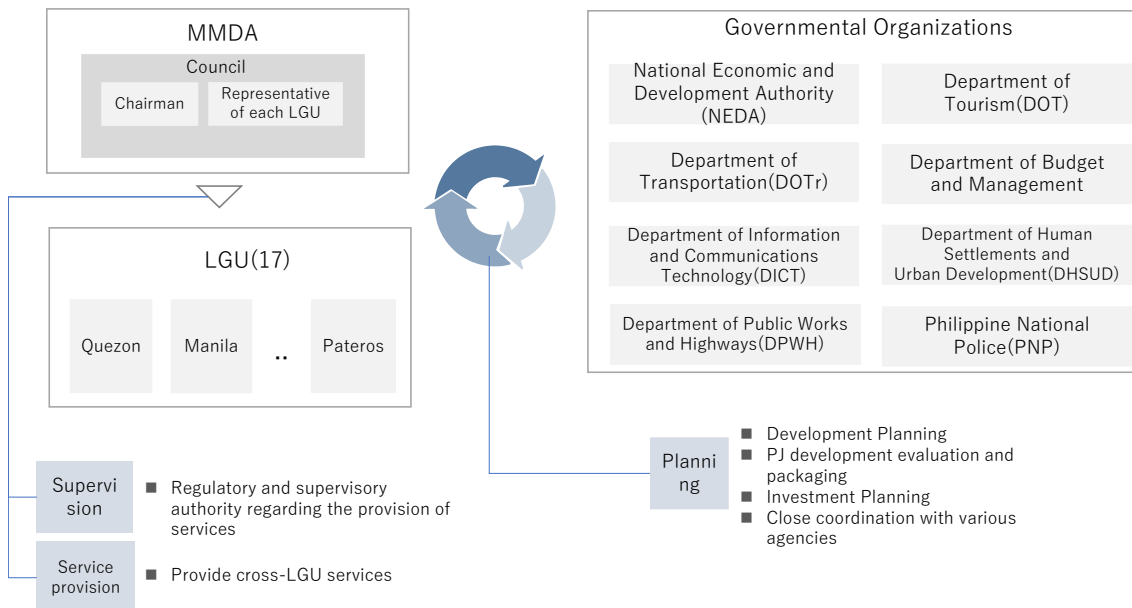
- **NO** traffic congestion
- **NO** household living in high hazard risk areas
- **NO** barrier for seamless mobility
- **NO** excessive transport cost burden for low-income groups
- **NO** air pollution

Source: NEDA <https://neda.gov.ph/wp-content/uploads/2015/03/FR-SUMMARY.-12149597.pdf>

Figure 4-53 Metro Manila Five Goals for Traffic and Transportation

4) Urban Development Promotion System

It is a system in which the Metropolitan Manila Development Authority (MMDA), the affiliated Local Government Units (LGU) and government-related organizations cooperate to promote it. Regarding the division of responsibility, the MMDA plays a central role, including in planning such as the formulation of development plans, the supervision of LGUs regarding service provision, and as a service provider of services across the LGUs. The MMDA also collaborates with governmental organizations such as NEDA, DOTR and DICT in order to align with national development goals and priorities. Based on the MMDA's development plans, LGUs, NGOs, enterprises, etc. share the responsibility for implementing individual projects.



Source: Created by A Survey Team Based on MMDA <https://mmda.gov.ph/mmda-about-us.html>
Figure 4-54 Urban Development Promotion System of Metro Manila

5) Smart City Project

In Metro Manila, LGUs and ICT vendors are collaborating to progress portions of demonstration projects such as the introduction of e-tricycles, digital payments for public transport such as buses, and suspicious person information detection via camera image analysis. Looking at the wider Metro Manila, greenfield-type smart city development is progressing in New Clark City in the north.

As an example, the following is an overview of the e-tricycle demonstration project in Quezon City and the New Clark City development project.

Table 4-17 E-Tricycle Demonstration Project in Quezon City

<p>Outline of smart city initiatives</p>	<ul style="list-style-type: none"> As air pollution caused by fossil fuel vehicles becomes more serious, this is an initiative to promote the introduction of electric tricycles (e-tricycles) that can reduce the burden on the environment, via a model demonstration of a e-tricycle business that can be operated sustainably in Quezon City and the promotion of understanding of the business by the local governments and private businesses that will be involved in the spread of e-tricycles in the future. E-tricycles have already been introduced in Manila and Boracay Island. The Department of Energy (DOE) has announced a policy of halving domestic fossil fuel vehicles and converting them to e-tricycles by 2020 as its e-vehicle strategy, as well as related initiatives.
<p>Expected benefits and vision</p>	<ul style="list-style-type: none"> The overall benefits of the initiatives are reducing air pollution and the burden on the environment and suppressing the damage to the respiratory health of citizens, via the reduction of exhaust gas. The following three results are anticipated from the demonstration project (1) Twenty e-tricycles will be introduced in Quezon City, and an

	<p>independent and sustainable maintenance system will be established by local government agencies and operators.</p> <ul style="list-style-type: none"> • (2) The possibility of substituting existing vehicles will be demonstrated in terms of the economic, societal, and environmental aspects. • (3) A model for an independent and sustainable e-tricycle business will be established, and a draft promotion plan for public-private e-tricycle businesses will be formulated.
Components (Technologies)	<ul style="list-style-type: none"> • E-tricycles (electric-powered tricycle equipped with a lithium-ion battery), power supply equipment
Approach	<ul style="list-style-type: none"> • Construction of the maintenance system: March 2016 - June 2017 <ul style="list-style-type: none"> ➤ Explanation of the business to related parties ➤ Review of the e-tricycle specifications and ordering of materials ➤ Development of e-tricycle bases and power supply equipment ➤ Construction of the maintenance system ➤ Formulation of the maintenance manual and technical guidance • Operation implementation and monitoring: March 2016 - February 2019 <ul style="list-style-type: none"> ➤ Clarification of procedures related to supervision and licensing of operating businesses ➤ Building of a business operation and management system ➤ Formulation of an operating business monitoring plan ➤ Examination of operating methods and locations ➤ Trial operation ➤ Collection of operating results data ➤ Collection of user data ➤ Analysis of substitutability for existing vehicles • Establishment and promotion activities of the e-tricycle business model: April 2016 - February 2019 <ul style="list-style-type: none"> ➤ E-tricycle market research ➤ Surveys in the existing project implementation area • Formulation of business models and recommendations to Philippine public institutions and private businesses for dissemination of e-tricycle businesses
Player / Promoting organizations	<ul style="list-style-type: none"> • Uzushio Electric Co., Ltd. (BEMAC): Project implementation entity; development of e-tricycle base power supply equipment, demonstration project operation and system construction, business model establishment and dissemination activities • BEET (BEMAC's local subsidiary): Project implementation entity: construction of the maintenance system, technical guidance, data collection such as operation results, formulation of local business development plans • JICA: Advice and guidance related to project management and implementation • Quezon City: Securing bases for demonstration operations,

	<ul style="list-style-type: none"> providing operational advice and support, and coordinating with existing tricycle operators Contracted operating businesses: Implementation of demonstration operation, maintenance work University of the Philippines: Analysis of reduction of environmental burden
Public-private cost sharing	<ul style="list-style-type: none"> BEMAC's project costs are borne by JICA, but the responsibility for other costs is unknown

Source: JICA Study Team

Table 4-18 New Clark City Development Project

Outline of smart city initiatives	<ul style="list-style-type: none"> A national project that aims to solve problems in Manila such as traffic congestion and dense population, which will create a resident population of 1.2 million and 800,000 jobs by 2065 by relocating government facilities and constructing high-speed railways. The project consists of five major areas ((1) government agencies, (2) transportation infrastructure system, (3) industrial facilities, (4) composite facilities, and (5) agricultural facilities), with the construction of sports facilities and composite facilities proceeding first. In the smart city context, an efficient power supply system is planned that will ascertain the power consumption of homes, offices, factories, etc. in real time and utilize the accumulated data.
Expected benefits and vision	<ul style="list-style-type: none"> By 2065, a large-scale city for a population of 1.2 million will be developed by developing electric, water and sewage, gas, communication, and transportation infrastructure, developing industrial complexes and residential and commercial facilities, and attracting advanced research facilities, universities, hospitals, etc.
Components	<ul style="list-style-type: none"> Power supply system, transportation infrastructure system, etc.
Approach	<ul style="list-style-type: none"> Phase 1 development started in 2018. A sports facility has been developed and was used for the Southeast Asian Games in November 2019 Phase 1 will be completed by 2022 and Phase 2 will progress until 2050 Since the sports facilities, etc. are being used for the COVID-19 response, overall development has been delayed
Player / Promoting organizations	<ul style="list-style-type: none"> Below are the parties related to the power distribution system Philippine Bases Conversion and Development Authority (BCDA): Project management Joint venture between Meralco, Marubeni, Kansai Electric Power, Chubu Electric Power and BCDA: Construction of the distribution system

Source: JICA Study Team

(3) Cebu

1) Urban Development Plan for Metro Cebu

Metro Cebu, which consists of 13 LGUs including Cebu City in the major metropolitan area of Cebu, is a metropolitan area that, like Metro Manila, has been officially established

by the Philippine government. As with Metro Manila, the population of the region is expected to increase in the future, and in addition to the deterioration of the living environment due to being a high-density city, there are serious issues such as sewage wastewater, traffic congestion, traffic volume management, and garbage management. Under these circumstances, the Metro Cebu Development and Coordinating Board (MCDCCB) formulated the “Mega Cebu Vision 2050” in 2013 with the cooperation of JICA and Yokohama City. It describes the vision for Metro Cebu in 2050, and as shown in the figure below, it consists of four pillars, “competitiveness,” “livability,” “mobility,” and “metropolitan management,” and 15 developments related to them.

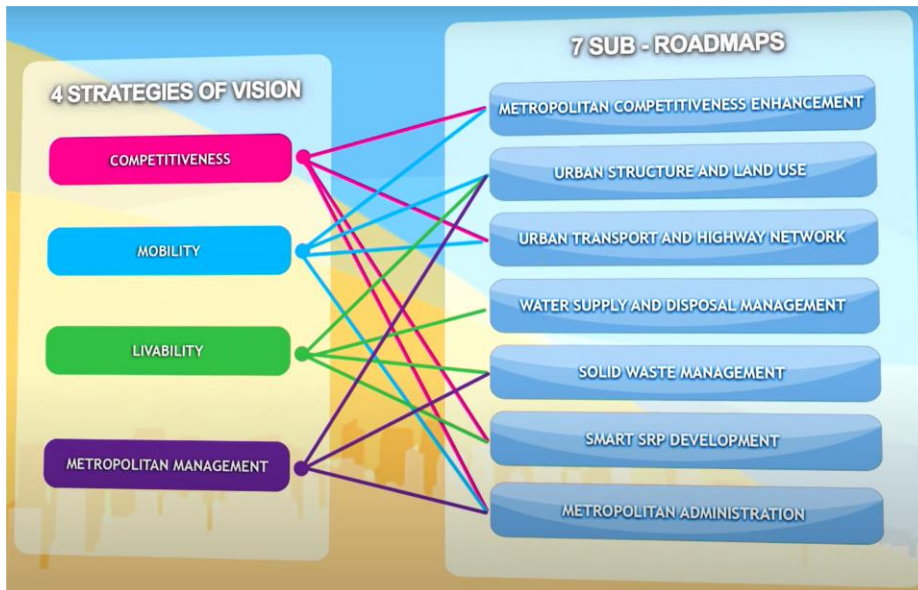


Source: MCDCCB-JICA 2013.

Source: JICA <https://openjicareport.jica.go.jp/pdf/12235529.pdf>

Figure 4-55 Overview of Mega Cebu Vision 2050

Furthermore, a study of the roadmap and action plan for urban development towards the realization of the vision was conducted in 2015 with the cooperation of JICA. In this, seven sub-roadmaps for realizing the vision were established.



Source: JICA https://www.youtube.com/watch?v=Av_P3iYdYXM

Figure 4-56 7 Sub-Roadmaps for Mega Cebu Vision 2050

2) Issues

As with Metro Manila, the population is increasing, and it is expected that it will double from its 2010 size to five million in 2050. On the other hand, land in the city is limited, the number of high-density areas is increasing, and the deterioration of the living environment is an issue. In addition, although the severity differs in each LGU, common issues include sewage wastewater, traffic congestion and volume management, solid waste management, and clean water.

Development Issues per LGU	Danao	Compostela	Liloan	Consolacion	Mandaue	Lapu - Lapu	Cordova	Cebu	Talisay	Minglanilla	Naga	San Fernando	Carcar
Septage & sewerage	●	●	●	●	●	●	●	●	●	●	●	●	●
Solid waste management	●	●	●	●	●	●	●	●	●	●	●	●	●
Traffic congestion / management	●	●	●	●	●	●	●	●	●	●	●	●	●
Water supply / water resources	●	●	●	●	●	●	●	●	●	●	●	●	●
Population Increase / Urbanization/ population inflow	●	●	●	●	●	●	●	●	●	●	●	●	●
Public transport / terminal	●	●	●	●	●	●	●	●	●	●	●	●	●
Informal settlers	●	●	●	●	●	●	●	●	●	●	●	●	●
Roads / bridges / transport infrastructure	●	●	●	●	●	●	●	●	●	●	●	●	●
Salt water intrusion	●	●	●	●	●	●	●	●	●	●	●	●	●
Economic development	●	●	●	●	●	●	●	●	●	●	●	●	●
Drainage	●	●	●	●	●	●	●	●	●	●	●	●	●
Dumping site / sanitary landfill	●	●	●	●	●	●	●	●	●	●	●	●	●

Source: JICA https://www.youtube.com/watch?v=Av_P3iYdYXM

Figure 4-57 Issues for Each LGU in Metro Cebu

3) Urban Development Strategies

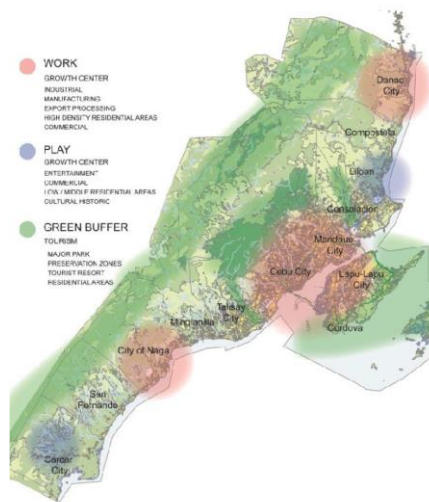
Although smart cities are not clearly positioned within the abovementioned seven sub-roadmaps, there are detailed descriptions of the roadmaps for “urban structure and land use,”

“smart SRP,” and “promotion system” that are likely to be related.

Urban Structure and Land Use

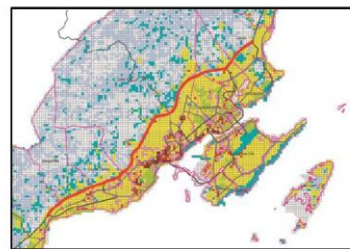
The aim is to promote functional, safe, and environmentally friendly urban spaces, and the following measures have been organized.

- The region is divided into six local clusters, and each cluster is divided into corporate activity areas, commercial areas, travel areas, etc.
- Areas with a low risk of landslides and floods have been designated for urban formation, and areas have been established for urbanization to cope with the increasing population
- Development of a green loop to promote compact urbanization and the development of amenity spaces for road users
- An industry-government investment plan for urbanization development



Source: JICA Study Team.

Figure 8.5 Concept of Urban Structure and Urban Functions in Metro Cebu



Source: JICA Study Team.

Figure 8.4 Urban Limit



Source: JICA Study Team.

Figure 8.6 Concept of the Green Loop

Source: JICA <https://openjicareport.jica.go.jp/pdf/12235529.pdf>

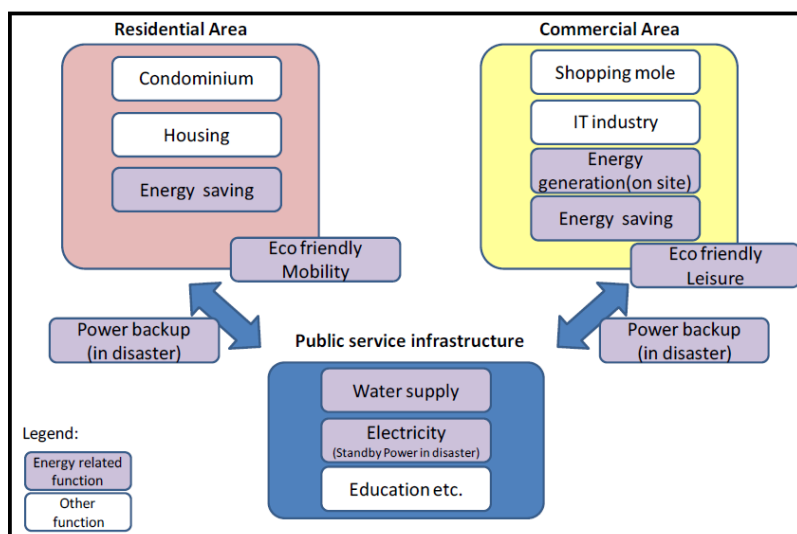
Figure 4-58 Metro Cebu Urban Structure and Land Use Policies

The creation of land use management guidelines, etc. has been set as a short-term roadmap, and the construction of a green loop, trains and transit-oriented development towards a compact city, sidewalk installation, etc. have been set as a medium- to long-term roadmap.

Smart SRP

The South Road Properties (SRP) is a 300ha area of reclaimed land which was developed with an ODA loan. By making the SRP a model for the gathering of Cebu’s IT industry, the relocation of private companies and public institutions is progressing. The following measures have been organized to attract more IT companies.

- Establishment of power supply and energy-saving technology, installation of energy-saving equipment and eco-mobility in residential and commercial areas
- The disaster response system utilizes the public water and power infrastructure as a backup in the event of a disaster
- Investment promotion (tax and procedural alleviation)



Source: JICA Study Team.

Figure 12.1 Basic Concept of Smart Development for SRP

Source: JICA <https://openjicareport.jica.go.jp/pdf/12235529.pdf>

Figure 4-59 Development Concept of Metro Cebu SPR

As a short-term roadmap, the building of a power supply system and the introduction of a demand visualization system is planned, and in the medium to long term, spreading the know-how acquired through SRP throughout Metro Cebu is planned.

Promotion System

The system consists of the Metro Cebu Development and Coordinating Board (MCDCB), the LGUs under its management, NGOs, enterprises, and government-related organizations such as NEDA cooperating with its promotion. It is intended to have a similar structure to Metro Manila, except that unlike the MMDA, the MCDCB is not an organization with a legal basis. As for the division of roles, MCDCB coordinates issues across the LGUs, coordinates between the LGUs and public-private partnerships, and coordinates partnerships at the regional, national and international levels.

The project management mechanism of MCDCB involves a PMO being set up for each project at the start of the project, and project managers and staff being dispatched or assigned from related organizations. When making decisions from a technical perspective, the establishment of a technical research unit within MCDCB is being considered, which will promote the project by involving experts in infrastructure planning, design, economics, financial auditing, etc.

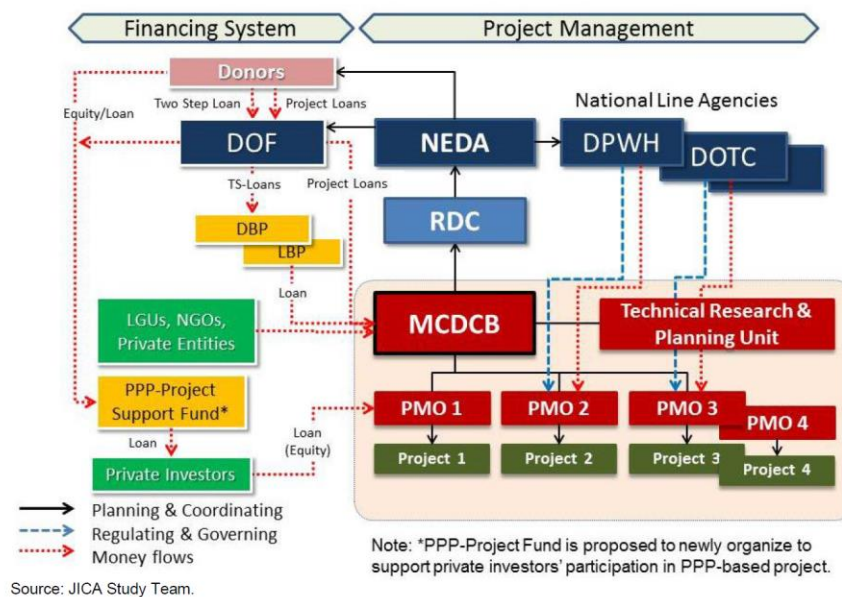


Figure 13.1 Priority Project Implementation and Management System

Source: JICA <https://openjicareport.jica.go.jp/pdf/12235529.pdf>

Figure 4-60 Urban Development Promotion System of Metro Cebu

As a short-term roadmap, strengthening the capabilities of the MCDCB is planned, especially from the perspectives of feasibility studies, project finance, and planning. In the medium to long term, the development of a Metro Cebu Governance Organization by transforming the MCDCB into an organization with a legal basis is being considered.

4) Smart City Project

None of the projects are clearly positioned as a smart city project, but 14 anchor projects are set up in the urban development roadmap and action plan studies. The organization which leads a project is different for each project.

Table 8 List of Anchor Programs

	Programs	Primary Responsible Organizations
1.	Investment Promotion by a Mega Cebu Investment Board (MCIB) through Cebu Branding	Cebu Province (Investment Promotion Center) and DTI
2.	Urban Greening (Completion of 'Green Loop', etc.)	DPWH, DENR, related LGUs
3.	Operationalization of Mega Cebu Spatial Plan	MCDCB (Technical Research & Planning Unit), all LGUs
4.	Urban Fringe Highway Network Development (Circumferential Road, etc.)	DPWH
5.	Mactan Link Development	DPWH and DOTC (in the case of rail bridge)
6.	Mass Transit Network Development (MRT/LRT/BRT)	DOTC
7.	Gateway Development (Airport, Seaport)	DOTC, CPA and MCIAA
8.	Integrated Road Traffic Management and Bottleneck Clearance	MCDCB (a new service unit) with support from DPWH
9.	Surface Water Resource Development	MCWD and related LGUs
10.	Urban Septage / Sewerage Service	MCWD and other water works/districts
11.	Comprehensive Flood Control	Participating LGUs with support from DPWH
12.	Metropolitan Solid Waste Management	MCDCB (a new service unit) with participating LGUs
13.	Advanced Energy Management System	Cebu City with an energy solution company
14.	Institutional Building of Metropolitan Governance	MCDCB

Source: JICA Study Team

Source: JICA <https://openjicareport.jica.go.jp/pdf/12235529.pdf>

Figure 4-61 Metro Cebu Anchor Project

(4) Davao

1) Urban Development Plan of Metro Davao

Metro Davao, which consists of seven LGUs including Davao City, is a group of LGUs that was established when the current President Duterte was the mayor of Davao. The area is more than six times that of Metro Manila and three times that of Metro Cebu. However, unlike Metro Manila and Metro Cebu, there is no formal legal framework.

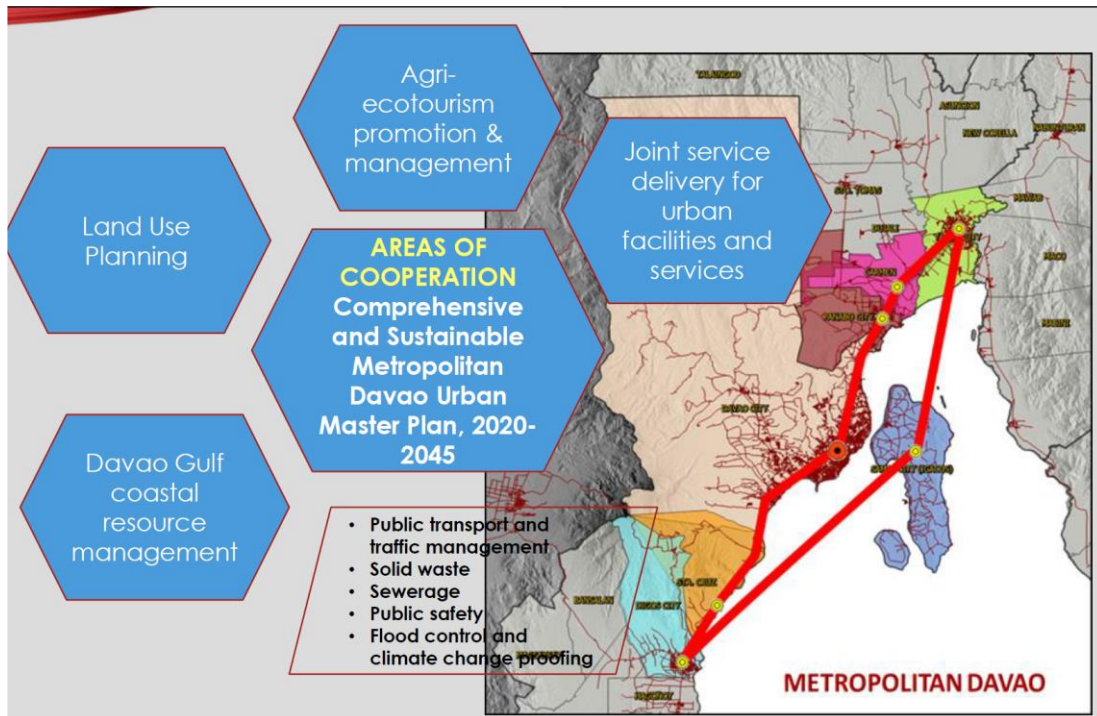
In 2018, Davao City, the center of Metro Davao, formulated an infrastructure development plan with the support of JICA. Under the strong leadership of the Mayor of Davao City, Metro Davao has a policy of formulating a Metropolitan Davao Sustainable Urban Master Plan (MDSUMP) aimed towards realizing the following vision (as of June 2021). It has been announced that the MDSUMP will be based on the Metro Davao Urban Master Plan (MDUP) 2018-2040, which was formulated by the Mindanao Development Authority (MinDA) and Palafox Associates (a Philippine architectural firm) in 2017.

- Vision: A highly industrialized, globally competitive metropolis; a diverse and cohesive community living in a safe and climate-resistant environment with modern and efficient infrastructure that is supported by human resources of highly skilled and productive men and women and governance that promotes equal opportunities for all

The issues facing Metro Davao include population growth, traffic congestion, water pollution, garbage management, environmental destruction, road infrastructure and flood control, and it has been announced that the MDSUMP will cover the following to address these issues.

- Land use plan
- Promotion and management of Agri-ecotourism
- Coastal resource management in Davao Gulf
- Joint service provision of urban facilities and services

Also, within the MDUP there is a concept that “all generated data will be stored and managed in a web-based interactive platform”.



Source: Davao City <https://www.davao.ph.emb-japan.go.jp/files/100151724.pdf>

Figure 4-62 Metro Davao Sustainable City Master Plan

2) Promotion System

As of January 2021, the Metropolitan Davao Development Coordinating Committee (MDDCC) is taking the lead in considering the MDSUMP, but since the MDDCC is an organization without legal status, there have been earlier claims of the necessity of establishing a Metropolitan Davao Development Authority (MDDA) that has a legal basis.

Meanwhile, in March 2021, a bill to establish an MDDA was passed. The MDDA's functions are envisioned as the creation of medium- to long-term development plans, the development, implementation, evaluation of projects and coordination with related organizations, as well as the provision of services across LGUs; it is thought that development will progress in the future led by the MDDA.

3) Smart City Project

As mentioned in the previous section, there are no smart city projects as of September 2021 because the urban development master plan is yet to be formulated.

4-2-6 Case Study in ASEAN Cities: Vietnam

1) Overview

In Vietnam, the national government presented its ideas and policies for future nationwide smart city development in 2018 and is currently progressing initiatives for a pilot project to build an advanced region.

Hanoi, Da Nang, and Ho Chi Minh City have each formulated information technology strategies and plans towards becoming smart cities, but their efforts have prioritized the construction of e-government and digital infrastructure. There are also private urban development projects called smart cities, but they all lack the essential elements of smart cities.

The Ministry of Construction is the flag-bearer of the country's smart city development, but the direction of urban planning and development has not been clearly defined and is left to each city.

Table 4-19 Overview of Vietnam's smart city policies

<p>Positioning of Smart City Policies in Country Strategies</p>	<ul style="list-style-type: none"> • In August 2018, the Prime Minister's Decision No. 950/QD-TTg “Scheme of Sustainable Smart City Development in Viet Nam 2018-2025, Orientation to 2030” was issued to provide guidelines for smart city development. • It describes a policy of aiming for the efficient management of urban administration, efficient utilization of resources such as land and energy, improvement of the quality of life, and socio-economic development, via the utilization of ICT.
<p>Vision for smart cities</p>	<ul style="list-style-type: none"> • The Prime Minister's Decision No. 950/QD-TTg “Scheme of Sustainable Smart City Development in Viet Nam 2018-2025, Orientation to 2030” <p style="text-align: center;"><u>General Purpose</u></p> <ul style="list-style-type: none"> - Economic growth and sustainable development with a low environmental burden - Effective utilization of resources such as natural resources and human resources - Improving the quality of life - Participation of citizens and organizational bodies in urban development - Limiting of potential risks - Improving the efficiency of national management and urban services. - Improving the economic competitiveness <p style="text-align: center;"><u>Specific objectives</u></p> <ul style="list-style-type: none"> - 2018-2020: Development of the legal system and data infrastructure for smart cities - 2021-2025: Execution of a pilot project - 2026-2030: Nationwide development of smart cities (Main measures) <ul style="list-style-type: none"> • Review of legal systems, policies, standards, etc. (formulation of

	KPIs that reflect trends in international standards and Vietnam’s characteristics), phased development of regulations and implementation of scientific research, data collaboration between cities nationwide, dissemination of applications related to smart cities, development of infrastructure related to smart cities, improvement of the convenience of residents of smart cities, promotion of human resource development and research development, securing of funds and technology from both inside and outside of the country, promotion of international cooperation (active participation in the activities of international organizations such as ASEAN), raising awareness about smart cities
Framework of policies and systems related to smart city promotion	<ul style="list-style-type: none"> • Within the above policy, ideas about the execution of individual tasks, schedules, and funding sources are assigned to each central organization.
Smart City Promotion System and Organization	<ul style="list-style-type: none"> • The central government (Ministry of Construction, Ministry of Information and Communication, etc.) is developing the legal system and formulating policies, and each region formulates individual master plans and implements projects. • Private sector involvement and investment will be conducted under appropriate plans and projects that provide mutual benefit for the government and enterprise are encouraged.

Source: JICA Study Team

2) Smart City Strategy

The main details of Vietnam's smart city strategy are as follows.

The Prime Minister's Decision No. 950/QD-TTg “Scheme of Sustainable Smart City Development in Viet Nam 2018-2025, Orientation to 2030”

Views and Principles

- 1) Comply with party policies, national laws, policies, strategies, plans, socio-economic development programs, national and regional urban development, and regional characteristics.
- 2) The utilization of means such as ICT to contribute to the promotion of competitiveness, innovation, creativity, transparency, leanness (removing waste), and the effective management of urban authorities is an important part of the Fourth Industrial Revolution. It will improve the efficiency of land use, energy and development resources, advance and improve the quality of the urban living environment and stimulate the growth and development of the socio-economy.
- 3) Aim to make a significant contribution to the nation's green growth strategy and sustainable development goals, so that all people in society will benefit, participate in construction investment and supervision, and manage smart cities.
- 4) Aim to make a significant contribution to the nation's green growth strategy and sustainable development goals, so that all people in society will benefit, participate in construction investment and supervision, and manage smart cities.

- 5) Based on the ICT reference framework for smart city development, unify and optimize existing technological infrastructure and ICT infrastructure to ensure interoperability and synchronous operation between smart cities. Further, the operational efficiency of smart cities is to be evaluated via KPIs.
- 6) Based on the ICT reference framework for smart city development, unify and optimize existing technological infrastructure and ICT infrastructure to ensure interoperability and synchronous operation between smart cities. Further, the operational efficiency of smart cities is to be evaluated via KPIs.
- 7) Provide the infrastructure for urban technology infrastructure systems and ICT infrastructure systems, including integrated systems connected to smart urban space databases, which are the smart city utilities for urban organizations and individuals who build and manage smart cities.

Objective (General Purpose)

- Vietnam's sustainable smart urban development towards the promotion of green growth, sustainable development, utilization, potential and benefits, and the improvement of resource efficiency.
- The effective utilization of resources and people to improve the quality of life, while ensuring the conditions for organizations, individuals and people to effectively participate in the research, construction investment and management of smart urban development.
- Limiting of potential risks.
- Improvement of the efficiency of national management and urban services.
- Improvement of economic competitiveness and international integration.

Objective (Specific Objectives)

Period until 2020: Building of the legal basis for smart urban development and prepare for investment for the implementation of pilots at the city and city level.

- Review and development of a common legal framework for sustainable smart urban development, and delivery of policy mechanisms
- Development of a master plan for the national standard system development for sustainable smart city development
- Construction of urban space data infrastructure and a national urban database
- Guidance and implementation of a decision-making support system in urban planning
- Support of at least three municipalities to approve overall projects on smart city development, implement infrastructure investments and shape smart city utility applications

Period until 2025: Implementation of Phase 1 of the Smart Urban Development Pilot.

- Application of an ICT reference framework for smart urban development in Vietnam
- Publication of national priority standards for smart city pilot construction, prioritizing areas of urban management, lighting, transportation, water and drainage, waste collection and treatment, power networks, disaster risk warning systems and ICT infrastructure systems
- Development of urban spatial data infrastructure merging of the data on the GIS platform of Phase 1 of the pilot city
- Application of the decision-making support system in urban planning and urban planning information retrieval systems
- Support of at least six municipalities / six economic areas to approve overall projects on smart city development and shape smart urban utilities to serve urban

residents, and form tests for the purpose of the formation of one-stop departments and civic collaboration centers

- Application of mechanisms for the issuing of smart, new city certifications

Direction to 2030: Completion of Phase 1 of the pilot and phased deployment of replication by sector and region to form a smart city network that can be deployed over a wide area.

- Completion of Phase 1 of the pilot and phased deployment of replication by sector and region to form a smart city network that can be deployed over a wide area.

Main Promotion Organization

1) Ministry of Construction

- Manage the project and tasks in coordination with ministries and regions as a permanent institution for the project.

2) Ministry of Information and Communications

- Plan the collaboration between the Ministry of Construction, the Ministry of Natural Resources and Environment, the Ministry of Science and Technology, etc. and direct and guide the regions that implement the ICT smart urban development framework. Formulate and promulgate general provisions for the decentralization of urban database management and the technical standards and regulations for ICT applicable to smart cities.

3) Ministry of Science and Technology

- Direct and prioritize the issues concerning smart urban development that arise in the process of implementing the project “Support the National Innovation Initiative for Startup Ecosystem to 2025” in accordance with the Prime Minister's Decision No. 844/QĐ-TTg.

7 Priority Tasks and Examples of Measures

1 Research and completion of legal documents and policy mechanisms for sustainable, smart urban development in Vietnam

- Integration of smart urban planning, management, and development policies under the Law on Urban Planning, etc.

2 Integration of smart urban planning, management, and development policies under the Law on Urban Planning, etc.

- Development and implementation of the ICT reference framework for smart urban development in Vietnam, etc.

3 Research, application and development of sustainable, smart urban planning

- Research and application of decision-making support technology in the urban plan drafting and evaluation, regional proposals and urban development programs by three municipalities, etc.

4 Planning and attracting investment resources for the construction and management of smart urban infrastructure

- Orientation of investment towards the repair and improvement of existing infrastructure to be applied to smart urban technology and the development of priority smart urban technology infrastructure (urban lighting, transportation, water supply, drainage, solid waste collection and treatment, power networks, warning systems), etc.

5 Establishment, evaluation and approval of pilot programs and projects for sustainable, smart urban development

- Review, preparation, approval and implementation of pilot project development related to city-level smart urban development

6 Promotion of e-government construction

- Promotion of the construction of e-government and the development of administrative services

7 Promotion of training and capacity building for managers and professionals to satisfy the needs of the phased development and operation of smart cities

- Training related to smart urban development, training of instructor teams, etc.

3) Digital Government Strategy

In Vietnam, a strategy related to digital government is being formulated separately from the policy related to smart cities (June 2021).

The main details are as follows.

The Prime Minister's Decision No. 942/QĐ-TTg “ E-government development strategy for digital government in the period 2021-2025 with a view to 2030”

Point of view

- 1) Develop a digital government that performs all of its operations in a safe digital environment, have a model that is redesigned and operated based on data and digital technology, provide higher quality services, make more timely decisions, and implement better policies. Use resources more optimally, create development, promote transfer to the national identification number system, and effectively solve major problems in socio-economic development and management.
- 2) Comprehensively develop the digital government, fundamentally achieve the e-government development goals by 2021 and shape the digital government in 2025.
- 3) People, enterprises and other organizations appropriately participate in the operation of national institutions and work with them to increase transparency, improve service quality, jointly solve problems and create social value.
- 4) Data is a new resource, and state agencies will provide open data for the development of digital government, the digital economy and digital society. Because local agencies will collaborate and share data, people will provide data to local agencies and important public service providers only once.
- 5) Centralized and decentralized implementation models will be combined that comply with Vietnam's e-government architecture framework and the architecture of ministries, sectors, and regions. Methods to provide synchronized services across all management levels will be developed and made available on location. The initial focus will be on national-scale platforms, applications, and services.
- 6) The domestic market will grow significantly, develop digital technologies and expand into the region and globally. The government will actively coordinate, plan and implement orientation activities to develop the market for digital technology enterprises in Vietnam. Open platforms and application ecosystems that provide services to the digital government will be formed.

Example of Tasks and Solutions

- 1) Example Tasks and Solutions
 - Research and proposal of document guidelines including amendments to electronic transaction laws and digital government regulations, etc.
- 2) Digital infrastructure development
 - Development and operation of stable, safe and smooth network infrastructure, etc.
- 3) Development of digital platforms and nationwide systems

- Development of the National Data Exchange Platform (NDXP), development of the National Identity Exchange and Electronic Authentication Platform (NIXA), construction of an identity and authentication platform on mobile devices, etc.
- 4) Development of domestic digital data
 - Development of various databases such as population, national lands, etc.
- 5) Development of various databases such as population, national lands, etc.
 - Building of an online conferencing environment, work platform, government cloud computing platform, etc.
- 6) Securing of national cybersecurity and safety
 - Building of e-government network security monitoring and operating support systems, etc.
- 7) Organizations, equipment, networks
 - Establishing a network of professional units and personnel to support the deployment from the central government to the areas implementing digital government and digital transformation
- 8) Training and development of digital skills
 - Training and development of digital skills
- 9) Training and development of digital skills
 - Forming the propagation and dissemination of the legal details and policies to raise the awareness of the people and society as a whole regarding e-government, digital government and digital drives, etc.
- 10) Cooperation between national institutions and enterprises
 - Establishing the conditions for all types of digital technology companies to research and invest in the building of digital government-developed products and services, etc.
- 11) Research, development and acquisition of core technologies
 - Digital government research and development, promotion of open platform applications, etc.
- 12) Standardization and restructuring of business processes
 - Implementation of close cooperation between administrative procedural reform and government development, etc.
- 13) International cooperation
 - Active cooperation with the development of digital government; preparation for and dynamic participation in the promotion of having a leading role in international organizations, active initiatives towards digital government, development of digital technology, the digital economy, and areas of particular strength; active work on the development of new international legal frameworks, standards and principles for digital technology in line with Vietnam's objectives and interests, etc.
- 14) Securing funding
 - Prioritization of public investment arrangements for infrastructure development projects, data centers, national databases, national platforms, domestic applications, service implementation, etc.
- 15) Measurement, monitoring and evaluation of implementation
 - Online monthly and annual publication of key indicators of e-government development by each service that provides services to the digital government, etc.

4) Strategy for Green Growth

Separately from the policy regarding smart cities, Vietnam has formulated a national strategy for green growth (October 2021).

The main details are as follows.

Point of View

- 1) Green growth will contribute to the promotion of economic restructuring via updating of the growth model, the improvement of competitiveness, the ability to withstand external shocks, and the realization of the socio-economic development strategy 2021-2030.
- 2) The expansion of green spaces is an important means of achieving sustainable development and will directly contribute to the long-term reduction of greenhouse gases towards a carbon-neutral economy.
- 3) It will contribute to human-centered green growth and reducing human vulnerability to climate change, encouraging individual responsibility for communities and societies, directing future generations towards green culture, and forming a civilized, modern society that is harmony with nature and the environment.
- 4) Green growth must be based on modern institutions and governance, advanced science and technology, and quality human resources, in accordance with the national landscape and domestic circumstances.
- 5) Green growth aims to invest in advanced technology, digital transformation and smart and sustainable infrastructure, which will create incentives for private investment to play an increasingly important role in the green economy.

Objective (General Purpose)

- Green growth will contribute to the goals of promoting economic restructuring via updating of the growth model, economic prosperity, environmental sustainability, achieving social justice, the green economy, carbon neutrality and limiting the rising of global temperatures.

Specific Objectives

Reducing per-GDP greenhouse gas emissions

- 2030 target: Greenhouse gas emissions per GDP reduced by at least 15% compared to 2014
- 2050 target: Greenhouse gas emissions per GDP reduced by at least 30% compared to 2014

Greening of the economic sector

- Develop sustainable infrastructure for the purpose of turning the economic sector greener, promoting the application of the circular economy model, efficiency of natural resources and energy based on science and technology, application of technology, and competitive advantage, and minimizing negative environmental impact.

Promoting a green lifestyle and sustainable consumption

- Build a lush green lifestyle that is combined with the traditional beautiful lifestyle to create a quality life that is in harmony with nature. Build new rural village areas to secure green and sustainable growth goals and create a sustainable consumer culture in the context of global integration.

Greening based on the principle of equality

- Improve the quality of life and the people’s resilience to climate change, secure opportunities to enjoy the fruits of development, and leave no one behind in the green transition.

5) Examples of Tasks at Each Institution

Ministry of Planning and Investment (MPI)

- Develop guidelines to integrate the implementation of the details of the strategy
- Develop mechanisms to monitor, evaluate and report on the strategies and management tools to support implementation (databases, green growth statistics), and pilot implementation
- Mobilize resources, construct systems of standards for regulation of domestic and international funding sources, regulation of climate financial sources, and national green classification standards, and identify green growth tasks and projects
- Build institutions and policies for green procurement, integrate green public procurement standards into contractor selection processes, build specific mechanisms for enterprises participating in the provision of green products and services, strengthen the application of circular economy principles in the building and management of industrial estates and economic areas, develop and implement programs to promote green policies on eco-industrial complexes and new ecosystems for innovation and business

Ministry of Finance (MOF)

- Develop preferential policy tools, programs and solutions to promote the soundness of capital markets and green protection
- Use taxes and fees as tools against unreasonable and harmful consumer behavior
- Establish a carbon market for the synchronous development of a mechanism for granting emission credits according to market mechanisms

Ministry of Natural Resources and Environment (MONRE)

- Develop measurement, reporting and verification (MRV) systems to reduce national greenhouse gas emissions, depending on capacity

Ministry of Industry and Trade (MOIT)

- Formulate policies to shift energy in a green, clean and sustainable direction, increase the proportion of renewable energy, reduce dependence on imports, absorb fossil fuels, and strictly control the approval and implementation of coal-fired power projects in accordance with national power plans approved by the competent authorities
- Strengthen technological solutions to ensure the construction of mechanisms to promote the uptake of new energy and renewable energy, increase the ability to integrate renewable energy into electricity generation, and facilitate the development of hydrogen gas fuels from offshore wind power

Ministry of Agriculture and Rural Development (MARD)

- Promote markets that are linked towards product value, improve the competitiveness of green, safety and organic produce, and meet international and national standards.
- Protect and develop forests through land, credit, insurance, tax and market mechanisms, and mechanisms and policies related to evidence of sustainable forest management based on national standards.
- Promote the construction of new rural village areas in a green and sustainable direction, increase the extent to which communes (the base-level of government) meet the new rural village standards, control the rural environmental standards, and construct villages that are adaptable to the climate, ecological and smart

Ministry of Transport (MOT)

- Develop green transportation infrastructure, develop public transportation, and establish institutions and policies to improve freight productivity in the transportation sub-sector

- Implement solutions to encourage vehicles that use clean energy, which is economically, efficiently and technologically friendly to the environment

Ministry of Construction (MOC)

- Develop economic norms and standards for the development of green growth urban development mechanisms and policies, green and smart urban technology infrastructure, green materials, green buildings and highly energy-efficient structures
- Apply science and technology to the development of the green material manufacturing industry and the development of energy efficiency, and build a smart urban spatial database system with interdisciplinary interconnections
- Develop and implement training programs that meet the needs of developing and operating smart and sustainable cities
- Build a national portfolio of carbon dioxide emissions in clean technology, advanced technology, high tech and manufacturing to promote investment mobilization. Create innovation for green growth.

Ministry of Education and Training (MOET)

- Set up integrated green growth content and educational activities, raise the awareness of educators about the role, meaning and direction of green growth activities, and shape green awareness in schools and society.

Ministry of Health (MOH)

- Develop regulations, standards and roadmaps for sustainable, environmental medical facilities that are resistant to climate change and environmental disasters.
- Build a system to manage and supervise medical waste classification, consumption, and treatment activities to meet national and international standards
- Build a database system to monitor, predict and warn of the impacts of climate and air pollution on electricity supply at an early stage

Ministry of Culture, Sports and Tourism (MOCST)

- Develop programs related to green lifestyle and green tourism development, build, apply and develop standards for a tourism development model that responds to the green growth of tourist areas and tourist spots, and implement green tourism labeling for tourism businesses

Ministry of Labor, Invalids and Social Affairs (MOLISA)

- Promote the development of technical human resources in the green economy sector, formulate and implement policies to encourage the creation of green jobs and social security policies, and provide social assistance to vulnerable enterprises

State Bank of Vietnam (SBV)

- Review and coordinate with banks and credit institutions in line with green growth goals, research and build green banking development models, and promote preferential credit policies for green investment projects

Ministry of Information and Communications (MIC)

- Raise the overall society's awareness of green growth through promotion by newspapers, broadcasting, and electronic information management organizations, strategic promotion of grassroots information, and the dissemination of other related content

(2) Ho Chi Minh City

1) Overview

In Ho Chi Minh City, as prompt action is required to address social issues such as traffic congestion and environmental problems including waste disposal that accompany rapid urbanization, the public and private sectors are working on “smart city construction” that utilizes information technology etc., improves the lives of the people and creates new business opportunities.

Specifically, the “2017-2020 Ho Chi Minh City Smart City Construction Plan Towards 2025” was formulated in November 2017.

The main fields of initiatives towards smart cities include improving public services, applying it to policy decision-making, ensuring administrative transparency, improving information access, environmental and disaster countermeasures, and improving transportation infrastructure.

2) Overall Objectives of The Plan

- Secure the economic growth rate in the knowledge and digital economies.
- Forecast-based, effective urban governance.
- Improve the quality of living and work environment.
- Increase people's involvement in management. (People are the center of the city, so the economy can be developed sustainably by maximizing the use of this resource)

3) Roadmap for implementation of the plan

- In Phase 1(2017-2020): Build a technology platform for a smart city. Implement smart solutions to meet the urgent needs of the city under revolutionary programs that bring practical benefits to the people, such as e-government, transportation, environment, flood protection, safety and order, and health.
- In Phase 2(2021-2025): Implement smart solutions in specialized fields. Data is updated and further expanded to build a smart city.
- In Phase 3(from 2025 onwards): Goals and tasks from 2025 onwards will continue to be implemented towards the long-term vision, and specialized smart solutions will be upgraded to expand into other areas.

The four pillars of the smart city project

- Shared data warehouse (shared data center) and open data ecosystem
- Smart city operations center (IOC: Intelligent Operations Center)
- Socio-economic simulation center
- Smart city information security center

The operation of a large city like Ho Chi Minh City requires a variety of information to coordinate processing, forecasting and strategic planning, so a shared data center relating to the city and housing infrastructure, public investment management and land management will be built as a top priority. The shared data center is considered as a prerequisite for the success of a smart city operations center that utilizes the city's day-to-day information sources and data in all areas and help all levels of management.

Subsequently, a research center (socio-economic simulation center) will be built to simulate the development of urban socio-economic development strategies.

Because ensuring information security is indispensable for ensuring the operational safety of these centers, an information security center will be established.

4) Status of Promotion of The Plan

In the three years since the introduction of the smart city plan, the shape and appearance of the city has been shaped around the four pillars, and the foundation and prerequisites for the region to advance between 2020 and 2025 have been born, beginning with strong transformation of the education sector.

Promoting the Role of The Online Ecosystem

According to the Ho Chi Minh City Department of Information and Communications, Phase 1 has achieved some fundamental results.

The city's shared data warehouse is shared via the city's open data portal, sharing data with people and enterprises and encouraging people to participate in the monitoring and management of the government and social activities.

In particular, applications in the areas of transportation, health, education, flood control, and the environment provide many utilities to the people, such as information retrieval, monitoring, and contributing opinions.

It is also being effectively implemented in many industries and fields, such as digital transformation to increase productivity, management efficiency, and interaction, through the formation of education, health, tourism, and smart city ecosystems.

To date, a comprehensive architecture system for the education sector has been completed, schools throughout the city have been integrated, recording processing on the IT ecosystem platform is covered, and a database of the 1.7 million students and 80,000 teachers in 24 districts has been built.

The digitization and data conversion of the basic education sector has been completed, and everything from electronic contact books, electronic transcription, emulation, rewards, and recruitment to data management software and educational services is processed online and optimized utilities are provided to teachers, parents, students and managers. In particular, the online ecosystem for student education, research and self-learning activities has brought about a very high level of interaction and created the foundation for building a lifelong learning society in Ho Chi Minh City.

Progress of The Four Pillars of Becoming A Smart City

The first pillar, the shared data center, operates at Quang Trung Software Park (QTSC). The Ho Chi Minh City People's Committee has published a list of shared spatial data for Ho Chi Minh City (March 31, 2020). This has become an important and necessary resource in smart urban planning and management.

The second pillar, the smart city operations center at the Ho Chi Minh City People's Committee Headquarters (in operation since April 2019), has so far connected and integrated data from more than 1,500 cameras from camera systems in some districts for the Ministry of Transport, the Ministry of Health, the Ministry of Education and Training, the Ho Chi Minh City Police, and the operations center; it is also using 50 cameras with functions such as facial recognition. The smart city operations center is a place that supports the resolution of the problems that arise in all aspects of society, such as vehicles, crowd detection, are security measures.

The third pillar, the Center for Socio-Economic Simulation and Forecast (in operation since June 2019), has been conducting research and information gathering to build a database that meets the requirements for analysis, forecasting, and building simulation models. It develops quantitative models for analysis, prediction and simulation of problems related to major socio-economic indicators, gradually systematizes them, and contributes to solving domestic and foreign issues related to urban development requirements.

The center also provides consulting services and collaborates with domestic and foreign organizations and individuals. From 2021, the scope of its simulation of development trends in all areas will be expanded for the city's People's Committee and related organizations under the Smart City Project.

Regarding the fourth pillar, the information security center, a project to establish a joint stock company (the Ho Chi Minh City Information Security Center Operating Joint Stock Company) that will operate the smart city information security center has been approved. Saigon Industries Co., Ltd. owns 75% of the shares of the operating company.

(3) Hanoi

1) Overview

Since 2016, Hanoi has been actively working on the application and development of information technology, and is aiming to establish a holistic, synchronous, unified information technology system throughout the city. The goal is to solve the issues that arise in all areas of society that benefit from smart cities; urban planning, transportation infrastructure, energy, education, health and environmental development; from a people-centric perspective and using sustainable methods based on the application of the key technologies of the Fourth Industrial Revolution.

2) Process of Building Smart Cities

Hanoi's smart city roadmap consists of three phases.

- In Phase 1(2018-2020): Form the core components of a smart city, such as infrastructure platforms, databases, e-government, and smart systems in core areas (education, health, transportation, tourism, environment, security, order).
- In Phase 2(2020-2025): Complete the people's participation in the fundamental smart systems and shape the digital economy.
- In Phase 3(from 2025 onwards): Develop a high-level smart city that has the characteristics of a knowledge economy.

The Ministry of Information and Communication is focused on building and developing the foundation of e-government in the first phase of the smart city construction process.

The city has implemented the regular use of online public services, shared “one-stop electronic” software at three levels of government, and achieved 100% use in 1,671 management procedures.

- Regarding urban transport, it applies the ‘iparking’ system to search for parking lots and pay for parking via mobile devices. Hanoi’s digital traffic map has been deployed to provide information on traffic conditions and manage public passenger transport within the city.

- Regarding education, electronic school reports, family contact details and online admissions are being used in 2,700 schools and universities, with 250,000 families participating and 6.3 million page views. The online application rate for the three levels of elementary school, junior high school, and high school has reached 70.68%.
- Regarding health management, electronic documents have been implemented in a health management system that holds 900,000 records to date.
- It has also built a database of 7.5 million people and set up applications that provide services to people, enterprises and city management.

In October 2019, a joint venture between the BRG Group (Vietnam) and Sumitomo Group (Japan) invested US\$4.138 billion in a 272-hectare area in the Dong Anh district and commenced a smart city project that is scheduled to be completed in 2028. This project applies many smart technologies that possess the six factors of smart energy, smart transportation, smart governance, smart learning, smart life and smart economy.

Hanoi is gradually developing into a smart megacity based on new technology, culture and modern people. According to the Hanoi People's Committee, Hanoi will focus on two major issues in the future: the development of smart city technology infrastructure (lighting, water and drainage, smart transportation, etc.) and the shaping of smart residents.

In order to do this, Hanoi will first form a smart operations center based on the latest technology platform. The smart operations center will have functions focused on the most pressing issues of modern city life: surveillance, traffic operations, public crime prevention and control centers. An information security and security monitoring center, an information technology support center, a press and communication information management center and a data fixing center will be the tools for executing and monitoring socio-economic activities.

Hanoi will select the two fields of transportation and tourism as the first areas to be deployed. Specifically, an integrated smart traffic center will be launched that will include a visual traffic safety monitoring system, public safety monitoring software, an intelligent signal control system, electronic traffic signs and a traffic operation center monitoring software system, and a public passenger transportation management software system, a bus smart electronic ticketing system, and a restricted and regulated toll collection system for personal vehicles will be built.

In the field of tourism, Hanoi will deploy a travel portal application for mobile phones, software for managing tourism service businesses, and a Hanoi tourist map, and build integrated infrastructure for the city's tourism data.

3) Core Elements of A Smart City in Hanoi

- First, build a city on the latest ICT infrastructure that utilizes the Internet of Things.
- Second, create a situation where the people are proud of having a very low unemployment rate and a relatively high income. This is considered the most important factor in building a smart city.
- Third, a dedicated team of experts will be needed to manage and operate the new smart city technology systems.

4) Challenges in Making Hanoi a Smart City

- Many difficulties and challenges are being faced in the move towards becoming a smart city, including ICT infrastructure, general technology infrastructure, traffic congestion, water shortages, wastewater treatment, and environmental pollution.
- It is difficult to secure human resources with sufficient qualifications for smart city development and e-government management.
- Technology, which is an important foundation of smart cities, will connect governments to enterprises and people, but human resources are the key.
- The development of urban and rural infrastructure, promotion of administrative reform, improvement of the investment environment, and improvement of the quality of human resources are also required.

(4) Da Nang

The city of Da Nang is, in addition to introducing an e-government information system in 2014, Smart City architecture framework was approved in 2018, setting the basic standards for future Da Nang Smart City plans. The Architecture also defines 16 areas of smart city development: IOC (Intelligent Operation Center), Smart Citizen, Public Services, Open Data, Tourism, Commerce, Agriculture, Lighting, Water Management, Waste Management, Education, Healthcare, Hygiene and Food Security, Security and Emergency Services, Disaster Prevention and Transportation.¹

Then it announced a smart city construction plan for the 2018-2025 period as a comprehensive smart city construction plan. The smart city plan will solve problems related to building the smart city, such as technology, policies, and financial resources, through consensus between the city leaders and citizens. And it defines six pillars: smart management, smart economy, smart transportation, smart environment, smart living, and smart citizens.

Da Nang has also been selected as a Smart JAMP target city by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and the development of digital maps, etc. will be carried out in line with the master plan for smart cities in Da Nang. It is envisioned that technologies that contribute to the smart city will be actively studied in the future.

¹ Quoted from WeGO Feasibility Study Program 2018, Data Analytics Platform for Smart Traffic in Da Nang

4-2-7 Case Study in ASEAN Cities: Lao PDR

(1) Initiatives for Smart Cities as a Country

1) Overview

In Lao PDR, although there is no comprehensive national strategy or plan for smart cities, the promotion and strengthening of ICT is positioned as a key measure for national growth.

Table 4-20 Outline of Smart City Policy in Lao PDR

Positioning of Smart City Policies in Country Strategies	<ul style="list-style-type: none"> • No national smart city policy has been formulated, but the 9th Socio-Economic Development Plan states that smart city policy should be concretely incorporated for the first time. • However, although the specific Smart City policy is not clear in the 9th Socio-Economic Development Plan, the promotion of Smart City Development in Luang Namtha, Oudomxay, and Vientiane are listed as priority projects for achieving the plan. • The Lao government considers smart cities as one of the key projects to attract more foreign investment and strengthen its economic competitiveness by making Laos an open country that connects landlocked countries to Indochina through the use of IT-based logistics facilities and other means.
Vision for smart cities	<ul style="list-style-type: none"> • While there is no vision for smart cities as a national state, the Lao government stated in the 8th Socio-Economic Development Plan that “the government aims to boost technological capabilities including innovation, which is the key to sustaining growth, by promoting structural conversion of the economy and raising productivity,” and to this end, it aims to strengthen ICT.
Framework of policies and systems related to smart city promotion	<ul style="list-style-type: none"> • Although there are no policies or legal systems specializing in smart cities, the Lao government has been promoting enactment of laws related to ICT since around 2011 and has so far enacted the Electronic Commerce Act (2012), the Information Technology and Communication Act (2016), and the Electronic Data Protection Act (2017). • In November 2021, The Digital Economic Development Plan was approved by the Parliament. The plan also includes work plans, guidelines, and standards for smart city development. • There is no system specializing in smart cities, such as tax incentives, but projects belonging sectors such as the use of advanced and modern technologies are regarded as preferential investment projects and are able to receive exemptions from corporate taxes and concession leasing on national land.
Smart city Promotion system and organization	<ul style="list-style-type: none"> • There is no national organizational structure dedicated to smart cities, but The Department of Housing and Urban Planning (DHUP) of the Ministry of Public Works and Transport (MPWT) is in charge of developing urban plans that incorporate smart cities. • The Ministry of Technology and Communications (MTC) is one organization that implements ICT related measures.

	<ul style="list-style-type: none"> Under the MTC, an organization called the E-Government Center has been established to promote ICT. It is mandated to centralize government IT services, and to manage and develop management and service software. The center is also responsible for managing services related to access to government information, businesses, and citizens, as well as training and promoting e-Governance.
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Source: JICA Study Team

2) National Strategy and Economic Policy

Vision 2030

Vision 2030 is the top policy frame of the Lao government formulated in 2016, which leads to other national and sector-specific policies, as well as short-term policies such as the One-Year and Five-Year National Socio-Economic Development Plan (NSEDP). It aims to raise the income level from low middle-income countries to upper middle-income countries by 2030, and it calls for a four-fold increase in per capita GDP and GNI compared to 2015. Lower targets are for achieving higher targets, other goals set out in the Vision are as follows:

1)	Top Middle-Income Countries with Intelligent Economic, Green and Sustainable Development
2)	GNI more than quadrupled from 2015
3)	Massive economies based on industrial and social market economies
4)	Social justice, peace and order, and improved development disparities between urban and rural areas
5)	Improving the lives of citizens and the quality of human resources, and guaranteeing the rights of citizens by law
6)	The administrative system is enhanced by following the 3-builds directive
7)	Efficient utilization of the natural resources
8)	Moving toward regional and international integration

3) Socio-Economic Development Plan

5-Year Socio-Economic Development Plan

The Lao PDR has formulated the National Socio-Economic Division Development Plan (NSEDP) every five years, establishing a framework and agenda for achieving national development goals and objectives, and establishing priorities and budgetary allocations for national development over the next few years. In March 2021, The 9th National Socio-Economic Development Five-Year Plan, approved by the Diet, drastically lowered the growth target due to the sluggish economic growth of trading partner countries, chronic fiscal deficits, the influences of COVID-19, etc.

The average growth rate was set at 4%, which is about half that of the 8th NSEDP. The 9th NSEDP aims to achieve SDGs by 2030 by enabling effective achievement of LDC graduation standards through high-quality, comprehensive, green growth, and it appears that the company is trying to shift from high growth to more sustainable growth. To achieve these goals, the following six key items have been set.

1)	Sustainable growth of a high-quality, stable and sustainable economy.
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2)	Develop human resources who can research and apply science and technology to create added value in manufacturing and services.
3)	Pursuit of people's happiness.
4)	Conserving the natural environment and reducing the risk of disasters.
5)	Strengthened infrastructure and proactive regional and international initiatives that take advantage of geographical advantages. Participation in a cooperative framework.
6)	Improving the efficiency of state administration and building an equal and just society protected by the authority and rigor of the rule of law.

For sustainable development, it is stated that the government will work on economic structural reform to restore the stagnant economy while considering the burden on the environment and society. From the perspective of national land development, the government aims to develop land, sea, and air transportation networks and telecommunications infrastructure as transportation bases for goods and services, thereby promoting the integration of the economy, trade, and services. To this end, the promotion and utilization of ICT technologies in all areas is one of the key measures.

4) National Land Planning

The land of Lao PDR is long and narrow from north to south, and is unique in each region, such as a plain near the opening from the mountainous region. As a part of the 9th Socio-Economic Developments Plan, each region has various potentials due to its geographical location, and the Plan describes the necessity of developing the region according to its characteristics. The development policy in each region is as follows.

- **Urban and Special Economic Zones:** Approximately 35% of the population in Lao PDR live in urban areas, and the relatively rapid growth of population in urban areas, particularly in Vientiane Capital, poses concerns about problems such as excessive population concentration, air pollution, and deterioration of sanitary conditions. For this reason, it is planned to be an environmentally friendly and attractive city for appropriate urban planning and urban management to promote investment for job creation and increased incomes, as well as to attract tourism and trade.
- **Northern Region:** Since the northern region is close to China, it is planned to maximize economic and social development by exporting to and providing services to China. In particular, the Lao government emphasizes production and services related to the Lao-China railway, which opened in December 2021, and plans to focus on developing green tourism and other forms of tourism that take full advantage of the railway, growing export cattle and fruit trees for export to China, and the promotion of the construction of processing sites for corn and rubber. In addition, as infrastructure improvement and construction to connect to Lao PDR-China railways, the government is focusing mainly on the development of roads connecting production areas and tourism service areas with Lao PDR-China railways, as well as the development of railways, expressways, dry ports, smart cities, etc., in Luang Namtha, Oudomxay, and Luang Prabang.
- **Central Region:** The central region has a policy of focusing on services, eco-tourism, light industry, etc. In addition to food and beverages, clothing, electric appliances, electronic equipment, machinery, and vehicles, the manufacturing and processing of

construction materials, textiles and natural dyes, wood, wood products, processed wood products, traditional foods, handicrafts, etc., will be promoted. Construction and development of existing infrastructure will also continue in the economic special zone of Vientiane Capital, as well as in industrial zones and industrial parks in Khammouane and Savannakhet prefectures.

- **Southern Region:** Since the southern district is an area where agriculture is active, mainly in the Bolaven Plateau in Champasak Prefecture, it is planned to concentrate on agricultural production and agricultural processing. In particular, the government of Laos promotes the production and processing of coffee, wood, rubber, plant oil, tea, traditional pharmaceuticals, and the development of mineral processing industries such as the food and beverage industry, construction materials, and aluminum, as well as the development of infrastructure such as industrial parks and eco-tourism development in the Phonthong District, Champasak Province, and Attapeu province.

5) Smart City Policy

Although there is no comprehensive smart city policy as a national state, the 9th Socio-Economic Development Plan states that smart city development will be promoted in the Luang Namtha, Oudomxay, Luang Prabang and Vientiane Capital, with the goal of establishing at least one smart city model. However, smart city development in all regions is developed by private foreign-owned companies such as from Thailand and China, and the government is promoting private-sector-led development.

On the other hand, as the Digital Economic Development Plan was approved by Congress in November 2021, the government is focusing on the utilization of ICT technology and the promotion of digitization. To achieve the six priority items of the 9th NSEDP listed previously, the government is promoting digitization and the utilization of ICT technology in all sectors.

In Lao PDR, where communication infrastructure is not in place, smart cities are moving ahead with the improvement of communications infrastructure, such as the development and upgrading of Internet communications, the expansion of cloud systems, and the improvement of web host systems, as well as the digitization and utilization of ICT. The following are examples of ICT utilization measures that are listed to achieve the six priority items listed in the 9th Socio-Economic Development Plan.

- Developing E-learning tools
- Introduction of mobile banking and mobile money to modernize payment and revenue collection systems
- Developing electronic administrative services, such as e-Disaster, e-Agriculture, e-Signature, and government-based open-data
- Improving and expanding digital public services such as e-Services and Single Sign-On
- Establishment of E-market
- Promoting Certification of Electronic Origin and Electronic Licensing
- Construction of a digital park in Vientiane
- Construction of the Digital Economic Special Zone

6) Smart City-Related Organizations

Organizations specializing in smart cities have not been established, but organizations related to smart cities are as follows.

- Department of Housing & Urban Planning (DHUP) in Ministry of Public Utilities and Transport (MPWT): This is in charge of urban planning incorporating the Smart City.
- Ministry of Technology and Communications (MTC): This has formulated regulations, policies, and plans for ICT.
- E-Government Center: Organizations under MTC that implement digital transformation in the public sector. Concretely, the following are carried out: centralization of computer service of the government, development and management of software for administration service, construction, management and supply of the service for the centralization of government information, training and promotion on the government and the electronic government, etc.
- Lao National Internet Center (LANIC): The organization under MTC is engaged in the development of internet and other communication infrastructures in Lao PDR and the operation of national data centers.

(2) Vientiane

1) Urban Issues and Urban Planning in Vientiane

Outline and History of Urban Planning in Vientiane

Vientiane is the capital of Laos, which has been developing as the center of politics, culture, and the economy. The streets are partially influenced by the period of French rule.

Vientiane, which is the recipient of the domestic population influx, has been experiencing significant population growth in recent years due to the exodus of its rural population, mainly young people, to urban areas, and the population is expected to exceed 1.4 million by 2030. Along with this, the improvement of sewage treatment facilities and waste treatment facilities has become a problem. In addition, traffic jams are occurring because the volume of traffic is also on the rise, and improvements in road and traffic functions are required.

Vientiane's Spatial Planning

Following the master plan for the year 2010, an urban development master plan for the year 2030 was developed in 2011 with the cooperation of Japan. The Second Master Plan classifies urban planning areas in the capital city of Vientiane into six areas (historical conservation areas, inner city areas, suburban areas, etc.), sets urban development and land use policies for each classification, and indicates the policy for infrastructure facility development. The “Multi-Core Urban Structure” is also adopted in order to disperse urban functions to prevent sprawling and to realize a city harmonized with nature.

In order for Vientiane to become a hub city in the GMS and a city loved by its citizens for its comfortable living environment as a central city of the nation, it is necessary to develop industrial parks and logistics bases, strengthen its functions as a human resource center for education and vocational training, and develop the city under appropriate regulatory guidance based on consideration of environmental conservation.

In February 2019, the new master plan was approved, emphasizing the importance of environmental protection and green space and public recreational areas, and the basic plan focuses on providing low-cost residential areas and building drainage systems to respond to floods.



Source: JICA (2011) “Lao PDR ‘Master Plan for Urban Development in Vientiane, Capital’”
Figure 4-63 Overview of Multi-Core Urban Structure

2) Smart City-Related Policies in Vientiane

Vientiane Capital is promoting smart city development with environmentally friendly urban development as a pilot project of the ASEAN Smart City Network (ASCN). However, there is no substantial movement, and in 2021, the Department of Technology and Communications (DOTC) is about to start preparing the Smart City Master Plan for the Vientiane Capital.

On the other hand, the Vientiane City Administration is encouraging private companies to participate in development projects through public-private partnerships, and several regions of Vientiane utilize ICT.

It is designated to be developed as a “Smart Zone.” The areas covered are Thatluang Marsh Specific Economic Zone, Vientiane Saysettha Development Zone, Long Thanh Specific Economic Zone, and Nongchan, Nongtha and Nong-Or.

3) Vientiane's Smart City Vision

Vientiane is a center of economic, industrial, and cultural activities surrounded by natural environments. Vientiane's administration has declared its development visions in ASCN based on the six indicators of “peace, cleanliness, greenery, light, attraction, and prosperity,” emphasizing the importance of environmentally friendly urban development.

4) Smart City Policy

There is no policy specializing in smart cities at the unit level, and private-sector-led smart city development is being carried out in area development.

However, the three key areas identified by the government in ASCN are: 1) health/welfare, 2) high-quality environmental conditions, and 3) well-developed infrastructures. In order to develop it as a livable city, focusing on the fields such as education, public health,

transportation, housing, public safety, and welfare are also positioned as important, and health welfare is put into the priority area. On the environmental front the focus is on waste management, and at the same time, the emphasis is placed on urban development with disaster prevention functions that are resistant to floods and fires. In infrastructure development, it is positioned as one of the priority projects to promote economic growth and aims to expand infrastructure and cities that can respond to population growth.

5) Vientiane's Smart City Project

Smart City Development by Foreign Companies

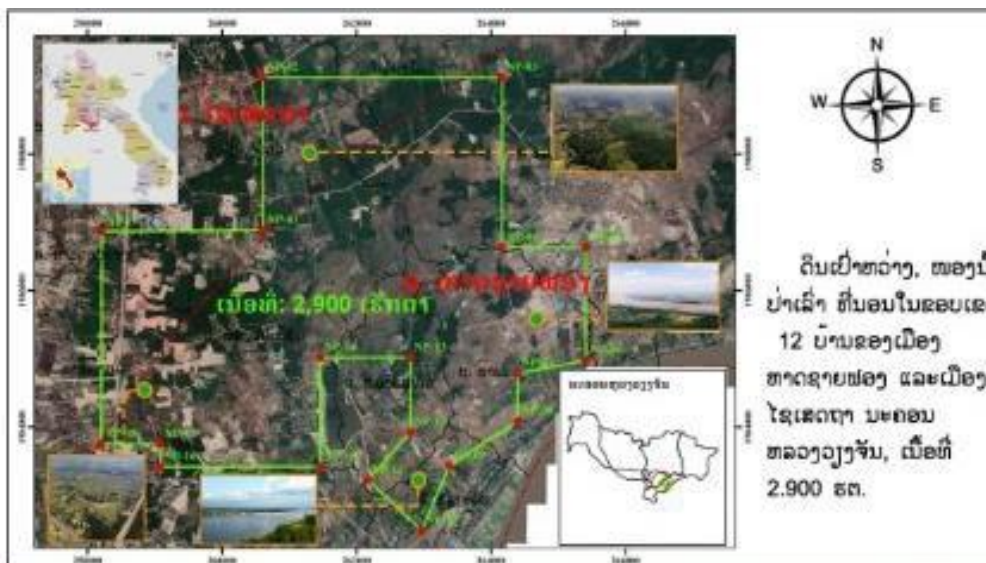
Among the areas designated by the Vientiane City Administration to develop as “smart zones,” Thatluang Marsh Specific Economic Zone has been developing IT systems for smart cities by real estate companies in Shanghai. Smart City feasibility studies by HUAWEI Technologies also seem to have been carried out, but the details and progress of the project are unknown.

Smart City Development by Local Companies

Douangchaleun Development Construction Group, a locally constructed company in Lao PDR, is conducting a feasibility study (F/S) of smart city projects in the Vientiane Capital. This F/S was approved by the government of Laos in July 2020, and as of November 2021, it was in the early stage of data collection.

The target area is 2,900 hectares, spanning 12 villages in Saysettha and Hatxayfong districts, and consists of 13 zones, including business zones, industrial zones, and residential zones. Education/medical facilities, sports/recreation areas, tourist areas, and agricultural zones are scheduled to be provided. In addition, condominiums, housing complexes, expressways, forested areas, and public parks will be constructed in the center of the new city.

Of the 2,900 hectares, 1,500 hectares are used to construct buildings and other structures, and it is planned to construct infrastructure such as roads and parking lots on 600 hectares of land, and green spaces and parks on 800 hectares of land.





Source: Douangchaleun Development Construction Group <http://www.ddcgroup-lao.com/services/home/>
 Figure 4-64 Douangchaleun Development Construction to develop smart cities

(3) Luang Prabang

1) Urban Issues and Urban Planning in Luang Prabang

Urban Planning Overview and History of Luang Prabang

Luang Prabang is an ancient capital located in northern Laos, and the urban area, that once flourished as the capital of the Lancer dynasty, was registered as a UNESCO World Heritage Site in 1995 as a cultural heritage. A town with a unique atmosphere and the best sightseeing spot in Laos that combines traditional Buddhist architecture with Western-style architecture built during the 19th and 20th centuries of French Colonial Period.

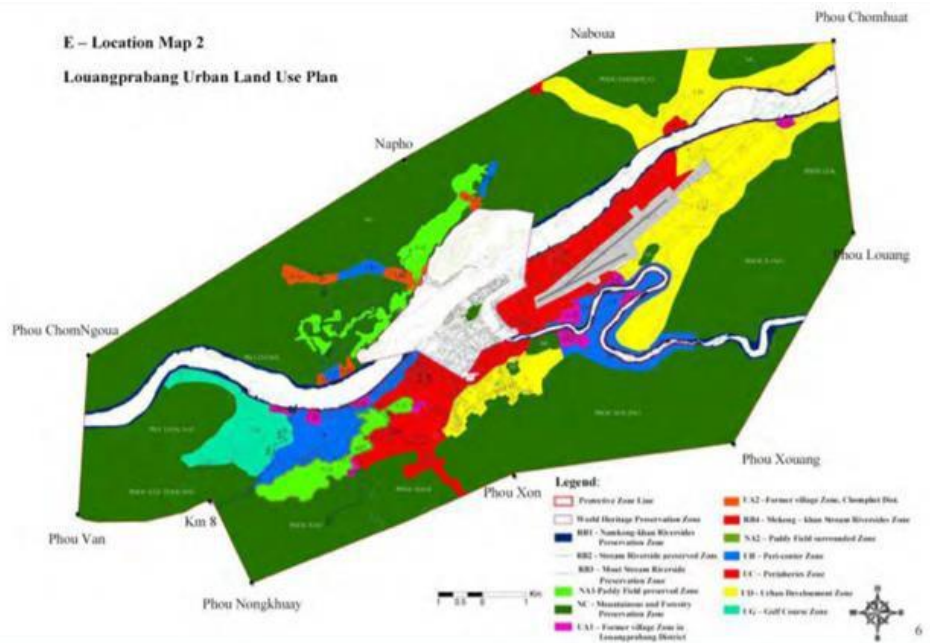
The district of Luang Prabang, the prefectural capital, is the center of commerce, services, administration and tourism in Luang Prabang province. Young people tend to gather from other districts to seek jobs in urban districts, and some urbanization is progressing compared to other northern districts.

Environmental degradation, such as increased automobile traffic, waste, and sewage discharge due to urban development pressure and increased number of tourists, has become an issue, as well as aging urban infrastructure, such as flood damage due to aging drainage channels, and restrictions on nighttime movement of residents and tourists due to aging sidewalks and streetlights.

Spatial Planning for Luang Prabang

The urban planning of the area including the central urban district of Luang Prabang is prepared by the Ministry of Public Utilities and Transport (MPWT), and the natural protection district, the legacy district, the area for urban development in the future, etc. are determined.

The Heritage Area conforms to the Heritage Area Conservation and Utilization Plan (PSMV) (2001) prepared with the support of the French Development Agency, and this plan delimits about 820 ha of the urban area in every zone, and details land use plans, building regulations, and regulations on the reconstruction of buildings.



Source: Regulation on Louangprabang Urban Planning (2012)

Figure 4-65 Zoning Plan Defined by PSMV

2) Smart City-Related Policies in Luang Prabang

Although no policy specific to smart cities has been formulated, a five-year development plan has been formulated at the provincial level under a long-term vision to 2030, similar to the National Socio-Economic Development Plan.

In the SEDP, long term vision was set, and in the vision, Luang Prabang was defined as “a quality tourism center under heritage conservation, a cultural and educational center, a clean and organic agricultural center, and a city where a quality life can be secured.

In order to achieve this vision, the government has set 10 basic policies, including “promotion of tourism, environmental protection, transportation, investment, financial technology and vocational education centers, and service industries such as health care.”

3) Smart City Vision of Luang Prabang

In 2021, the project of smart city master plan formulation is being carried out with the support of Japan, and the vision of smart city is called “sustainable and smart legacy city for Luang Prabang and citizens.” Under this vision, Luang Prabang aims to be a city where seven components (cities, traffic, tourism, heritage, administration, citizens, and data) are interconnected.

4) Smart City Policy

There is no policy specializing in smart cities in the Luang Prabang administration, but in the master plan cited in section iii), the direction of building a smart city is divided into two layers: cyber space and physical space. In cyberspace, the introduction of digital twins, Wi-Fi

servicing, smart waste management, etc. is planned, and in physical space, a multi-core urban structure in which the target area is classified into three areas is adopted.

5) Smart City Project of Luang Prabang

As a government-led initiative, the master plan mentioned in iii) is underway, but no smart city projects are found under the present conditions. As for private-sector initiatives, telecommunications giant Unitel signed a cooperation agreement with Luang Prabang Province in December 2020 for the development of e-government and smart city systems and plans to implement e-government and smart city projects from 2021 to 2025. The fields to be smartened include administrative services, education, and medical care, and some areas have already implemented the payment of salaries to national public servants using electronic money.

4-2-8 Case Study in ASEAN Cities: Cambodia

(1) Initiatives for Smart Cities as a Country

1) Overview

Table 4-21 Overview of Smart City Policy in Cambodia

<p>Positioning of Smart City Policies in Country Strategies</p>	<ul style="list-style-type: none"> • One of the challenges for achieving comprehensive and Sustainable Development Goals in Cambodia (CSDGs) is “urban planning and strengthening urban management.” One of the approaches is smart city policy. <ul style="list-style-type: none"> - Specifically, it states, “To develop rules, laws, regulations, and building standards for smart cities that ensure quality, safety, beauty, and efficiency, and to promote actual development (in particular, promote the development of cities on the border with neighboring countries).” - It is mentioned in S4's four priority areas; [(4) Inclusive and sustainable development] - [3: Strengthening urban planning and management - CSDGs is the Cambodian version of SDGs adopted by the Cambodian government in response to SDGs adopted at the UN Summit in September 2015.
<p>Vision for smart cities</p>	<ul style="list-style-type: none"> • In Cambodia, country-based smart city policies are not clearly proposed. • Meanwhile, the government announced the Cambodian Digital Economic and Social Policy Framework 2021-2035 in June 2021. It represents a long-term vision for building a vigorous digital economy and society by establishing a foundation to promote the adoption and transformation of digital in all sectors of society, states, citizens and companies. It will be an effort to aim for economic growth in a new form by incorporating digital into economic structure, development, and international trade. • The purpose is to improve the well-being of Cambodian people, build a digital economy focusing on developing ICT as a new starting point for economic growth, and to construct an ecosystem to improve productivity and economic efficiency.
<p>Framework of policies and systems related to smart city promotion</p>	<ul style="list-style-type: none"> • In Cambodia, there are no policies or systems to promote smart cities on a country-by-country basis. • On the other hand, the digital economy is being promoted, such as the “Cambodian Digital Economic and Social Policy Framework 2021-2035” mentioned in the previous Vision for smart cities. • With respect to investment, the new Investment Law promulgated in 2021 provides for 18 investment preferential fields (innovative high-tech industries and R&D activities, innovative and highly competitive in new industries and manufacturing ventures that generate high value-added products, agriculture, agricultural processing products, food

	<p>processing, tourism, manufacturing, electricity and electronics, business related to machinery, development business of special economic zones, infrastructure, development business of distribution network) that can select preferential measures such as the right to receive exemption of business incomes tax for 3 to 9 years from the time of the initial sales, and the right to deduct capital expenditure by special amortization prescribed by the current tax system according to the applicable fields and investment activity.</p> <ul style="list-style-type: none"> • In addition, it is relatively open for foreign investment and there are incentives for investors such as 100% equity ownership by foreign companies, exemption from corporate tax for up to 8 years, corporate tax rate of 20% after the end of the incentive period, tax exemption from capital goods, and restrictions on repatriation of capital.
<p>Smart City Promotion System and Organization</p>	<ul style="list-style-type: none"> • In February 2021, the Smart city Coordination Committee was approved and established as an organization that promotes smart cities, and the Ministry of Interior has set it aside as the Administrator. (However, it is uncertain whether or not there are human resources and resources to summarize smart city policy as a document, and to what extent the effectiveness is.) • At the local level, the Smart City Committee was established in 2019 under the State of Siem Reap. The main objectives are as follows. <ul style="list-style-type: none"> - Reviewing the Smart City Project and integrating it into a Five- and Three-Year Development Plan. - Sharing ideas between the public and private sectors. - Work plans for project implementation. - Reporting to relevant ministries, national agencies, and state assemblies. - Integration of purposes and projects into committees between each authority for development of tourism industries. - Planning and evaluation of project. - Reporting to technical coordinating council of the state parliament.

Source: Compiled by JICA Study Team

2) National Strategy and Economic Policy

Cambodia Vision 2030 (Cambodia Vision 2030)

The Cambodian government aims to become a high-income country by 2050 from ninth among the 10 ASEAN countries in GDP per capita. It is a challenge to work on agricultural development, development of physical infrastructure, private sector development and employment, capacity development whose development was delayed from river flooding and historical ill-conditioning, and to construct infrastructure for poverty reduction and long-term sustainable economic growth by raising national incomes.

In response to the issue, the Cambodian government formulated the Cambodia Vision 2030 (Cambodia Vision 2030) under the leadership of the Supreme National Council of Cambodia (SNEC) at the end of 2012, with the goal of becoming an upper middle-income country by 2030 and a high-income country by 2050. In addition, “Dynamic political system,

economic development, and prosperity of a country based on a fair society” are the main visions, and “sustainable comprehensive green growth” and “strengthening organizational structure and governance,” “fair, just and harmonious society” and “extension of national identity” are the paths for achieving these visions. It aims to become a middle-income country by 2030 and a high-income country by 2050, while maintaining an economic growth rate in the 7% range as its economic growth target. It was the first time that the Cambodian government, which had formulated a five-year development plan since the Paris Peaceful Agreement in 1992, had independently set up a long-term growth and development vision.

Cambodia Digital Economic and Social Policy Framework 2021-2035

The Cambodian government announced the “Digital Economic and Social Policy Framework of Cambodia 2021-2035” in June 2021. This represents building a vibrant digital economy and society by laying the foundations for promoting digital adoption and evolution in all sectors of society, the state, the people and the business community. It will be an effort to aim at economic growth in a new form by incorporating digitization into economic structure, development, and international trade.

This vision summarizes the purpose of accelerating new economic growth and the promotion of social welfare through a “New Normal” after pandemics. In order to improve well-being of the Cambodian people, the purpose is to construct an ecosystem which improves productivity and economic efficiency by constructing a digital economy as a new starting point for economic growth. The framework focuses on two foundations and three pillars; five indicators in total.

- Two foundations: developing digital infrastructure, fostering digital trust and confidence
- Three pillars: creating digital citizens, building the digital government, and promoting digital businesses.

Cambodian Sustainable Development Goals (CSDGs)

Cambodian Sustainable Development Goals CSDGs are the Cambodian version of SDGs adopted by the Cambodian government in response to SDGs adopted at the UN Summit in September 2015. UNDP Cambodia Accelerator Labs, the Ministry of Government Planning of Cambodia, and the Cambodian Institute of Technology are cooperating and promoting the initiative.

CSDGs, like SDGs, have 17 goals, but as with CMDGs (the Cambodian version of MDGs adopted at the UN Millennium Summit in September 2000, and the predecessor of CSDGs), another goal has been added, reflecting the actual situation in Cambodia. The 18th goal is “to eliminate landmines and unexploded ordnance and to assist victims,” which are items not included in SDGs.

CSDGs are positioned to be complemented by Cambodia Vision 2030 and integrated into the National Strategic Development Plan 2019-2023 (NSDP) of the Socio-Economic Development Plan.

This framework is not by itself an action plan for achieving goals. It is intended to establish a basis for monitoring results through actions of the Royal Government, the private sector, and other stakeholders, which are integrated into the national planning process and are development partners.

The specific four objectives are listed as follows.

- To present national goals, targets, and indicators based on Cambodia's priorities.
- To identify organizations that meet goals and are responsible for monitoring schedules and implementing activities.
- To identify data sources and data cycles for each indicator that provide practical definitions and methods for calculating indicators.
- To present paths toward achieving the goals, to set national baselines, and to set annual target value at a quasi-national level.



Source: UN Human Rights “End of Mission Statement by United Nations Special Rapporteur on the situation of human rights in Cambodia”, Professor Rhona Smith (<https://www.ohchr.org/en/NewsEvents/Pages/DisplayNews.aspx?NewsID=24579&LangID=E>)

Figure 4-66 18 Goals in the CSDGs

3) Socio-Economic Plan and National Land Plan

The Ministry of Planning is responsible for the “socio-economic development plan” in Cambodia, and the Ministry of Land Management, Urban Planning and Construction is responsible for the “land spatial plan.”

Table 4-22 Development Plans by Administrative Level

Type of planning	Socio-economic Development Plan	Spatial Plan
National level	4th Rectangular Strategy 2018-2023 (RS4) National Strategic Development Plan 2019-23 (NSDP)	National policy on spatial planning National Spatial Planning
Wide area regional level		Regional spatial planning Notice on the Management of the Gulf Region of Cambodia (February 2012)
Capital city/ Province level	Five-Year Development Plan, Three-Year Rolling Plan One-Year Development Plan Project (implemented with national budget)	Capital Land Use Plan and Master Plan (Phnom Penh Strategic Direction 2035) was broadly approved as a fifteen-year vision in December 2015 Provincial Space Planning
City/County/District level	Five-Year Development Plan, Three-Year Rolling Plan One-Year Development Plan Project (implemented with national budget)	City's Land Use Plan (Battambang LUP was approved as a Fifteen-Year Vision in December 2015) Master plan for county/district land use
Commune/ Sangkat level	Five-Year Development Plan, Three-Year Rolling Plan and One-Year Development Plan projects (implemented with national budget) Commune/Sangkat plans to be consolidated into a District Integration Workshop (DIW)	Land Use Plan by each Commune/Sangkat

Source: Ministry of Land, Infrastructure and Transport Japan, Overview of national land policies in each country (Cambodia) (<https://www.mlit.go.jp/kokudokeikaku/international/spw/general/cambodia/index.html>)

4th Rectangular Strategy 2018-2023

The 4th Rectangular Strategy 2018-2023 is a superordinate political guideline of the ruling party, and it is positioned as the basis of the socio-economic policy agenda, the five-year national strategic development plan, and the sector-by-sector strategy including physical spatial planning.

It was formulated to achieve the long-term goal of “Cambodia becoming a high-mid-range incoming country by 2030 and an advanced /high-incoming country by 2050,” and is currently being formulated up to the Fourth Rectangular Strategy (RS4). RS4 was formulated in September 2018 as a “Fourth Phase: Establishing the Foundation for Realizing the Quadrilateral Strategy for Growth, Jobs, Fair and Efficient: Cambodia Vision 2050.” The cabinet has set its goals for this term, with particular emphasis on methods for achieving economic growth. One example is the use of new technologies that emerge in the era of the digital economy as a means of realizing high-level and sustainable economic growth. In addition, in light of the challenges in the 3rd Rectangular Strategy of the previous fiscal year, RS4 has set the “acceleration of governance” as a core target.

Examples of The Challenges Related to the 3rd Rectangular Strategy

Need for human resource development, economic diversification, the need to foster high value-added industries, the importance of the agricultural sector, restoring confidence in the public and judicial sectors, improvement health services, improving the financial sector, and the necessity of natural resource reform.

RS4 also sets four strategic goals as follows:

- 1) Continuing economic growth of approximately 7%
- 2) Creating jobs that are qualitatively and quantitatively better
- 3) Addressing poverty issues, such as reducing the poverty rate to 10% or less
- 4) Improving and strengthening the capacity and governance of public agencies

In addition, the comprehensive environmental and priority areas for achieving the

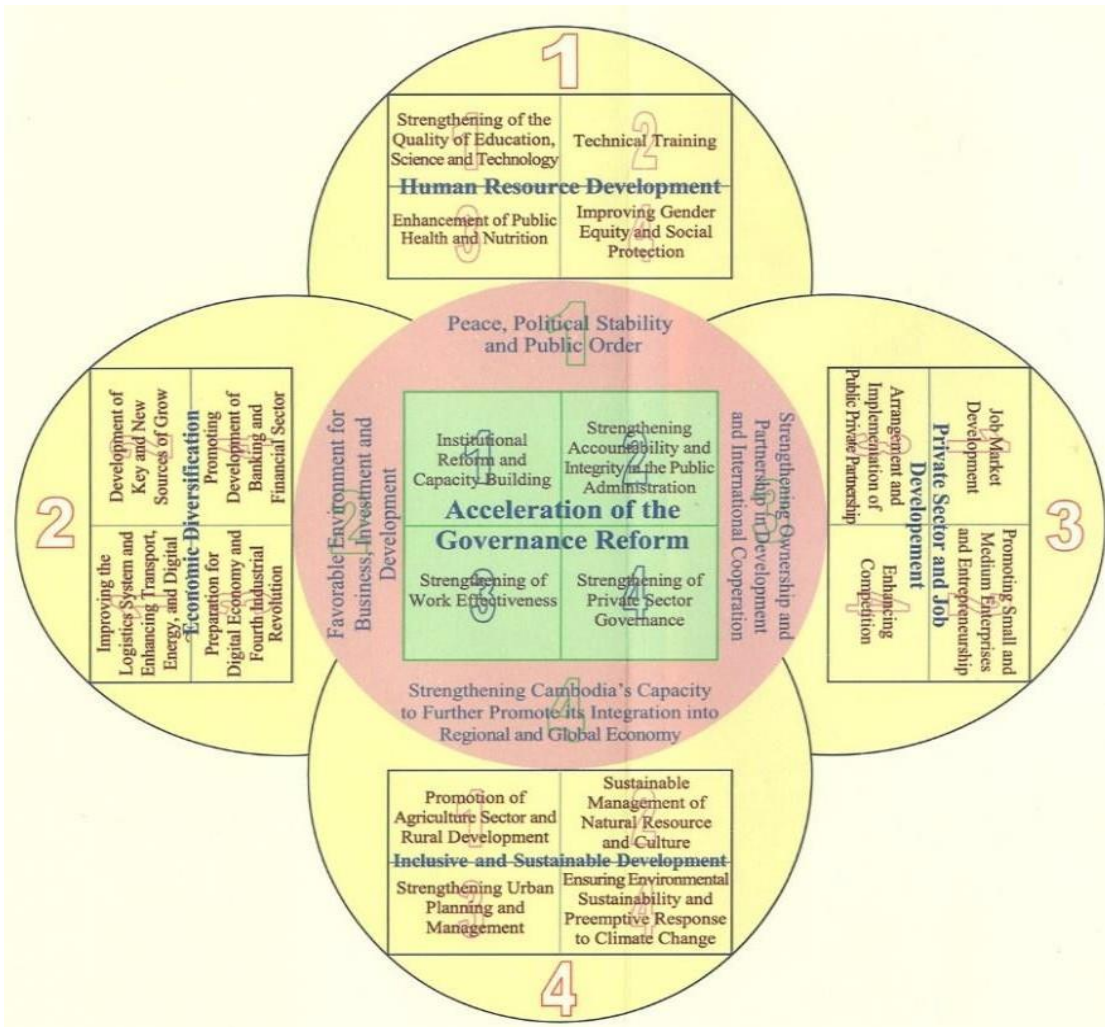
preceding strategic goals are listed as follows.

Four Priority Areas (Yellow Circle Part in Figure 4-67)

- 1) Human resource development
- 2) Diversification of economies
- 3) Private sector and job development
- 4) Comprehensive and sustainable development

Four Comprehensive Environments (Red Circle Part in Figure 4-67)

- 1) Peace, political stability and public order
- 2) Business and investment environment
- 3) Ownership and Partnership in Development and International Cooperation
- 4) Capacity Enhancement to Promote Integration into Regional and Global Economies



Source: The Rectangular Strategy for Growth, Employment, and Equity and Efficiency: Building the Foundation Toward Realizing the Cambodia Vision 2050 Phase IV

Figure 4-67 Overview of the 4th Rectangular Strategy

National Strategic Development Plan 2019-23

National Strategic Development Plan 2019-23 (hereinafter NSDP) serves as an action plan

that summarizes government-wide priority policies based on RS4, published in November 2019, and its composition also conforms to RS4. The period covered is from the year 2019 to 2023.

Industrial Development Policy 2015-2025

Industrial Development Policy 2015-2025 was published by Cambodia in 2016, in Cambodia Vision 2030, and it presents policy improvement priority items and action plans for each sector focusing on industrial development policy to achieve “becoming the upper middle-income country in 2030.” The basis of RS4 is that it aims at development by knowledge-intensive industry in future from the economics of labor-intensive industry.

The National Policy on Spatial Planning 2011

The Cambodian spatial plan specifies the hierarchy of spatial planning at each level in Cambodia to avoid conflicting opinions arising in the spatial planning at each administrative level.

Cambodia's National Policy on Spatial Planning 2011 is that “the entire territory is used, organized, developed and protected by an integrated and strategic territorial plan and the harmony of regionally important means and measures.” The national policy sets forth many goals and targets set in the CSDGs, as well as visions, goals, targets, and strategies for government-wide spatial planning to ensure sustainability, fairness and equilibrium, etc. The drafting is carried out by the Ministry of Land Management and Urban Planning and Construction (MLMUPC).

Table 4-23 Spatial Planning Structure by Administrative Level

Level of Plan	Spatial Planning	Status
National Level	National Policy on Spatial Planning	Adopted in 2011
	National Spatial Plan	Does not yet exist.
Broader Regional Level	Regional Spatial Plans	The only example so far is the Circular on Cambodia Coastal Area Management (February 2012).
Capital/Provincial Level	Capital Land Use Planning and Master Plan	Phnom Penh Strategic Orientation Plan 2035 was approved in principle in December 2015, with a 15 year vision.
	Provincial Spatial Plans	Some provincial land use plans/PLUP are currently being developed in parallel with District/Municipal/LUP. 6 provincial spatial plans and costal area management plan are being drafted.
Municipal/District/Khan Level	Municipal Land Use Plans	So far, only the Battambang LUP has been prepared and approved in December 2015.
	District/Khan Land Use Master Plans	Some have been drafted, but none have been endorsed. A total of 23 municipal/district LUP are being reviewed and to be finalized in 2018 (MLMUPC, 2018). 13 others are in the making.
Commune/Sangkat Level	Commune/Sangkat Land Use Planning/CLUP	These plans began to be developed after a 2009 sub-decree came into effect, but there is no record of how many exist.

Source: World Bank “CAMBODIA August 2018 ACHIEVING THE POTENTIAL OF URBANIZATION” (<https://openknowledge.worldbank.org/handle/10986/30867>)

Comprehensive Land Policy “The White Paper on Land Policy” 2015

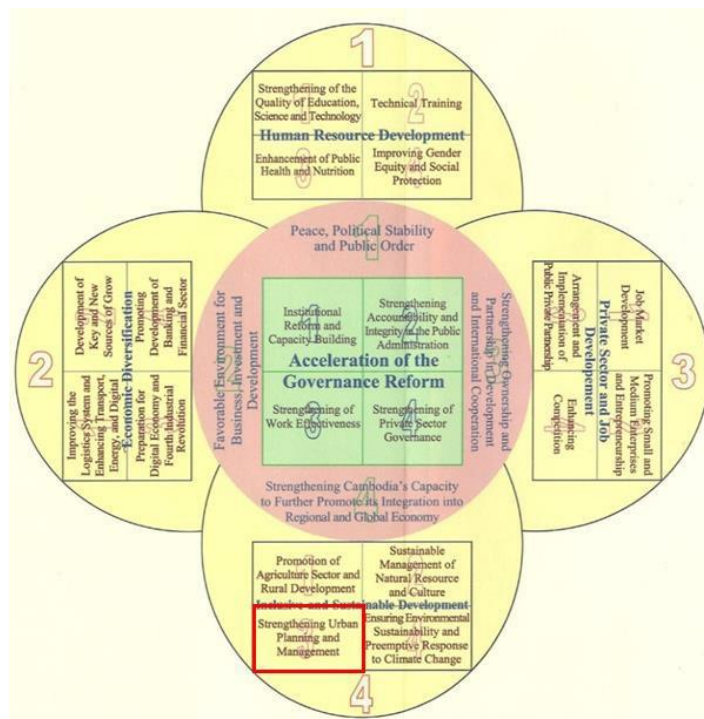
In the Comprehensive Land Policy “The White Paper on Land Policy” 2015, the government presents that necessary support, such as supporting the spatial planning and

urban development of designated industrial zones like Svay Rieng, Sihanoukville, and the Koccon local area, as well as Poipeto City, will be provided, such as by supporting the spatial planning and urban development of designated industrial zones such as Svalien, Sihanoukville, and the Koh Kong, as well as Poipet City, for coordination of industrial activities to aim at entering into the field of improving land-use planning, environmental management, residential development and infrastructural development.

This is an attempt to make Phnom Penh an industrial agglomerated city by implementing a long-term urban development plan that clearly divides it into industrial, administrative and residential areas. The goal is to transform Phnom Penh into a center of culture, knowledge and industry, full of dynamism.

4) Smart City Policy

The Cambodian government has set “urban planning and strengthening of urban management” as one of the challenges for achievement of CSDGs and has taken up smart city policy as one of its approaches. Specifically, it states that “To ensure quality, safety, beauty, and efficiency, we will not only strengthen the development and implementation of rules, laws, regulations, and building standards for smart cities, but also promote development and deployment by enhancing them (in particular, promote the development of cities on the border with neighboring countries).”



Source: “The Rectangular Strategy for Growth, Employment, and Equity and Efficiency: Building the Foundation Toward Realizing the Cambodia Vision 2050 Phase IV”

Figure 4-68 (Repeated Figure) 4th Rectangular Strategy Diagram

(2) Phnom Penh

1) Urban Issues and Urban Planning in Phnom Penh

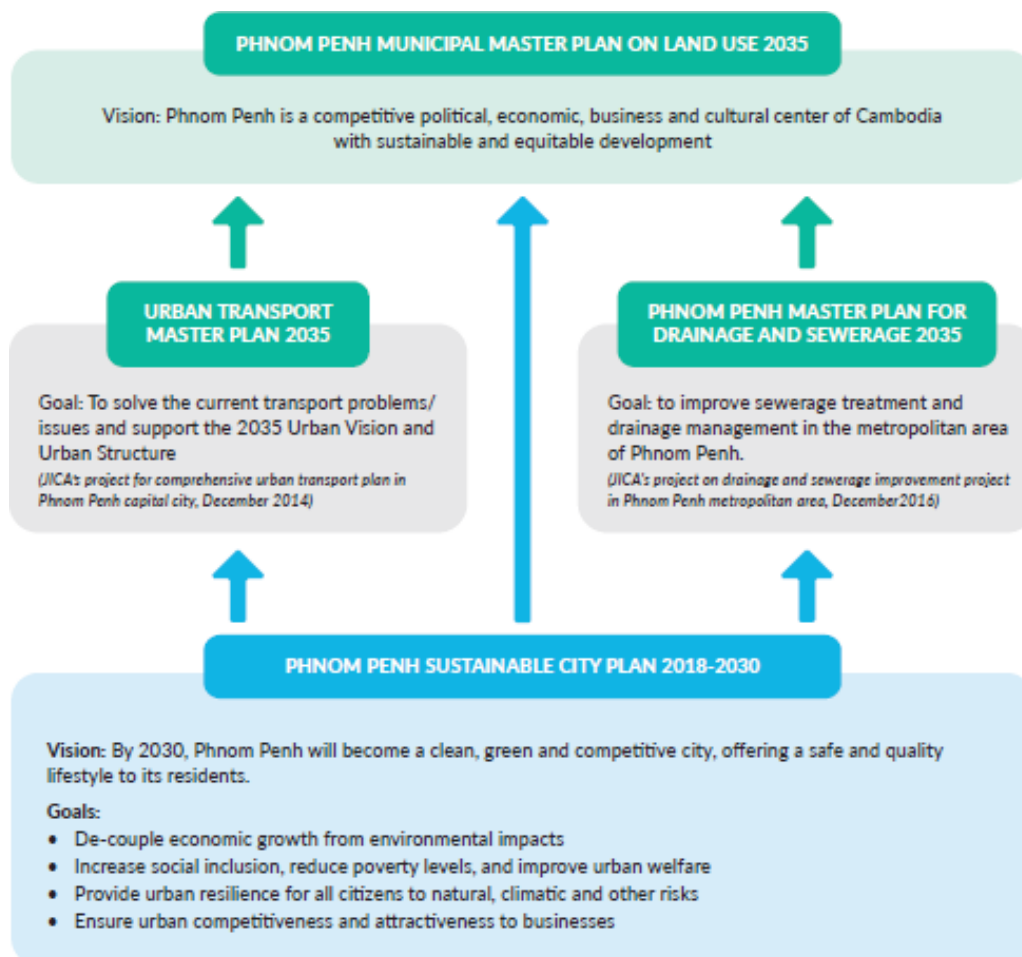
Overview and Background of Urban Planning in Phnom Penh

Phnom Penh is the capital of Cambodia, located in southern Cambodia, where the Tonle Sap River and the Mekong River cross, and is the administrative, cultural and economic center. Although it is known for its beautiful landscape due to urban planning during the colonial period in France, construction of high-rise buildings has advanced due to recent economic growth.

Phnom Penh has been selected as one of the cities of ASCN26, and the concerns in smart cities include the development of sidewalks and squares, roads to urban areas, public transport network development, traffic control centers, BRT/LRT, and cashless society.

Spatial Planning in Phnom Penh

In Phnom Penh, based on “Phnom Penh Sustainable City Plan 2018-2030,” together with “Urban Transport Master Plan 2035” and “Phnom Penh Master Plan for Drainage and Sewerage 2035,” land-use spatial planning is proposed as the “Municipal Master Plan for Phnom Penh Land Use 2035.”



Source: The Global Green Growth Institute (GGGI) “Phnom Penh Sustainable City Plan 2018-2030”

Figure 4-69 Structure of Urban Planning in Phnom Penh

Phnom Penh Sustainable City Plan 2018 -2030

Phnom Penh aims to promote economic growth and develop greenery-rich cities based on their environmental impacts for sustainable development. The Visions and Targets of the Phnom Penh Sustainable City Plan 2018 -2030 are as follows.

Vision:

- By the year of 2030, Phnom Penh aims to provide residents with safety and high-quality lifestyles and become a clean, green and competitive city.

Target:

- Combining economic growth with environmental impacts
- Increasing social inclusion, lowering the level of poverty, and improving urban welfare.
- Strengthening urban resilience to natural, climate, and other risks.
- Increasing the competitiveness of cities and make them more attractive for corporations.



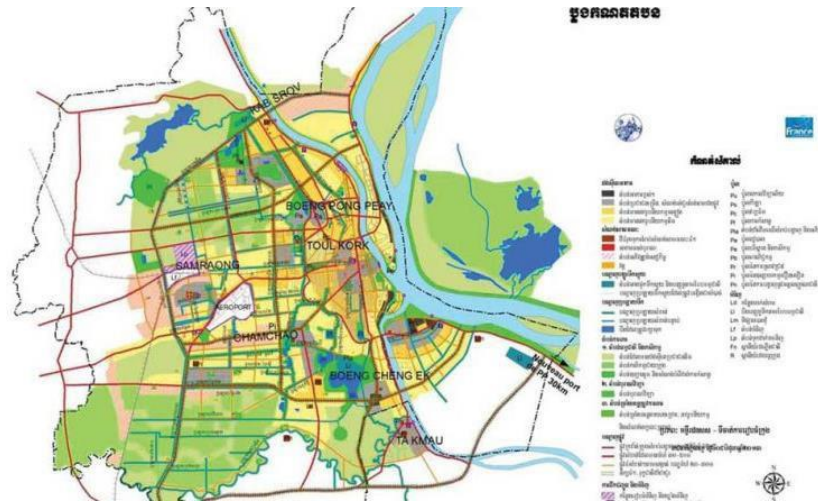
Source: JICA Study Team

Figure 4-70 Prioritized sectors of Phnom Penh Sustainable City Plan 2018-2030

Municipal Master Plan for Phnom Penh Land Use 2035

The Master Plan (established in 2015), supported by the French government, has given priority to implementing the following urban planning and infrastructure development initiatives:

- Development of national and ring road networks.
- Expansion of marine and land transport logistics networks, including ports, railways, and dry ports.
- Establishment of urban development MP (arrangement of public spaces, green spaces, roads, and various urban service functions).
- Establishment of historical and culture-protection areas and natural-conservation areas (Chak Tou Mok, Beugng Kok, etc.).
- Development of dams, sewage treatment, and landfills.
- Establishment of regulations for land, housing, and real estate development.



Source: MLMUPC, National Urban Development Strategy Framework, Draft, 2015
 Figure 4-71 Spatial Plan in Phnom Penh

2) Smart City-Related Policies in Phnom Penh

There is currently no clear smart city strategy or plan at the Phnom Penh Capital City level.

3) Smart City Vision

There is currently no clear smart city vision at the Phnom Penh Capital City level.

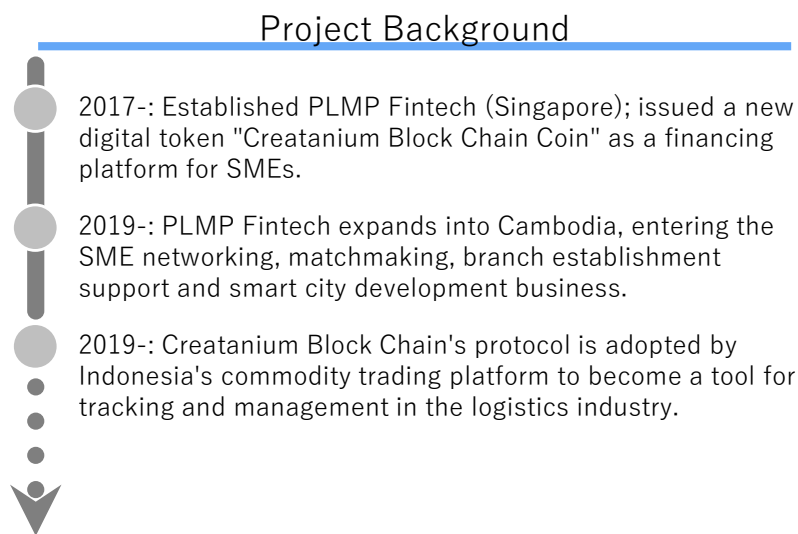
4) Smart City Policy

There is currently no policy dedicated to smart cities at the Phnom Penh Capital City level.

5) Smart City Project

Creatanium Blockchain Smart City business

The history and outline of the project are shown in the following.



Source: Compiled by JICA Study Team
 Figure 4-72 History of “Creatanium Blockchain Smart City” Business

Outline of “Creatanium Blockchain Smart City” Business

Outline of smart city initiatives	<ul style="list-style-type: none"> • “Creatanium Blockchain Smart City,” promoted by Singapore's start-up “PLMP Fintech” and under its umbrella “Creatanium Development” is the green field development business in the agricultural and industrial SEZ (about 105 ha) located 30km southwest to Phnom Penh International Airport which has been developing as a part of the “One Way One Road” initiative by the Chinese and Cambodian governments. • Within SEZ, 5 zones, 1) Customs clearance, 2) Warehousing, 3) Processing, 4) R&D, 5) Housing and Commercial, will be deployed, and the business entity will develop residential and commercial facilities, including condominium and detached houses in an area of 20 hectares. • This system develops an area management method in which block chain technology is utilized for data collection from IoT devices and sensors and various e-transaction in the area. A “digital passport” is issued to residents and employees in the area, and diverse and advanced urban services are provided via apps.
Expected utility and vision	<ul style="list-style-type: none"> • Eliminate barriers to sharing of information and resource between public and private stakeholders by utilizing the transparency of data through blockchain technology and promote coordination in development and area management. Creating platforms for Small to Medium Enterprises (SMEs) from all over ASEAN to develop highly transparent businesses.
Components (Technologies)	<ul style="list-style-type: none"> • The “Creatanium” blockchain is responsible for e-transactions between B2B, B2C and C2C. In addition, data from IoT devices and sensors is collected and managed integrated by blockchain.
Approach	<ul style="list-style-type: none"> • Smart city development using blockchain technology including support for SMEs.
Players and propulsion entities	<ul style="list-style-type: none"> • 105 Hectares of the SEZ are national projects authorized by the Cambodian government in collaboration with the Chinese government. • Of these, 20 hectares of “Creatanium Blockchain Smart City” will be promoted by Singapore's start-up “PLMP Fintech” and under its umbrella “Creatanium Development.”
Framework of the resident’s participation	<ul style="list-style-type: none"> • Consensus building with the existing residents and neighboring residents in the district and participation in urban formation/ development process is unknown.

6) Other Smart City-Related Projects

Traffic Control System Development Project in Phnom Penh Capital City

Though Phnom Penh Capital City has mainly worked on traffic improvement measures such as improvement of traffic lights and improvement of intersections, construction of grade separation by its own budget, traffic lights are displayed irrespective of traffic volume and flow, because signal equipment and control systems at each intersection in Phnom Penh are not unified, and the deterioration of traffic jams between each intersection, and increase in the number of fatalities of traffic accidents have become serious. Therefore, JICA's grant aid provided support for the development of intersection traffic lights and traffic control centers at 115 locations in Phnom Penh (64 existing traffic lights, 45 new traffic lights, and 6 intersections in the national road No. 1 line).

Sustainable Design of Urban Mobility in Middle-Sized Metropolitan Regions (SMMR)

SMMR, which is supported by Germany, has installed two photovoltaic-powered surveillance cameras on National Highway No. 2 under the permission of Phnom Penh Capital City Government. By recognizing the image of these cameras with artificial intelligence, detecting the vehicle passage situation, and further machine learning, it is aimed to improve the accuracy of the vehicle passage situation recognition by the surveillance cameras in the multipoint and the efficient traffic control system operation using it.

Bakong (Electronic Currency Using Blockchain)

Bakong, jointly developed by the National Bank of Cambodia and Soramitsu Corporation, is a central bank digital monetary system that uses digitized Cambodia Riel (KHR) or USD to enable immediate and final transactions. Pilot operation started in July 2019, and formal operation started in October 2020. By this system, various payments between individuals, between corporations, and at the storefront can be made immediately by a personal computer or a smart phone.

(3) Siem Reap

1) Urban Issues and Urban Planning in Siem Reap

Overview and Background of Urban Planning in Siem Reap

Siem Reap is the capital of Siem Reap Province in northwest Cambodia. It has become a sightseeing base for the ancient ruins of Angkor including Angkor Wat and Angkor Tom, and regional development centered on the tourism industry is an important issue.

Due to the rapid increase of tourists, rapid increase of automobiles, environmental deterioration caused by increase of waste and sewage discharge, severity of traffic congestion, increase of crimes, etc. are becoming apparent, and measures for infrastructure development and tourism service improvement have not been kept up. Therefore, from the viewpoint of ruins conservation and environmental protection, the sustainable development of tourism resources in the ruins area and the state and the improvement of the living environment of local residents have become urgent issues.

It has been selected as one of the cities of ASCN26 cities, and the issues of interest related to smart cities in Siem Reap include wastewater treatment, waste treatment, integrated data systems, and safety measures (CCTV), tourist centers, and the like. Smart cities are being promoted with smart sightseeing management systems and improvement of waste management and wastewater treatment as priority projects.

Spatial Planning in Siem Reap: Master Plan for Sustainable Development in The Siem Reap and Angkor Regions (2006-2020)

An overview of the master plan for sustainable development of the Siem Reap and the Angkor Region is given in the following.

Vision:

- By the year of 2030, Phnom Penh aims to provide safe, high-quality life and become a clean, green and competitive city. It will also provide residents with safety, high-quality lifestyles.

Goals:

- Combining economic growth with environmental impacts.
- Increasing social inclusion, lowering the level of poverty, and improving urban welfare.
- Providing all citizens with urban resilience to natural risks, climate risks, and other risks.
- Increasing the competitiveness of cities and make them more attractive for corporations.

Six Strategies for Desirable Future Image:

Strategy 1: Promotion of tourism aimed at medium-and high-end tourist groups for high-quality tourism.

Strategy 2: Maximization of local benefits.

Strategy 3: Creating an attractive town for tourists: building a human-scale city harmonized with the atmosphere of Angkor.

Strategy 4: Environmentally sustainable urban development.

Strategy 5: Building Infrastructure for Tourism and Residents.

Strategy 6: Strengthening Regional Administration and Public Finance.

2) Smart City-Related Policies in Siem Reap

There is no publicly accessible smart city-specific policies at the city level.

3) Smart City Vision

JICA is currently conducting survey and technical assistance to support Siem Reap to devise smart city vision and strategy.

4) Smart City Project

Smart Tourist Management System Project

Use security-enhancing systems, such as CCTV and traffic sensors, to make cities livable, smart, clean, and sustainable for both local residents and travelers.

Solid Waste and Wastewater Management Improvement Project

Develop solid waste and wastewater management infrastructure to ensure a high-quality environment. In addition, a feedback loop will be established to promote planning and implementation by utilizing technologies and data management systems.

SMART JAMP

The following projects are also scheduled to be implemented as a Pre-FS for Smart Siem Reap utilizing the Smart JAMP scheme promoted by the Ministry of Land, Infrastructure and Transport, Japan.

- Project No. 1: Smart City Data Collection & Analysis
Integrated data collection of urban environment and construction of analysis system.
- Project No. 2: CCTV System Introduction
Introduction of CCTV camera system for roadside environmental monitoring.
- Project No. 3: Official Parking System Introduction
Installation of parking sensors and development of empty vehicle information system.
- Project No. 4: Traffic Signal System Improvement
Establishment and renewal of traffic signals and traffic control systems.
- Project No. 5: QR Code Development
Development of tourism-related services using QR code, improvement of convenience during stay.
- Project No. 6: Rental Cycling Service
Diversifying the means of transport for tourists and improving the degree of freedom of transfer.
- Project No. 7: Landfill Management System Introduction
Establishment of monitoring guidelines for landfill management.
- Project No. 8: Garbage Collection IoT Installation
Installation of trash bins with sensors in public places and separate collection of trash.

*Priority projects are No. 1 to 4.

(4) Battambang

1) Urban Issues and Urban Planning in Battambang

Overview and Background of Urban Planning in Battambang City

Battambang is the capital of Battambang Province in western Cambodia and the third largest city in Cambodia. It is also a region that borders Thailand and is as well a relay point that connects with Phnom Penh, the capital city of Thailand. It is characterized by landscapes such as buildings in the French colonial period style.

Because it is on the border with Thailand, many informal residential areas and open-air merchants, such as many cross-border workers, have become urban issues. At the same time, the challenge is that infrastructures related to sanitation and waste disposal have not been well developed, particularly in informal residential areas.

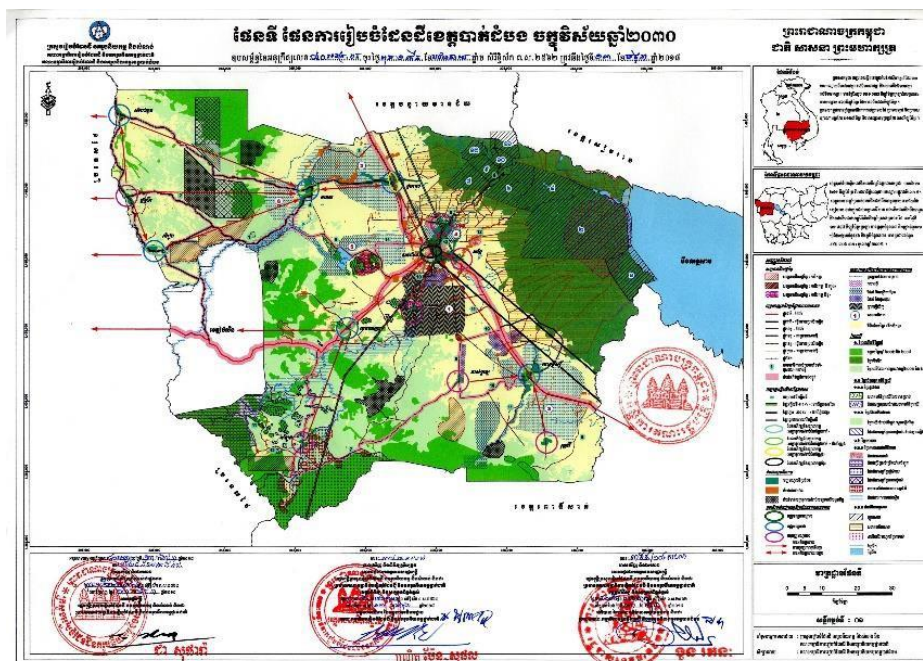
Selected as one the cities of ASCN26, there is interest in comprehensive urban development of Battambang city, including rebuilding of half of the informal open-air traders to a well-equipped retail stores, and the realization of a clean, greenery-rich residential city with sustainable waste management. The strategic objectives of ASCN26 by 2025 are as

follows.

- At least 2,800 young people acquire specific work skills.
- Move 50% of open stores to normal retailers and markets.
- Rehabilitate at least three irregular settlements are rehabilitated into regular housing.
- Develop a drainage system for the entire city.
- Construct two sewage treatment plants.
- Install sewerage systems in 85% of residential areas in the city.
- Increase the percentage of asphalt paving roads in the city from 17% in 2016 to 30% in 2022 and 40% in 2025.

Spatial Planning in Battambang: Battambang Provincial Land Use Plan for Cambodia 2030 Vision

For spatial planning in Battambang, “Battambang provincial land use plan for Cambodia 2030 vision” applies. Under this vision, it has the target of “becoming a high-mid-income country by 2030 and an advanced and a high-income country by 2050.”



Source: The map is originally produced by the Ministry of Land Management, Urban Planning and Construction.

Figure 4-73 Land-Use Planning Map for Battambang Toward Vision 2030

2) Smart City Policies in Battambang

There is no publicly accessible smart city-specific strategy or plan at the Battambang city level.

3) Smart City Vision

There is no publicly accessible smart city-specific vision at the Battambang city level.

4) Smart City Policy

There is no publicly accessible smart city-specific policy at the Battambang city level.

5) Smart City Project

Infrastructure Improvement Projects for Public Space Design and Waste Disposal

As a smart city project in ASCN26, in order to improve the living environment, the design of public spaces including public roads is being improved. In addition, the method of treating waste directly in rivers has been discontinued, and the infrastructure for waste treatment has been improved. Furthermore, Battambang city converted the river front to public space to address the problem of direct waste treatment in rivers and the associated flood risk.



Source: Centre for Livable Cities “ASEAN Smart Cities Network”

Figure 4-74 Improved River Front View

6) Other Projects

Sihanoukville

As a large-scale development, the Koh Kong area has been developed as a smart district, and the airport has recently been improved to enable departure and landing. In addition, Shenzhen from China is involved with the movement to develop a special economic zone. However, it is just the early stage when the policy paper to make the whole state smart has been created.

4-3. Analysis of ASEAN Cities

4-3-1 Quantitative Analyses of ASEAN Cities

(1) Basic Socio-demographic Information of ASEAN

This section provides an overview of ASEAN by organizing basic socio-demographic information and other statistical data of each ASEAN country.

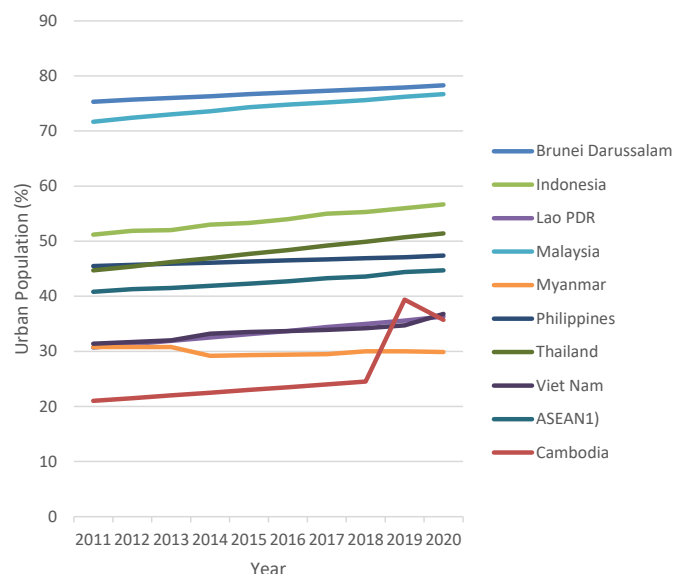
1) Population

- The population of ASEAN is approximately 4.5 million and is growing at a rate of about 1% per year.
- Some countries in the region are aging rapidly, with Singapore and Thailand having high percentages of population over 65 years old (15% and 13%, respectively).
- The percentage of urban population is increasing in almost all countries, approaching 80% in Brunei and Malaysia, and exceeding 50% in Indonesia and Thailand.

Table 4-24 Basic Information on ASEAN 1): Population

Item	Total land area	Number of Mid Year Population	Population Growth	Population Density	Population Structure						Urban Population
					(in percent)						
Unit	km ²	(in thousand)	(in percent)	(per Sq. Km)	(in percent)						(in percent)
Year		2020	2020	2020	2020						2020
					0-4	5-19	20-54	55-64	65+	Total	
Brunei Darussalam	5,765.0	453.6	-1.3	78.7	6.8	21.1	57.3	8.8	6.0	100.0	78.3
Cambodia	181,035.0	16,338.1	1.6	90.2	9.5	28.9	48.3	7.3	6.0	100.0	35.7
Indonesia	1,916,862.2	270,203.9	1.2	141.2	8.2	24.6	52.4	8.6	6.2	100.0	56.7
Lao PDR	236,800.0	7,261.2	1.9	30.7	10.6	30.6	48.4	5.9	4.4	100.0	36.3
Malaysia	331,388.0	32,583.8	0.2	98.3	7.8	24.2	52.8	8.2	7.0	100.0	76.7
Myanmar	676,576.0	54,817.9	0.9	81.0	9.1	27.1	48.8	8.4	6.6	100.0	29.9
Philippines	300,000.0	108,772.0	1.4	362.6	10.2	29.6	47.6	7.0	5.6	100.0	47.4
Singapore	719.9	5,685.8	-0.3	7,810.2	4.5	15.3	50.3	14.6	15.2	100.0	100.0
Thailand	513,139.5	68,127.8	0.2	132.8	5.4	17.8	50.4	13.4	13.0	100.0	51.4
Viet Nam	331,230.0	97,582.7	1.1	294.5	7.9	23.1	51.3	9.7	8.0	100.0	36.8
ASEAN	4,493,515.6	661,826.8	1.1	147.4	8.3	24.8	50.8	9.0	7.2	100.0	44.7

Source: Compiled by the Study Team from ASEAN STATISTICAL YEARBOOK 2021



Source: Compiled by the Study Team from ASEAN STATISTICAL YEARBOOK 2021
Figure 4-75 Urban Population Trend Until 2020

2) Labor Force and Economy

- In terms of life expectancy, only that in Laos and Myanmar is in the 60s, while that in other countries is in the 70s or above. The life expectancy in Thailand and Malaysia is around 75 years.
- GDP per capita for ASEAN as a whole is about 4,500 USD, and the primary industry ratio in Malaysia and Thailand is low at less than 10%.

Table 4-25 Basic Information on ASEAN 2): Economy

Item	Life Expectancy at Birth	Unemployment Rate of 15 Years Old and Over	Rate of Economic Growth		GDP per Capita at Current Prices in USD	ASEAN GDP Share of Major Group of Economic Sectors				
			(in percent)			(in percent)				
			2020	Average annual growth 2011-2020		2020	2020	2020	2020	2020
Unit	(in years)	(in percent)	(in percent)		(in US\$)	(in percent)				
Year	2020	2020	2020	Average annual growth 2011-2020	2020	2020				
						Agriculture	Industry	Services	Balancing	A+I+S
Brunei Darussalam	77.4	7.4	1.1	0.4	25,885.3	0.8	64.2	36.8	-1.9	100.0
Cambodia	72.0	2.4	-3.1	6.3	1,528.5	17.3	37.3	37.7	7.7	100.0
Indonesia	71.5	7.1	-2.1	4.6	3,928.5	12.4	39.4	44.1	4.1	100.0
Lao PDR	67.0	9.4	3.3	6.8	2,636.0	13.9	35.7	40.2	10.2	100.0
Malaysia	74.9	4.5	-5.6	4.0	10,328.1	7.1	36.8	54.9	1.1	100.0
Myanmar	66.6	0.5	3.2	6.5	1,285.8	22.0	36.3	41.8	0.0	100.0
Philippines	72.7	10.3	-9.6	4.7	3,323.6	10.2	29.2	60.7	0.0	100.0
Singapore	83.9	4.1	-5.4	2.9	59,784.8	0.0	25.9	74.1	0.0	100.0
Thailand	75.7	1.7	-6.1	2.3	7,361.8	6.2	34.2	59.6	0.0	100.0
Viet Nam	73.7	2.3	2.9	6.0	2,785.3	13.6	36.6	38.7	11.1	100.0
ASEAN			-3.3	4.4	4,533.2					

Source: Compiled by the Study Team from ASEAN STATISTICAL YEARBOOK 2021

3) Tourism

- In 2019, ASEAN received about 140 million tourists; however, in 2020, the number has dropped to 26 million due to the COVID-19 pandemic.

4) Road Infrastructure and Car Ownership

- Each country has made steady progress in road construction, and the society has been more dependent on automobiles, with Malaysia and Brunei having almost 1,000 cars per 1,000 people, followed by Thailand with approximately 600 cars, and Indonesia with nearly 500 cars.

Table 4-26 Basic Information on ASEAN 3) and 4): Tourism and Transportation

Item	Visitor Arrivals to ASEAN by Country of Destination		Road Total Length (Km)	Road Length of Paved Network (Km)	Total Vehicles per 1000 population
	Unit	(in thousands)	(in thousands)	(Km)	(Km)
Year	2019	2020	2019	2019	2019
Brunei Darussalam	333.2	62.3	3,714.0	3,223.2	997.8
Cambodia	6,610.6	1,306.1	63,432.4	12,008.7	27.9
Indonesia	16,107.0	4,052.9	564,010.0	325,606.0	485.1
Lao PDR	4,791.1	886.4	58,255.0	12,617.2	337.1
Malaysia	26,100.8	4,332.7	256,493.6	192,373.7	993.7
Myanmar	4,364.1	903.3	138,272.4	40,626.9	138.8
Philippines	8,260.9	1,482.5	33,018.3	32,087.1	109.0
Singapore	19,113.8	2,742.4	3,520.0	3,520.0	171.3
Thailand	39,916.3	6,702.4	702,210.2	408,188.4	608.7
Viet Nam	18,008.6	3,686.8	594,898.0	475,918.0	44.6
ASEAN	143,606.3	26,158.1			

Source: Compiled by the Study Team from ASEAN STATISTICAL YEARBOOK 2021

5) Infrastructure Service

- Some ASEAN countries still lack adequate infrastructure services, and ensuring the access to water, sewage, and electricity is a major challenge in many countries.
- Meanwhile, cell phone penetration is over 100% in all countries except Laos, indicating that access to ICT is advancing rapidly.

Table 4-27. Basic Information on ASEAN 5): Infrastructure Service

Item	Population with Access to Improved Drinking Water	Population with Access to Improved Sanitation	Population with access to electricity	Access to Cellular/ Mobile Phones Cellular/Mobile Phone Density	Internet Subscribers /Users per 100 Persons	Number of deaths, missing persons and directly persons attributed to climate-related disasters per 100,000 population
Unit	(in percent)	(in percent)	(in percent)	(per 100 persons)	(per 100 persons)	(per 100,000 persons)
Year	2020	2020	2020	2019	2019	2019
Brunei Darussalam	100.0	93.0	99.7	132.7	95.0	
Cambodia	79.7	80.4	85.8	129.9	78.3	3,142.8
Indonesia	90.2	79.5	99.2	126.1	47.7	1,936.7
Lao PDR	77.5	75.3	93.0	60.8	25.5	10,795.5
Malaysia	96.5	99.7	99.9	139.6	84.2	266.0
Myanmar	83.9	80.1	57.0	137.7	33.1	2,494.0
Philippines	93.3	81.1	87.9	154.8	63.7	9,058.7
Singapore	100.0	100.0	100.0	155.6	88.9	
Thailand	99.9	98.7	99.7	186.2	66.7	7,217.5
Viet Nam	97.4	94.0	99.5	141.2	68.7	0.3
ASEAN				139.1	57.0	

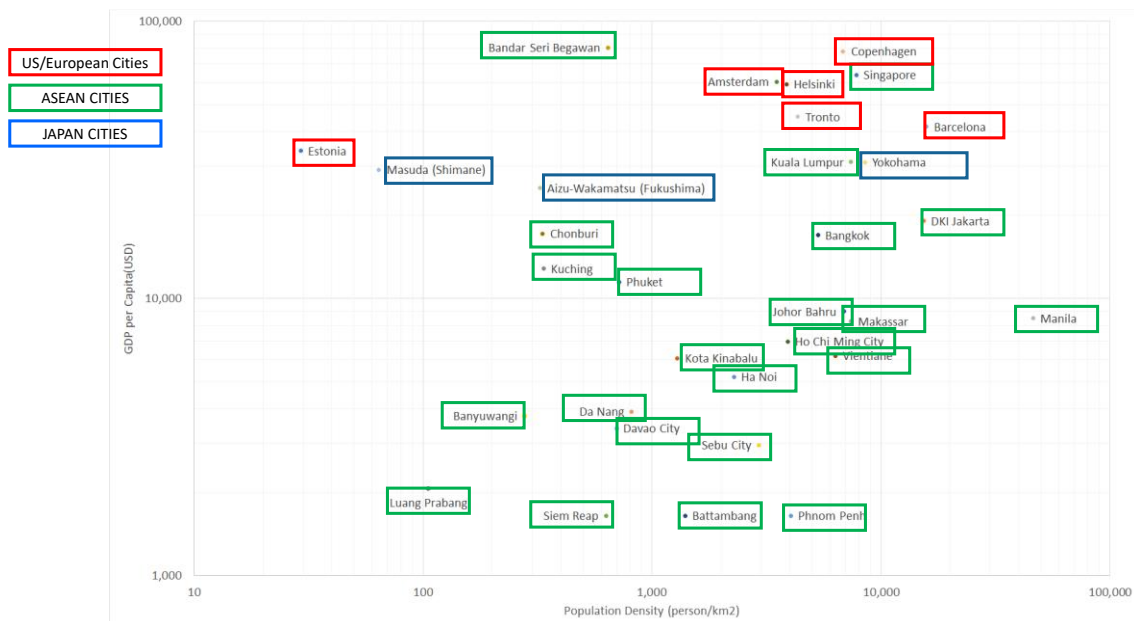
Source: Compiled by the Study Team from ASEAN STATISTICAL YEARBOOK 2021

(2) Basic Information of ASEAN Cities

To give an overview of the economic level and scale of each ASEAN city, GDP per capita and population density of each city are shown in the figure below. The cities in Europe, the U.S., and Japan are also shown for reference.

It can be observed that ASEAN cities differ greatly in terms of population size and economic level (GDP per capita). In contrast, the differences among the Japanese cities are limited to the population density, and there is not a big difference in their economic level.

Aiming to understand better the ASEAN cities, it would be helpful to group these cities based on the relationship between GDPs per capita and population density, and then to consider what kind of cities they should aim for.



Source: Compiled by the Study Team from ASEAN STATISTICAL YEARBOOK 2021

Figure 4-76 Relationship Between GDP Per Capita and Population Density

Basic information and major urban issues in each of the ASEAN cities are collected and organized on the following pages and thereafter. The major urban issues in the table are three issues that have been highlighted in the growth strategies and plans of each city.

Table 4-28 Basic Information for Each Country and City (1/4)

National level	Country name		Indonesia			Cambodia		
	Basic indicator	Population (2019, World Bank)	27,063 Million			1,649 Million		
		GDP (nominal, 2019, World Bank)	11,191 Billion USD			271 Billion USD		
		GDP per capita (nominal, USD)	4,135			1,643		
		Political system	Presidential system, republican system			Constitutional monarchy		
		Religion	Islamic 87%, Christian 10%			Buddhism 98%		
Industry Structure (2019, World Bank)	Primary: 13% Secondary: 39% Tertiary: 44%			Primary: 21% Secondary: 34% Tertiary: 39%				
Urban level	City name		Jakarta	Makassar	Banyuwangi	Phnom Penh	Siem Reap	Battambang
	Basic indicator	Area (km ²)	664	199.3	5,782	679	10,299	11,702
		Population (thousand)	10,154	1,338	1,593	2,281	1,014	997
		Population Density (People/km ²)	15,292	6,718	275.6	3,361	98.48	85.21
		GRDP per capita (USD)	19,030	8,270	3,764	1643 (Country)	1643 (Country)	1643 (Country)
	Urban issues	Major Urban Issues: Three	Traffic jam	Medical and health care	Poorly developed public service	Traffic jam	Traffic jam	Urban poor
			Flood damage	Traffic jam	Human resource development	Transport infrastructure deficit	Waste treatment	Waste treatment
			Urban poor	Education	Promotion of tourism	Public space development	Promotion of tourism	Infrastructure development

Source: JICA Study Team

Table 4-29 Basic Information for Each Country and City (2/4)

National level	Country name		Thailand			Laos	
	Basic indicator	Population (2019, World Bank)	6,963 Million			717 Million	
		GDP (nominal, 2019, World Bank)	5,443 Billion USD			182 Billion USD	
		GDP per capita (nominal, USD)	7,817			2,538	
		Political system	Constitutional monarchy			People's Democratic Republic	
		Religion	Buddhism: 94%, Islam: 5%			Buddhism	
		Industry Structure (2019, World Bank)	Primary: 8% Secondary: 33% Tertiary: 59%			Primary: 15% Secondary: 31% Tertiary: 43%	
Urban level	City name		Bangkok	Chonburi	Phuket	Vientiane	Luang Prabang
	Basic indicator	Area (km ²)	1569	Prefecture: 4360	Prefecture: 543	679	10,299
		Population (thousand)	8280	Prefecture: 1535	Prefecture: 415	2,281	1,014
		Population Density (People/km ²)	5300	3520	764	3,361	98.48
		GRDP per capita (USD)	16,909	17,132	11,448	1643 (Country)	1643 (Country)
	Urban issues	Major Urban Issues: Three	Urban competitiveness Strengthening	Industrial development	Promotion of tourism	Traffic jam	Traffic jam
			Traffic jam	Inviting companies	Environmental protection	Lack of transport infrastructure	Waste treatment
			Environmental load	Enhancement of environment	Education	Public space development	Promotion of tourism

Source: JICA Study Team

Table 4-30 Basic Information for Each Country and City (3/4)

National level	Country name		Philippines			Vietnam		
	Basic indicator	Population (2019, World Bank)	10,812 Million			9,646 Million		
		GDP (nominal, 2019, World Bank)	3,768 Billion USD			2,619 Billion USD		
		GDP per capita (nominal, USD)	3,485			2,715		
		Political system	Constitutional monarchy			Socialist Republic		
		Religion	Christian (Catholic) 83%, Christian Teaching (Other) 10%, Islam 5%			French 80%		
Industry Structure (2019, World Bank)	Primary: 9% Secondary: 30% Tertiary: 61%			Primary: 14% Secondary: 34% Tertiary: 42%				
Urban level	City name		Cebu	Davao	Manila	Da Nang	Hanoi	Ho Chi Minh
	Basic indicator	Area (km ²)	315	2,444	38.55	1,285	3,359	2,095.6
		Population (thousand)	923	1,700	1,780	1,000	7,600	8,200
		Population Density (People/km ²)	2,930	699	46,173	814	2,280	3,924
		GRDP per capita (USD)	2,956	3,395	8,482	3,910	5,211	6,988
	Urban issues	Major Urban Issues: Three	Population growth and dense cities	Deterioration of living environment with population growth	Population growth and dense cities	Economic growth and population growth	Infrastructure (transportation, water and sewage)	Infrastructure (transportation, water and sewage)
			Wastewater treatment	Traffic jam	Safe and affordable Provision of houses	Environmental Issues (Large Air pollution, etc.)	Environmental Issues (Large Air pollution, etc.)	Environmental Issues (Large Air pollution, etc.)
Traffic jam			Water pollution	Traffic jam	Shortage of freight distribution infrastructure	Shortage of affordable houses	Shortage of affordable houses	

Source: JICA Study Team

Table 4-31 Basic Information for Each Country and City (4/4)

National level	Country name		Malaysia			
	Basic indicator	Population (2019, World Bank)	3,195 Million			
		GDP (nominal, 2019, World Bank)	3,647 Billion USD			
		GDP per capita (nominal, USD)	11,415			
		Political system	Constitutional monarchy			
		Religion	Islam			
Industry Structure (2019, World Bank)	Primary: 7% Secondary: 37% Tertiary: 54%					
Urban level	City name		Johor Bahru	Kuala Lumpur	Kota Kinabalu	Kuching
	Basic indicator	Area (km ²)	220	243	366.03	4,195
		Population (thousand)	1,500	1,800	453	685
		Population Density (People/km ²)	6,909	7,377	1,290	163.27
		GRDP per capita (USD)	8,962	31,073	6,078	12,806
	Urban issues	Major Urban Issues: Three	Economic growth	International Commercial & Finance Enhancing urban functions	Housing environment improvement	Strengthening transportation systems
			Environment Friendly Improvement of infrastructure efficiency	Development of transportation systems	Development of sewerage infrastructure	Measures against floods and other disasters
			Improving Mobility Quality	Improving Position as a Creative City	Environmentally friendly urban planning	Urban sprawl through digitization

Source: JICA Study Team

4-3-2 Classification of Urban Challenges in ASEAN Cities

(1) Method of Classifying Cities

In categorizing the challenges facing ASEAN cities, we assumed that the nature of these challenges would vary depending on the economic level and the characteristics of the city. Therefore, “economic level” and “characteristics of cities” were defined as the two axes for classification, and a classification type was established for each.

First, the economic level of the cities was categorized into “Leading Group,” “Transforming Group,” and “Emerging Group” based on the GDP of the country to which the city belongs. The country allocations are as follows.

- Leading Group: Malaysia, Thailand, (Singapore), (Brunei)
- Transforming Group: Indonesia, Philippines, Vietnam
- Emerging Group: Laos, Cambodia, (Myanmar)

Next, with regard to the characteristics of cities, based on population size, industry, and function, the cities were classified as “large cities/representative cities,” “regional core cities,” and “cities specializing in specific industries.” Smart cities can be established not only as municipal initiatives, but also as development projects in limited areas or land, including large-scale real estate development projects on land owned by the private sector. With this in mind, “specific areas” was also established as a classification category. It is assumed that smart cities in these specific areas will be highly dependent on the project entity and location and will not be affected by the size of the country's economy or the city's industry and functions.

- Metropolises and representative cities: Major metropolitan areas representing ASEAN and the economic centers of the country concerned
- Core regional cities: Regional cities and core cities in the country with a certain size in terms of population and economy
- Cities specializing in specific industries: Cities specializing in specific industries or functions such as agriculture, industry, tourism, etc.
- Specific areas: Smart cities in specific areas, including greenfield developments

(2) Identifying Typical Urban Challenges According to Classification

The figure below summarizes typical issues in the target ASEAN cities according to the urban classification on the two axes described above. Note that the issues of the cities were identified and organized according to the issues emphasized in the growth strategies and plans of each city. It should also be noted that although these issues are common to some extent for all urban classifications, they are described with a high degree of urgency or priority for the relevant urban classifications.

Typical Issues by Classification of Cities		Classification of Cities by Characteristics			District/ Street	
		Metropolitan Area				
High Income	Classification by Economic Scale	A	B	C	D	
			Metropolises and Representative Cities A Metropolises that represent ASEAN and economic center cities of the country	Core Regional Cities Local cities and core cities that have a certain size in terms of population and economy (excluding the major cities in A)	Cities specializing in specific industries Cities with specific industries (agricultural areas, industrial cities, tourist cities, etc.)	Specific Area D Greenfield Development Area
			Common Issues : <ul style="list-style-type: none"> Traffic problems (traffic congestion) Deterioration of urban environment Generation of urban poor 	Common Issues : <ul style="list-style-type: none"> Traffic problems (traffic congestion) Generation of urban poor Improvement of quality of life 	Common Issues : <ul style="list-style-type: none"> Strengthening of the production base Improve convenience of living 	*Often unaffected by the economic scale of the country or city
		1 LEADING GROUP (Singapore), (Burunei), Malaysia, Thailand [GDP per capita: 7,500 USD+]	Issues : <ul style="list-style-type: none"> To strengthen international competitiveness Expansion of maintenance and management of urban infrastructure Bangkok, Kuala Lumpur	Issues : <ul style="list-style-type: none"> Expansion of urban amenities Development of infrastructure for sustainable growth Johor Bahru, Kuching	Issues : <ul style="list-style-type: none"> High value-added industries Human resource development and attraction Kota Kinabalu, Chonburi, Phuket	Issue : <ul style="list-style-type: none"> Improvement of quality of life Provision of high-quality infrastructure services
2 TRANSFORMING GROUP Indonesia, Philippines, Vietnam [GDP per capita: 2,500 USD+]	Issues : <ul style="list-style-type: none"> Enhancement of urban productivity Improvement of quality of life Jakarta, Manila, Hanoi, Ho Chi Minh City	Issues : <ul style="list-style-type: none"> Deterioration of urban environment Inclusive provision of infrastructure and urban services Makassar, Danang	Issues : <ul style="list-style-type: none"> High value-added industries Increased environmental impact (due to inappropriate resource management) Cebu, Davao			
3 EMERGING GROUP Lao PDR, Cambodia, Myanmar [GDP per capita ~2,500 USD]	Issues : <ul style="list-style-type: none"> Leading economic growth Development of basic living infrastructure Vientiane, Phnom Penh, Yangon	Issues : <ul style="list-style-type: none"> Development of basic infrastructure Secure livelihood infrastructure for residents Mandalay, Nay Pyi Daw	Issues : <ul style="list-style-type: none"> Industrial development Weak industrial base Secure livelihood infrastructure for residents Siem Reap, Luang Prabang, Battambang, Banyuwangi	City : Bangkok (Bangsoo) Chonburi (AMATA)		

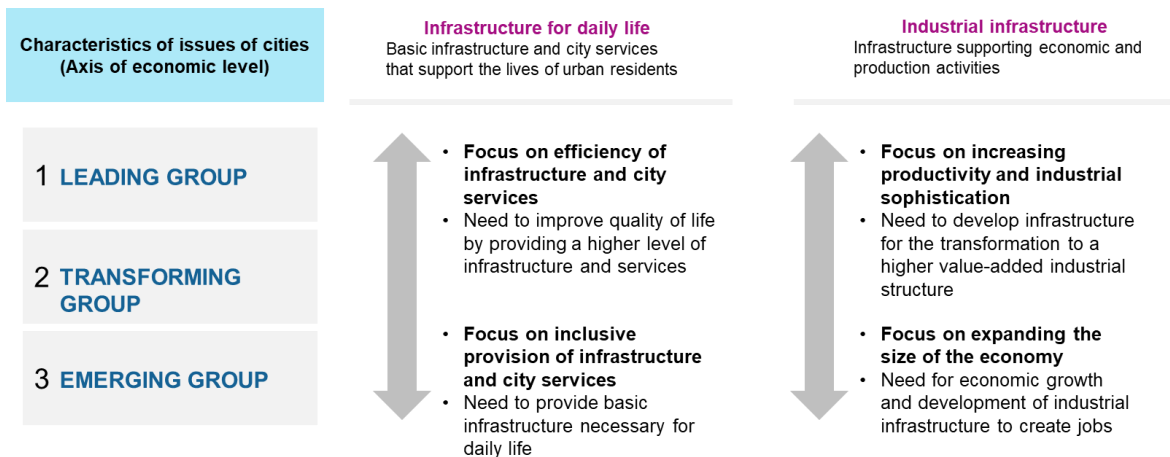
Source: JICA Study Team

Figure 4-77 Extracting Challenges Based on the Characteristics of Cities and the Economic Level of Countries

(3) Outlining of Urban Challenges According to Classification of Cities

The characteristics and trends of typical issues of cities for each of the above urban classifications were also organized using the “economic level” and “characteristics of cities” axes.

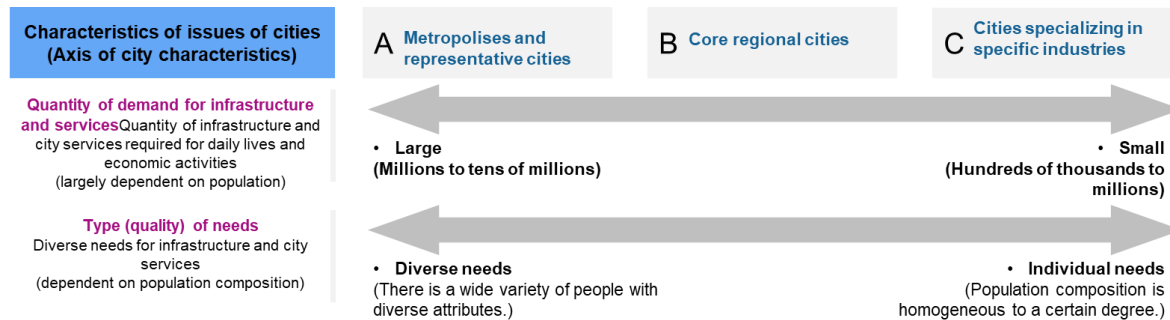
The figure below summarizes the characteristics of the issues in two cross-sections, living infrastructure and industrial infrastructure, along the axis of economic level.



Source: JICA Study Team

Figure 4-78 Extracting Characteristics of Issues of Cities Organized by Axis of Economic Level

The figure below summarizes the characteristics of issues in two cross-sections, the quantity of demand for infrastructure services and the type (quality) of needs, along the axis of urban characteristics.



Source: JICA Study Team

Figure 4-79 Characteristics of Issues of Cities Organized by Axis of Characteristics of Cities

4-3-3 Direction of Smart City According to Urban Classification

Based on the classification and organization of issues of cities presented above, we examined the direction of smart city development for each of these classifications.

Based on the above summary of the characteristics and trends of the issues, the direction to aim for as a smart city can be summarized as follows.

Classification at The Economic Level

- **Leading / Transforming:** Aiming to provide urban infrastructure and urban services to improve productivity and efficiency.
- **Transforming / Emerging:** Aim to provide all basic infrastructure services to all.

Classification by City Characteristics

- **Metropolises / regional cities:** Aiming to meet the diverse needs of various urban residents, from daily life to economic activities.
- **Regional cities / cities specializing in specific industries:** Aiming to meet individual needs from daily life to economic activities.

Based on the above, the following smart city directions were established according to urban classification.

Table 4-32 General Directions for Smart Cities According to City Classifications

	Classification by city characteristics	Metropolises / regional cities	Regional cities / cities specializing in specific industries
Classification at the economic level	Directions	Aim to meet the diverse needs of various urban residents, from daily life to economic activities.	Aim to meet individual needs, from daily life to economic activities.
Leading / Transforming	Aim to provide urban infrastructure and urban services to improve productivity and efficiency.	<u>Focus on self-reliance and development:</u> Promote voluntary efforts by businesses and citizens.	<u>Focus on vision pursuit:</u> Develop initiatives to achieve the vision of the city's future.
Transforming / Emerging	Aim to provide all basic infrastructure services to all.	<u>Focus on problem solving:</u> Promote initiatives effectively and efficiently solve urban issues.	<u>Focus on value creation:</u> Promote initiatives that effectively utilize the unique characteristics and resources of the region.

Source: JICA Study Team

Based on the above examination, the figure below shows more specific directions for each of the urban classifications: metropolises/representative cities, core regional cities, cities specializing in specific industries, and area development cities. It should be noted that these are only just rule of thumbs, and that the actual direction should be determined according to the individual circumstances of each city.

Suggestions on Direction of Smart City Development According to City Classification

Classification by economic scale

- 1 **LEADING GROUP**
- 2 **TRANSFORMING GROUP**
- 3 **EMERGING GROUP**

Classification by Character of Cities

A Metropolises and Representative Cities	B Core Regional Cities	C Cities specializing in specific industries
Leverage advantages of scale in population, economy, and assets	Provide appropriate technologies and services that match the characteristics of the city	Promote and strengthen the city's distinctive industries

- D Specific Area**
- Area Development**
- Present a new way of urban development
 - Embodiment of cutting-edge initiatives
 - Spreading beyond the area in the future

Self Sustaining Promote companies and citizens initiatives		Vision-Oriented Promote initiatives that is inline with the city vision	
<ul style="list-style-type: none"> • Promoting private business • Realization of efficient urban management 	<ul style="list-style-type: none"> • Encourage participation of local businesses and civic organizations • Achieve growth as a city with its own unique characteristics 	<ul style="list-style-type: none"> • Promote innovation and industrial development by fostering startups • Enhance productivity through DX 	
<ul style="list-style-type: none"> • Inclusively provide basic urban services to all citizens • Improve the efficiency of urban infrastructure 	<ul style="list-style-type: none"> • Appropriately utilize and manage limited resources and assets to improve the quality of life 	<ul style="list-style-type: none"> • Appropriately manage the burden on natural resources and the environment • Efficient development of industrial and living infrastructures 	
Problem-Oriented Solving urban issues effectively and efficiently		Value Creating Utilize unique regional characteristics and resources	

Source: JICA Study Team

Figure 4-80 Direction of Smart Cities According to Urban Classification

4-4. Interview-Based Study on ASEAN Cities

Interviews were conducted with local institutions in ASEAN countries to gather information on the status of smart city initiatives and issues. Below are the target institutions and the results of the interviews.

Table 4-33 Major Findings Through the Interview with Responsible Agencies

Country / Institution	Point
Thailand DEPA / (Thailand Smart City Office)	<ul style="list-style-type: none"> • [Vision/Policy] The policy is not technology-driven, but a smart city that places priority on the lives of its citizens. DEPA supports entities, both governmental and private, that are promoting smart city development. • [Organization] The Smart City Secretariat and Committee were established with the cross-sectional participation of relevant ministries and agencies, and they are used policy coordination and consensus building. • [System] Smart City Criteria are established, projects are reviewed and evaluated in light of these criteria, and tax incentives are granted to eligible projects to promote them. • [Issues] The local governments lack leadership and manpower in terms of capacity and are not agile and flexible enough to implement new technologies (due to the cumbersome administrative procedures in Thailand). • [Expectations for JICA] We expect not only surveys, but also assistance in social implementation of new technologies, and technical assistance for manpower shortage in local governments (not only in ASCN cities).
Laos DHUP	<ul style="list-style-type: none"> • [Vision/Policy] There is no strategy or policy specific to smart cities at the national level. MPWT's action plan calls for launching a smart city development program, but the contents are a blank slate. • [Organization] Several ministries are involved, including the Ministry of Foreign Affairs, the Ministry of Public Transport and Works, and the Ministry of Science, Technology and Communication, but no organization such as a Smart City Committee has yet been established. • [System] There are no policy institutions specific to smart cities. Since the banking sector is increasingly DX-oriented, it would be beneficial to exchange information with this sector. • [Issues] The data held by each ministry and agency is not shared. In addition, data acquisition methods and the data itself are not standardized, making sharing difficult. • [Expectations for JICA] It would be good to have something like a smart city guidebook. We hope that this tool will serve as a reference for governments and ministries in implementing NSEDPs and development plans, as it includes definitions of smart

Country / Institution	Point
	cities, implementation processes, funding methods, etc.
Laos LANIC	<ul style="list-style-type: none"> • [Vision/Policy] There is no strategy or policy specific to smart cities at the national level. Instead, they are encompassed in the National Digital Economy Development Plan. • [Organization] A task force will be formed in the future to implement the above Plan. There is no organization dedicated to smart cities, and the organization with jurisdiction will be DHUP of MPWT. ICT infrastructure is promoted by LANIC while ICT applications are promoted by the E-Government Center. • [System] There is a fund called the Digital Transformation Fund, which is mainly used to promote the development of ICT infrastructure in rural areas. • [Issues] Lack of funds and human resources to develop ICT infrastructure. Slow internet speed and high cost due to geographic factors are also issues faced by the country. • [Expectations for JICA] In addition to assistance in the development of ICT infrastructure, we would like JICA to introduce advanced Japanese case studies and share lessons learned from them.
Indonesia KOMINFO	<ul style="list-style-type: none"> • [Vision/ Policy] The Smart City Policy (“Movement Towards Smart Cities”) is positioned as part of self-sustaining development of urban and local governments in Indonesia. • [Organization] There is no organization dedicated to smart cities. At the national level, KOMINFO (Ministry of Communications and Technology) plays a central role in collaboration with related ministries and agencies. However, decentralization is underway, and project implementation is largely left to the initiative of each local government. • [System] Each municipality develops its own smart city plan, and KOMINFO provides advice and evaluation. In addition, there is a “Quick-Win Program” for short-term (one year) implementation of specific projects, which are in principle funded by each municipality, but if the project achieves results and is deemed eligible, financial support for scaling up is available from the Ministry of Finance. • [Issues] 1) Lack of leadership and awareness of issues, 2) Insufficient budget, 3) Lack of horizontal knowledge sharing between cities and local governments. • [Expectations for JICA] We hope that JICA's technical assistance will help us form a knowledge base. We believe that the Japanese invitation program is particularly useful in fostering awareness of the issues among leaders of each city and local government.
Philippines	<ul style="list-style-type: none"> • [Vision/Policy] There is no systematic strategy or vision for smart cities as a country, and it is encapsulated in the E-government

Country / Institution	Point
NEDA	<p>Plan 2022 and the e-commerce roadmap, an industrial policy.</p> <ul style="list-style-type: none"> • [Organization] DICT is the main coordinator for ICT-related policies, while NEDA is the main coordinator for industrial promotion and urban development. • [System] There is no policy system specific to smart cities, but tax incentives and government financial assistance are available in individual programs such as energy, mobility, etc. • [Issues] The citizens' trust in digital technology and the penetration of IT services are not very high. In addition, there are not many programming personnel or IT technicians (compared to other Asian countries). • [Expectations for JICA] In addition to assistance in formulating a master plan for smart cities, we hope to receive technical assistance that will promote DX in the Philippines.

Source: JICA Study Team

5. Smart City Approach for Developing Countries

Chapter 5 reviews the prerequisite conditions and implementing considerations for smart city initiative in the developing countries, basing its analysis on general overview of key socioeconomic, technological, organizational, and regulatory differences between the select developed and developing countries. Furthermore, potential approaches for promoting smart city initiative in the developing countries as well as the assessment sheet to guide toward the best development formula for the unique conditions of each country and city are presented.

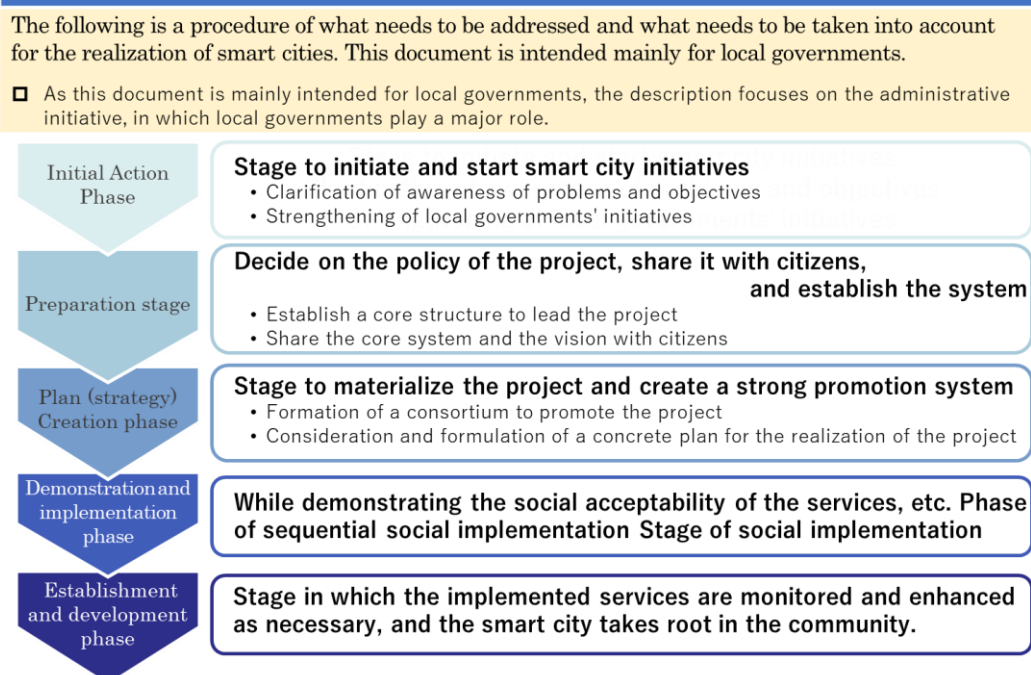
Furthermore, for the ASEAN countries and the region’s select cities, comparative overview of the current efforts related to smart city initiatives will be analyzed to yield a proposal for phased approach.

5-1. How to Proceed with Smart Cities (“Smart City Guidebook”)

In April 2021, Japan’s Cabinet Office, Ministry of Internal Affairs and Communications, Ministry of Economy, Trade and Industry, and Ministry of Land, Infrastructure, Transport and Tourism together prepared and released the “Smart City Guidebook”¹ to be used by local governments, regional councils, and area management organizations for implementing and operating smart city projects across Japan. For the purpose of offering clear conceptual and practical guidelines for the local governments, councils, and other organizations to initiate and to sustain a smart city initiative, the guidebook is configured firstly to summarize the significance and necessity of smart city approach, secondly to list the beneficial effects of introducing relevant schemes and technologies into the urban realm, and thirdly to show how to proceed with the planning and implementation of the actual project.

In this guidebook, the general process to lead the implementation of a smart city initiative is summarized into the five steps shown below in chronological order.

How to proceed with smart cities



Source: Cabinet Office “Smart City Guidebook”, translated and organized by JICA Study Team

Figure 5-1 “How to proceed with a smart city” in the Smart City Guidebook

¹ https://www8.cao.go.jp/cstp/society5_0/smartcity/index.html

In general, the approach described in the Smart City Guidebook can be applied to a certain extent in the developing countries' context when more suitable local approach has not yet been formulated. It is important, however, to always take a considerable look at the existing local approaches, if any, on which the target country or the city is already promoting smart city initiatives. The degree to which such local initiative has developed will vary in each country. For example, a conceptual policy for national initiative may have been established but may not yet be translated into concrete measures. It can also be that the master plans and concrete initiatives may have been established, but the implementation process has stalled due to financial, technological, or other issues. Thus, when promoting the smart city initiative in the developing countries, it is important to thoroughly examine what initiatives are being promoted, what is working and what is not, and what should be done to remove barriers and to make progress on the ongoing initiative. Such evaluation can be made by using the checklist of success factors that are derived from the best practices.

5-2. Characteristics of Cities in Developing Countries

In considering smart city approaches for the developing countries, it is helpful to incorporate the knowhow, the success factors, and the lessons learned from the early adopters in the developed countries, but always taking into account the key differences in the project environment between the former and the later. The following is a general summary of typical differences in the project environment between the developed and developing countries, derived from a brief survey of advanced case studies (Chapter 3) and those of developing countries (Chapter 4).

Table 5-1 Characteristics of Cities in Developing Countries (Differences from Developed Countries)

Item	Cities in Developed Countries	Cities in Developing Countries in Asia
Population and Economic Trajectory	<ul style="list-style-type: none"> Population growth is decelerating, and overall aging of population is in progress Slowed economic growth 	<ul style="list-style-type: none"> Continued inflow of population into cities by relatively younger age groups Accelerated economic growth
Infrastructure Asset Accumulation	<ul style="list-style-type: none"> Infrastructure supply has saturated and high-intensity infrastructure-building has slowed Maintenance of aging infrastructure stock has become a burden on city's finance Urban plots are spatially well-organized and zoned 	<ul style="list-style-type: none"> Infrastructure is underdeveloped and strong demand for further infrastructure-building exists Urban plots are spatially in disarray, with often undefined and informal boundaries and land uses
Architectural Heritage	<ul style="list-style-type: none"> Value is found in architectural heritage Well-built second-hand houses are reformed and resold 	<ul style="list-style-type: none"> "Scrap and build" approach Consumer orientation that favors the new over the old
Energy	<ul style="list-style-type: none"> Moving away from fossil fuel-based energy provision 	<ul style="list-style-type: none"> Cheap and conventional energy provision is pursued
Mobility	<ul style="list-style-type: none"> Urban public transportation is well developed and multimodal Connections between rail, bus, and other public transport modes are relatively seamless 	<ul style="list-style-type: none"> Urban public transportation is underdeveloped Dependence on private cars and motorcycles leads to chronic traffic congestion on roads
Community	<ul style="list-style-type: none"> Implementing community development as a system Developed citizenry with voluntary commitment to community management 	<ul style="list-style-type: none"> Large economic disparity within the city preventing community-building High-end housing and slums may be physically adjacent but communally segregated
Governance	<ul style="list-style-type: none"> Established democracy (trust between government and citizens) 	<ul style="list-style-type: none"> Top-down governance leads to weak citizen involvement Strong national control in

Item	Cities in Developed Countries	Cities in Developing Countries in Asia
	<ul style="list-style-type: none"> • Organizational and budgetary independence by local government • Cooperation between public and private sectors 	<ul style="list-style-type: none"> • local administration • Organizational and budgetary dependence on central government by local municipalities
ICT environment	<ul style="list-style-type: none"> • Transitioning from 4G to 5G • High-speed ICT infrastructure is in place • Cashless society 	<ul style="list-style-type: none"> • Lack of ICT infrastructure
Natural environment	<ul style="list-style-type: none"> • Artificial and managed urban greenery 	<ul style="list-style-type: none"> • Some greenery remains unmanaged
Digital literacy	<ul style="list-style-type: none"> • High level of digital literacy in the society, albeit with some generational gap 	<ul style="list-style-type: none"> • High degree of digital divide due to economic disparity and other factors
Initiatives for Smart Cities	<ul style="list-style-type: none"> • Smart city approach has shifted from technology-driven to human-oriented, where cities pursue sustainability and wellbeing of the citizens using ICT as one of the means • Active participation in urban development by residents, transitioning from business-led to community-led endeavor • Generous support from the EU • Carbon Neutral is aimed 	<ul style="list-style-type: none"> • Primarily technology-driven initiatives • Support from other countries through sale of technology and services • Urgent need to deal with immediate urban issues concerning safety, mobility, urban sanitation and environment

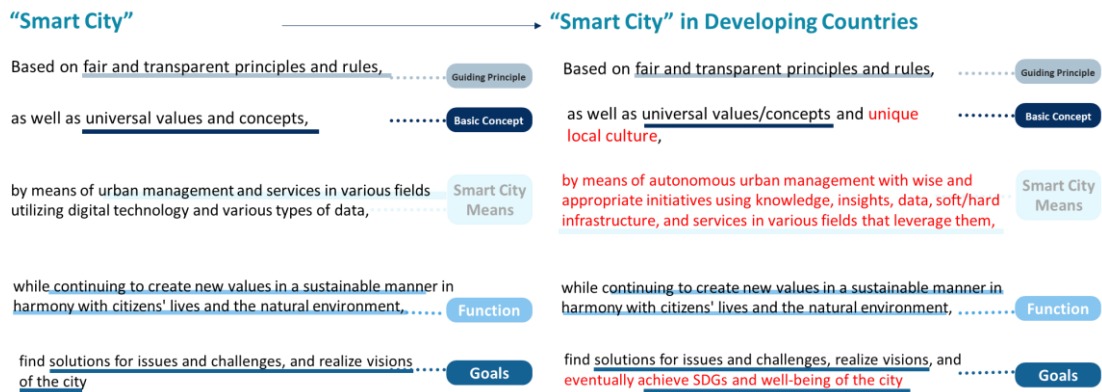
Source: JICA Study Team

5-3. What is to be a “Smart City” in Developing Countries?

Definition of a Smart City for Developing Countries

It is worth reiterating that smart city approach is not a revolutionary new type of urban-development, but to be regarded as an extension on the conventional urban planning toolbox, sharing the same basic principles and process with the traditional urban development practices. While the project environment in the developing countries is very different from those in the developed countries, what is shared between the former and the latter are the growing challenges with regards to the global environmental issues as well as the new opportunities to deploy an ever-powerful array of technological solutions and to incorporate advanced urban management and citizen engagement methodologies into the mix. Thus, the smart city approach should not be framed as simply ICT-focused or data-intensive urban management practices. Rather, the approach should encourage a broad perspective on formulating an approach that integrates the ICT infrastructures with urban services to allow high degree of citizen engagement and local autonomy in urban management.

In this context, the definition of a smart city as outlined in Chapter 2 (see left column below) is rearranged (as shown in the right column below), taking into account the context of developing countries.



Source: JICA Study Team

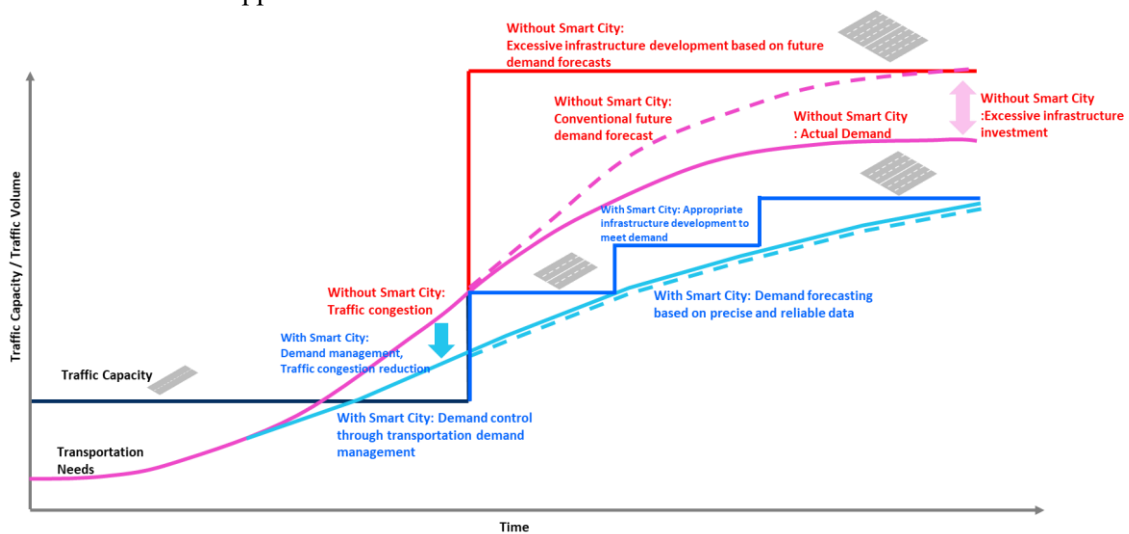
Figure 5-2 Smart City Definition (left) and Smart Cities in Developing Countries (right)

Concept and Image of a Smart City for Developing Countries

In the recent years, particularly in Japan and Europe, the need to scale back on the overbuilt infrastructure capacity to keep in steps with the shrinking demand and tax base has become pronounced, as evidenced by the public works projects to intentionally “down-size” the capacity of the existing infrastructures, such as by widening the pedestrian spaces within the existing roadway right-of-way (See Figure 5-3). In view of such general tendency toward intentional down-sizing, one of the many aims of the smart city approach here is to practice appropriately scaled and resource-efficient infrastructure planning in the developing countries, so as to avoid the build-for-maximum policy that has plagued the developed countries’ planning practice in their growing phase. The conventional practice in infrastructure planning has been to set the design capacity at the projected demand level in 20 years. This practice, however, has led to unnecessary investment and inefficiency that will likely never fulfill maximum capacity in its lifecycle, and this may also happen, if not already happening, in developing countries if the infrastructure planning practice is maintained in the same way.

A typical pattern of the relationship between the demand and supply balance on

infrastructure by time series could be illustrated in the figure below. First, there is a period of excess demand when infrastructure development cannot keep up with the pace of accelerated demand expansion during the city's growth period, and the excess demand puts pressure on the loading capacity of the existing stock. Then, when infrastructure investments are planned and implemented based on future demand forecast, there would be a period of surplus capacity in the existing infrastructure stock relative to actual demand. Such demand and supply balance ideally leads to a state of equilibrium in due time. However, during a period of rapid economic growth, such as the one experienced in Japan, there had been a pattern of excessive infrastructure investment based on demand forecasting using the build-for-maximum approach.



Source: JICA Study Team

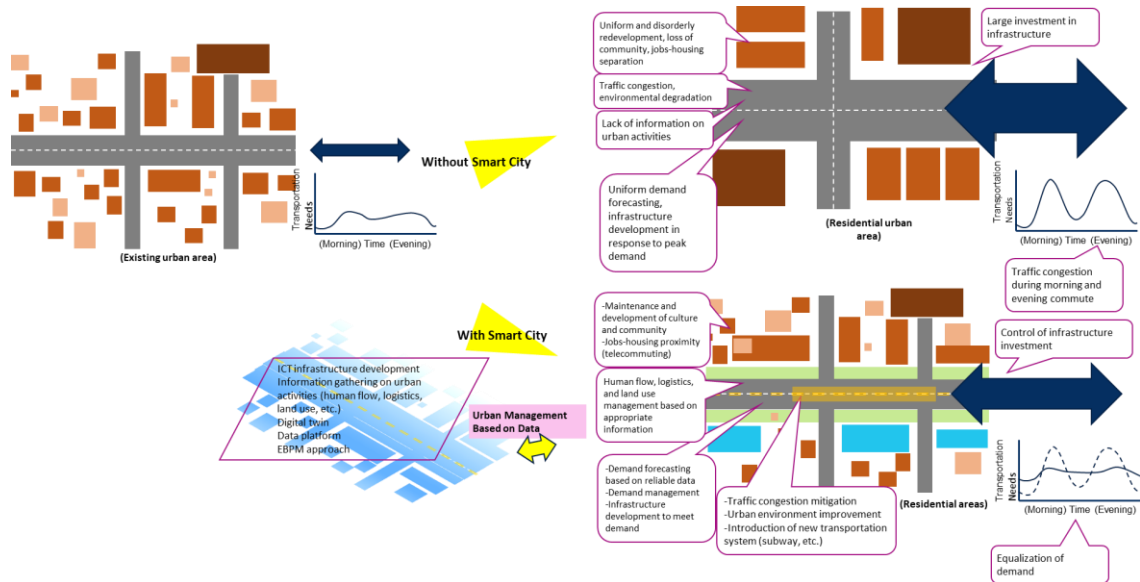
Figure 5-3 Concept of Smart City Planning

Predictably, when transitioning into an eventual contraction period, such excess infrastructure capacity would become increasingly underused, turning into heavy burdens on the environment and the public finance. In Japan, the development of inter-regional road networks is a typical example of such over-building practice in the past. As the use of private cars increased during the period of rapid economic growth from the 1950s to the 1970s, huge public investments were made as per political pressure to correct regional economic disparities, and the network of expressways and large bridges were built to every corner of the country without reaching the level of demand peaks expected in the planning. Today, the cost of maintaining such redundant infrastructures puts severe pressure on the finances of the contracting national and local governments.

In the developing countries today, there are new opportunities to introduce various data-gathering ICT systems ahead of heavy investments in the infrastructure. The datasets collected via such means will be used to formulate and to implement the infrastructure development planning in a manner consistent with the EBPM (Evidence Based Policy Making) principle, increasing the accuracy and timeliness of the public investment planning and implementation. In such a smart city approach, a highly accurate demand forecasting will be possible through the accumulation and analysis of a wide range and large quantity of actual datasets, enabling infrastructure investment to be sized for appropriate scale and be placed in the right place at the right time in a way that is consistent with the growth pattern

and distribution of the actual demand. In addition, such use of sensors also enables efficient asset utilization through the use of location data to analyze the overall demand and to manage the distribution of supply and distribution.

An image of the system is shown below.



Source: JICA Study Team

Figure 5-4 Concept of Smart City Development

The above description focuses on the efficiency benefits of urban development and urban management based on data and evidence, but it is worth noting that smart cities should not be oriented solely toward cost reduction, nor should they excessively pursue rationality through the use of data and other means. It is also important to ensure redundancy in anticipation of uncertainties in various factors, including population trends and economic conditions, and to take a more relaxed planning approach.

5-4. Smart City Approaches for Developing Countries

As mentioned above, the Cabinet Office's "Smart City Guidebook" provides general information on how to proceed with smart cities and shows the chronological steps to be taken when promoting smart city initiatives from scratch. However, in developing countries, smart city initiatives vary from country to country and city to city, and smart city initiatives have not yet been comprehensively established and are not yet in smooth operation.

In addition, developing countries have numerous issues unique to them, and it is necessary to consider approaches that consider the "individuality" of each country and city.

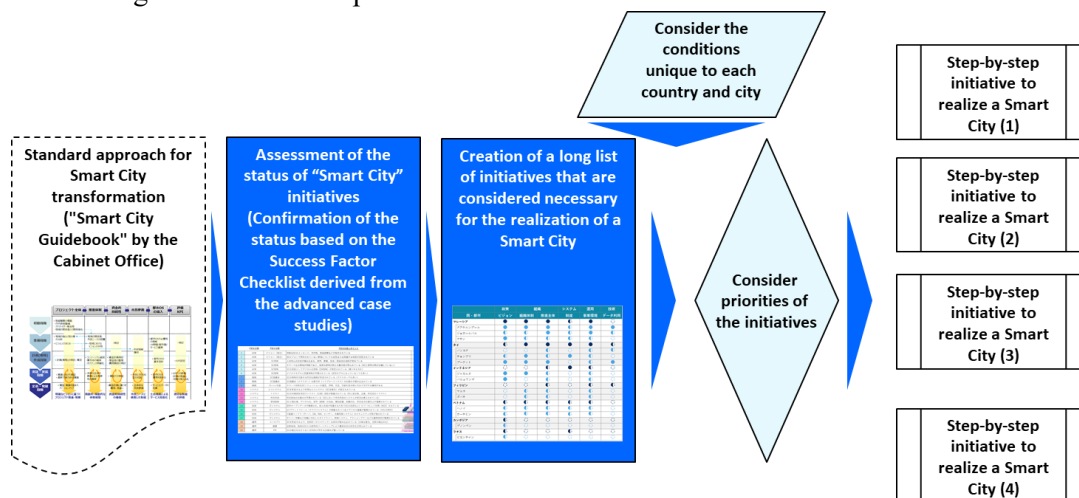
In light of the above, while keeping in mind the general approach to smart cities in developing countries, the first approach is to diagnose the current status of efforts in developing countries and cities based on success factors derived from case studies of advanced smart cities, utilize the strengths and overcome the weaknesses of each developing country and city, and show the path and shortest route to the realization of a smart city.

The above diagnosis will help each country and city to identify the initiatives necessary for the realization of a smart city. Depending on the target country or city, the necessary initiatives may be identified at this stage, but it is also possible that the necessary initiatives will be organized in a haphazard manner.

For those items that are identified as necessary, prioritization of initiatives should be examined based on the unique conditions of each country or city (e.g., urban issues that are considered important in each country or city, culture, acceptability, etc.).

As a result, depending on the status of efforts and priorities of each country and city, multiple stepwise measures are derived.

A diagram of the above process is shown below.



Source: JICA Study Team

Figure 5-5 Procedure for Considering Smart Cities in Developing Countries

5-4-1 Diagnosis of the Status of "Smart City" Initiatives

To diagnose the status of "smart city" initiatives, a checklist of success factors organized along five domains consisting of 21 elements that are derived from the analysis of case studies of early adopter cities will be used to diagnose each country and city. The checklist is shown below.

Table 5-2 Checklist for Diagnosing the Status of Initiatives For “Smart Cities” (replicated from Chapter 3: Smart City Framework)

	No	Theme	Points
Policy	1	Establishing concepts and vision	Aligned with national strategy and urban planning, positioned as an approach to creating new value in cities, improving the well-being of citizens, and achieving sustainable urban development.
	2	Comprehensiveness of vision and policy	The vision is positioned as a comprehensive approach, and it includes the possibility of spreading to various areas and creating new value.
	3	Specifics of vision and policy	A clear message, purpose, direction, and measurable targets for Smart City are presented.
	4	Policy Alignment	The target domain of Smart City is clear and consistent with existing urban planning and DX strategies (SC and urban planning/DX strategies are not separated)
	5	Sustainability of vision and policy	Business cases, investment strategies are considered, and business models are (at least partially) in place.
Organization	6	Sharing and PR of visions and concepts	Each entity involved shares the concept, vision, and values of Smart City, and promotional activities is conducted for citizens.
	7	Promotion Body	A competent organization or organizational structure is in place to take on a leading and pivotal role in the implementation of Smart City strategies and policies.
	8	Collaboration among public, Private, citizens, academia	A triple-helix (or quadruple-helix with the private sector) system of industry, government, and academia is incorporated into the Smart City ecosystem.
	9	Organizational effectiveness and capacity	There is an internal or an external organization that functions to steer the technical side of Smart City initiative, able to draft specification; manage selection, demonstration, implementation; and evaluation of smart technologies and solutions.
System	10	Building Ecosystems	An effective, functional, and sustainable ecosystem has been formed to promote Smart City.
	11	Creating a Trust	Trust has been built among stakeholders (government, businesses, and citizens) in the formation of Smart City, especially in urban management process of planning, implementing, and operating the city to promote Smart City.
	12	Setting of laws, regulations, and systems	Norms regarding legal and administrative processes, etc. necessary for Smart City have been clearly defined, and incentive mechanisms and facilities for promotion are in place.
	13	Participation and co-creation with Citizens	A system for citizen participation is in place (a system for citizen co-creation is being considered or implemented for Smart City).
	14	Cross-disciplinary	Smart City is linked to decarbonization, digitalization, urban (industrial) development, environmental consideration, crisis response, and improvement of the quality of life of citizens.
Technology	15	Urban infrastructure and ICT platform	ICT platform (City Operating System) that connects the infrastructure for the Smart City solutions and data collaboration is established or being planned (either partially or at full scale).
	16	Data utilization	Urban open data has been organized and is being used (or considered) as big data for Smart City, while also sufficiently accounting for data privacy.
	17	Ensuring Cyber Security	ICT infrastructure (servers, DBs, NWS, sensors, various control systems) is secured from cyber attacks and contingencies.
	18	Social system design and implementation	In the construction of Smart City, the aspect of social design has been introduced, and the selection and implementation of smart technologies and solutions have been optimized.
Operation	19	Ensuring flexibility in the implementation	A system that can flexibly modify and respond to changes in the political situation, social environment, and technological trends, as well as to the diverse needs of citizens, is incorporated.
	20	Strengthen collaboration and partnerships	Inter-city partnerships with neighboring regions and other countries to share the latest knowledge is established.
	21	Ensuring sustainability	A mechanism for making medium- to long-term commitments to Smart Cities is established.

Source: JICA Study Team

5-4-2 Results of Preliminary Diagnosis in ASEAN Countries and Cities

Based on the above analysis, the following is an attempt to conduct a preliminary diagnosis of the status of smart cities in the ASEAN countries and cities explained in the previous section.

(1) Malaysia

Table 5-3 Malaysia: Smart City Readiness Status in the Country and Major Cities

	Country/Region	Malaysia			
			Johor Bahru	Kuala Lumpur	Kota Kinabalu / Kuching
Evaluation Criteria	Policy and Vision	There is no specific strategy for smart cities, but the National Growth Plan mentions that efforts will be made.	There is a strategy for Smart City Iskandar Malaysia and specific numerical targets have been set.	Kuala Lumpur is developing the 2020 Kuala Lumpur Smart City Plan.	Through the ASCN framework, visions, action plans, etc. are defined.
	Organizational structure and promotion body	Ministry of Housing and Local Government (KPKT) is taking the lead in coordination and PR.	It is a government initiative led by the City of Johor Bahru and the Iskandar Regional Development Authority.	The City of Kuala Lumpur is the center. Data utilization is promoted by MDEC.	Kota Kinabalu City / Kuching City
	System	The Malaysia Smart City Framework (MSCF) has been established.	It is being promoted within the Malaysian Smart City Framework (MSCF).	It is being promoted within the Malaysian Smart City Framework (MSCF).	It is being promoted within the Malaysian Smart City Framework (MSCF).
	Technology	Promoting initiatives in the areas of economy, livelihood, environment, human resource development and empowerment, governance, mobility, and digital infrastructure.	Promoting initiatives in six areas: Economy, Mobility, Environment, Government, People, and Living, and seeking partners and investors.	Promoting the use of urban open data, such as the Malaysia City Brain Project	In Kota Kinabalu, water distribution monitoring technology, BRT system, and final waste disposal site development. In Kuching, ITS-based traffic signal system, etc.
	Operation	Many projects are still in the conceptual and planning stages. In addition, there are some projects that are in partial progress, but they have not become comprehensive efforts.	Formed a forum called the Futuristic Iskandar Malaysia Advisory Council to promote knowledge sharing.	Many businesses are in the conceptual / planning stage. It is an individual technical initiative.	Many businesses are in the conceptual / planning stage. It is an individual technical initiative.

Overall Comment	In Malaysia, the Smart City Framework is functioning as a guideline for initiatives. A large-scale development project is also underway in Iskandar, and it is expected to proceed autonomously once the business environment, including business partners, finance, and technology, is in place.
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Source: JICA Study Team

(2) Thailand

Table 5-4 Thailand: Smart City Readiness Status in the Country and Major Cities

	Country/Region	Thailand			
			Bangkok	Phuket	Chonburi
Evaluation criteria	Policy and Vision	Thailand 4.0, the national high-level strategy, stipulates the promotion of smart city initiatives.	There is no strategy for the Bangkok Metropolitan Administration, but each district or developer has its own vision and plan.	In Phuket City, a Smart City Development Plan is being developed by the city and DEPA.	There is no strategy for Chonburi Province, but it is being promoted within the EEC development strategy.
	Organizational structure and promotion body	The Smart City Committee and Smart City Office have been established as cross-ministry organizations.	An organization is formed for each project unit. (e.g., Bang Sue district is a consultative body centered on OTP and SRT)	While DEPA and the city are waving the flag, they are attracting local and global companies.	An organization is formed for each business unit.
	System	There is a system to establish Smart City Criteria, to examine and evaluate the initiatives, and to grant benefits to qualified projects.	Efforts are being made in line with the criteria set by the government.	Efforts are being made in line with the criteria set by the government.	In addition to the criteria set by the government, there are other mechanisms such as benefits, and deregulation based on the EEC special zone system.
	Technology	In the seven areas defined by the Smart City Criteria, each city and each business is promoting the initiatives.	The needs of each district and the solutions of each business are being developed according to the criteria set by the government.	In addition to the seven areas specified in the criteria, the organization is promoting the development of open data and data platforms.	Taking advantage of the characteristics of an industrial area, energy-related businesses such as waste heat recovery and smart grids are being promoted.
	Operation	Several cities have been recognized as Smart City Promotion Cities, but none have been fully implemented.	In many cases, the project is carried out as a development project. It is an individual technical approach.	A variety of digital services for tourists are being demonstrated in the city.	Many of them are individual technical efforts in each industrial park.

Overall Comment	In Thailand, smart city initiatives are being actively promoted in order to solve the problems of local cities and revitalize the economy. At present, planning, conceptualization, and demonstration projects are underway in various cities based on the Smart City Criteria, and the formation of successful models will be important in accelerating and further expanding these initiatives as they are fully implemented and operated in the future.
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Source: JICA Study Team

(3) Indonesia

Table 5-5 Indonesia: Smart City Readiness Status in the Country and Major Cities

	Country/Region	Indonesia			
			Jakarta	Makassar	Banyuwangi
Evaluation criteria	Policy and Vision	The Ministry of Communications and Information is implementing the Movement Towards Smart Cities program as part of its smart city policy.	The Jakarta Smart City project is being undertaken by the Jakarta Provincial Government's Department of Information and Communication as part of the Jakarta City 4.0 initiative.	The Makassar Smart City Program is being implemented under the vision of a Smart and Sombre city.	In the Banyuwangi Smart Kampung, the goal is to reduce poverty and improve education and welfare services through smarter government services.
	Organizational structure and promotion body	It is led by the Ministry of Communications and Information and works with seven related ministries, including the Ministry of Finance, the National Development Planning Agency, and other multiple ministries.	The Jakarta Provincial Government's Department of Information and Communication is taking the lead in this project.	The Makassar Government Communications and Information Agency is the main player.	The Banyuwangi Provincial Department of Communications and Information is the lead agency.
	System	The government will dispatch experts and provide budgetary support for the implementation of the master plans for smart cities in each city.	Six indicators have been established, and services related to these indicators are being developed in collaboration with the private sector as appropriate.	A system specific to smart cities has not been established.	SWOT analysis is conducted in six areas, and projects are established for each strategy, with roadmaps for the short, medium, and long term.
	Technology	Efforts are being promoted in each city and by each business.	Through the Jakarta smart city portal, Jaki (application), residents can access the services provided by "Jakarta Smart City".	Three missions, five elements, and three drivers are provided.	The main objective of using smart technology for administrative services is to spread services to residents throughout the prefecture.
	Operation	There are no restrictions on a national basis, and the direction of smart city development is left up to	It is characterized by the fact that the information gathered through resident participation is analyzed by	The Makassar Livable City Plan is being planned as a framework to integrate strategies for smart	In addition to the administrative services that the Department of Communications and

		each city.	the Data Analysis Department and utilized as data-driven for future policy and application development.	and sustainable development.	Information is working on, the Department of Tourism and the Department of Small and Medium Enterprises are also working on the implementation of smart technologies in other areas.
Overall Comment	In Indonesia, the central government is actively promoting the transformation of each city into a smart city, mainly through the Movement Towards Smart Cities program. In line with this, each city is promoting smart city development by setting up a vision for each issue. On the other hand, each city is working in its own field, and although there are efforts to share knowledge among cities, the sharing of knowledge is insufficient.				

Source: JICA Study Team

(4) Philippines

Table 5-6 Philippines: Smart City Readiness Status in the Country and Major Cities

	Country/Region	Philippines			
		Manila	Cebu	Davao	
Evaluation criteria	Policy and vision	There is no national level policy or development plan for Smart City. As the topic of Smart City is relevant to many ministries, each ministry has several master plans that may be relevant.	There is a roadmap for the development of transportation infrastructure as Metro Manila, adopting the principles of Smart City, including perspectives on urban mobility, natural environment, sustainability, etc.	Conducted a roadmap study on Metro Cebu's vision for 2050 and urban development toward that vision, with a roadmap that may be relevant to Smart City.	The Metro Davao Sustainable City Master Plan will be developed based on the infrastructure development plan.
	Organizational structure and promotion agency	No special organization has been formed. The driving force for each project is different. (Private sector, local government, government agency, etc.)	The Metropolitan Manila Development Authority formulates a development plan consistent with the country's development goals and priorities. Based on this plan, individual projects are divided among LGUs, NGOs, and businesses.	Each project has a different lead organization. It may take the form of a national agency initiative, Metro Cebu Development Coordination Committee initiative, or private sector collaboration.	The Metro-Davao Development Coordinating Committee is expected to become the Metro-Davao Development Authority and will lead the development.
	System	No national ecosystem has been established. It is only project-based.	It is being built and promoted on a project basis.	It is being built and promoted on a project basis.	This will be done on a project basis.
	Technology	An open data portal is available to the public. The security of the IT infrastructure is fragile compared to other countries and needs to be strengthened.	It is being built and promoted on a project basis.	It is being built and promoted on a project basis.	This will be done on a project basis.
	Operation	Many of the projects are in the development and demonstration stages, and consideration of	This is being considered on a project basis.	This is being considered on a project basis.	This will be done on a project basis.

		sustainability and PR is still in the future.			
Overall Comment	There is no integrated policy or organization at the national level, and efforts are being made on a project basis at the municipal level. Large-scale local governments that have infrastructure development roadmaps need to coordinate their overall plans with individual projects and create an ecosystem for project promotion. It is important to create a successful model and expand it horizontally with the support of the government.				

Source: JICA Study Team

(5) Vietnam

Table 5-7 Vietnam: Smart City Readiness Status in the Country and Major Cities

	Country/Region	Vietnam			
			Ho Chi Minh	Hanoi	Da Nang
Evaluation criteria	Policy and vision	As a decision of the Prime Minister, the national policy for smart city development until 2030 has already been promulgated, which shows the vision, basic policy, and major measures for smart city development.	Plans and roadmaps for the conversion to smart cities are being developed.	Plans and roadmaps for the conversion to smart cities are being developed.	Plans and roadmaps for the conversion to smart cities are being developed.
	Organizational structure and promotion agency	The Ministry of Construction and the Ministry of Information and Communication will take the lead in developing laws and regulations, formulating policies, and implementing master plans and projects in each region.	There is no specific promotion system for smart cities, but the Information and Communication Bureau will take the lead in promoting digital government-related measures for the above.	There is no specific promotion system for smart cities, but the Information and Communication Bureau will take the lead in promoting digital government-related measures for the above.	There is no specific promotion system for smart cities. With the support of other countries and the private sector, the Information and Communication Bureau and others are promoting individual initiatives.
	System	Currently, there is no actual system, ecosystem formation, or capital investment specific to smart cities.	There is no actual system or ecosystem formation, capital investment, etc. specific to smart cities.	There is no actual system or ecosystem formation, capital investment, etc. specific to smart cities.	There is no actual system or ecosystem formation, capital investment, etc. specific to smart cities.
	Technology	The Ministry of Information and Communication has developed an ICT reference framework for smart cities and has established evaluation indicators for smart cities.	The implementation of individual elemental technologies such as data warehouses, open data portals, and smart city centers is progressing.	The implementation of individual elemental technologies such as online administrative services, digital traffic maps, and health management systems is progressing.	Demonstrations of individual elemental technologies, such as the introduction of digital government and the development of digital maps, are in progress.

	Operation	There is no concrete operational status regarding the smart city policy mentioned above.	This is being considered on a project basis.	This is being considered on a project basis.	This is being considered on a project basis.
Overall Comment		Although plans and roadmaps for smart cities have already been formulated as part of national and regional policies, there are weaknesses in the specific organizational structure and promotion system to realize the plans. The current focus is on the introduction of digital government by the information and communication sector and demonstration and implementation projects of individual technologies, and the overall picture of the formation of smart cities is not clear.			

Source: JICA Study Team

(6) Lao PDR

Table 5-8 Lao PDR: Smart City Readiness Status in the Country and Major Cities

	Country/Region	Lao PDR		
		Vientiane	Luang Prabang	
Evaluation Criteria	Policy and vision	Although there is no specific strategy for smart cities, the promotion of smart city development is a priority project for achieving the plan in the 9th National Socio-Economic Development Plan.	Through the ASCN framework, visions, action plans, etc. for Smart City have been defined, and a master plan for smart cities is being formulated with support from Japan in 2021.	Through the ASCN framework, visions, action plans, etc. for Smart City have been defined, and a master plan for smart cities is being formulated with support from Japan in 2021.
	Organizational structure and promotion agency	Although there is no organization dedicated to smart cities, The Department of Housing and Urban Planning of the Ministry of Public Works and Transportation are in charge of urban planning that incorporates smart cities, while the Ministry of Technology and Communications and its subordinate organization, the E-Government Center, are promoting ICT.	Vientiane Capital is taking the lead in developing a special economic zone with smart technology and developing a master plan for a smart city.	Luang Prabang City is taking the lead in developing a master plan for a smart city.
	System	It seems that the Digital Economy Development Plan approved in November 2021 and it sets guidelines and standards for smart city development, but the details are unclear.	There are no standards or legal systems specific to smart cities.	There are no standards or legal systems specific to smart cities.
	Technology	In the 9th National Socio-Economic Development Plan, it is stated that digitalization of financial, administrative and other sectors will be promoted.	In the action plan set forth in the ASCN framework, education, public health, transportation, housing, and safety are identified as focus areas.	In the action plan set forth in the ASCN framework, waste and wastewater management, sidewalks and street lighting, and conservation of heritage areas are identified as focus areas.
	Operation	Smart city development by private companies and e-government initiatives by the Lao	The private sector is developing smart cities, but they are still in the planning and conceptual	Projects on smart e-governance by the private sector are underway, but they have

		government are underway, but they are not comprehensive initiatives.	stages, and none are at the implementation stage.	not yet become comprehensive initiatives for smart cities.
Overall Comment	<p>The term “smart city” is not yet widely used in the country, and smart cities are being discussed in the context of digitalization and ICT promotion. First of all, it is necessary to formulate a vision and policies on how to position smart cities as an extension of digitalization. It is also necessary to strengthen the ICT infrastructure, which is the foundation for the realization of smart cities. Since state-led smart cities take time, it is expected that the development of smart cities led by the private sector will be promoted first, and by creating a successful model, state-led efforts will be accelerated.</p>			

Source: JICA Study Team

(7) Cambodia

Table 5-9 Cambodia: Smart City Readiness Status in the Country and Major Cities

	Country/Region	Cambodia			
			Phnom Penh	Siem Reap	Battambang
Evaluation Criteria	Policy and Vision	Although there is a long-term vision called the Digital Economy and Society Policy Framework, there is no strategy specific to smart cities.	There is no strategy specific to smart cities.	There is no strategy specific to smart cities.	There is no strategy specific to smart cities.
	Organizational structure and promotion body	The Smart City Coordinating Committee was established in February 2021 as a promotion body, but it is unclear to what extent it will be viable and capable.	There is no specific promotion body for smart cities. Each individual project is under the jurisdiction of its own organization.	Smart City Committee to be established in 2019. The committee will be responsible for developing and reviewing work plans for the implementation of smart city projects.	There is no entity dedicated to the promotion of smart cities.
	System	Policies and systems to promote smart cities are not yet in place, but the Digital Economy and Society Policy Framework aims to build an ecosystem to improve economic efficiency through the digital economy. There are also incentives for investment in high-tech industries.	No system specific to smart cities has been established.	A system specific to smart cities has not been established.	A system specific to smart cities has not been established.
	Technology	In each city, initiatives can be seen in areas such as waste treatment, wastewater treatment, traffic management, and tourism, but there are no examples of implementation of data utilization and ensuring digital security on a national level.	Efforts are being made in the areas of traffic control systems, AI-based traffic analysis, and electronic currency.	Efforts are being made in the areas of wastewater treatment, waste management, integrated data systems, safety measures (CCTV), and tourist management systems.	Efforts are being made in the areas of waste treatment, wastewater systems, and sewage treatment.
	Operation	There are many individual technical approaches, but there is no established project as a cross-sectoral Smart City yet.	There are many individual technical approaches.	Implemented projects such as smart tourism.	There are many individual technical approaches.

Overall Comment	Although policies and systems specific to smart cities have not yet been established in Cambodia, there are indications that the country intends to actively promote Smart City, including the establishment of the Smart City Coordinating Committee, which will serve as the driving force. However, at this point, each city is only working on individual technical projects and initiatives, and it will take some time before large-scale smart city development can be implemented.
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Source: JICA Study Team

(8) Summary of the readiness of ASEAN countries and cities for smart cities

The following table schematically shows the results of the above evaluation of the readiness status of ASEAN countries and cities.

Table 5-10 Readiness Status of ASEAN And Major Cities to Become Smart Cities

●: Prepared ◐: Partially ○: Not prepared

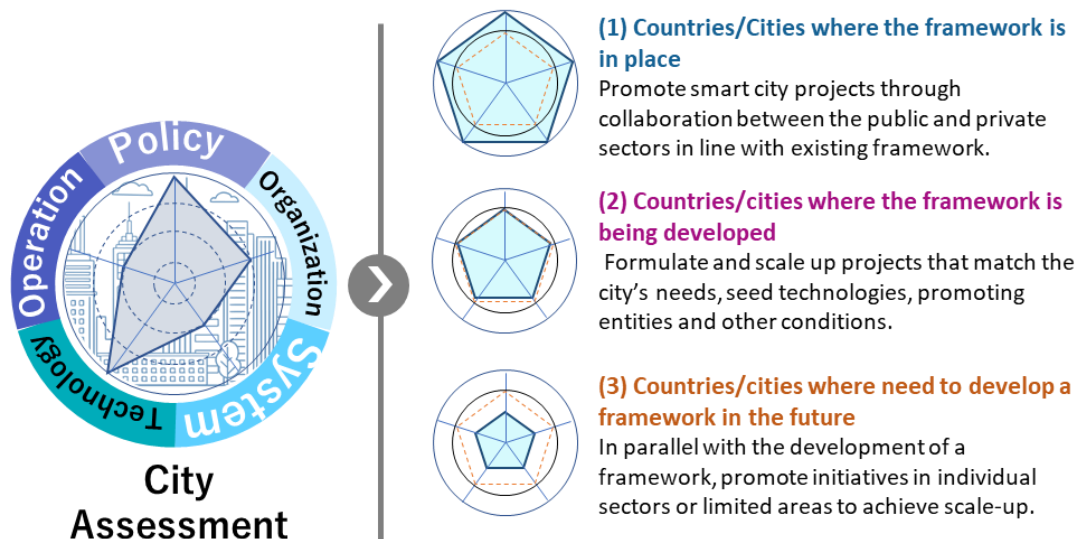
Country and City	Policy and Vision	Organization	System	Technology	Operation
Malaysia	●	◐	●	◐	●
Johor Bahru	●	●	●	◐	●
Kuala Lumpur	◐	◐	◐	◐	◐
Kota Kinabalu	●	◐	◐	◐	○
Kuching	●	◐	◐	◐	○
Thailand	●	●	●	◐	◐
Bangkok	○	◐	◐	◐	○
Phuket	●	●	◐	◐	◐
Chonburi	◐	◐	●	◐	◐
Indonesia	●	◐	●	◐	◐
Jakarta	◐	●	○	◐	◐
Makassar	◐	◐	◐	◐	○
Banyuwangi	◐	◐	◐	◐	○
Philippines	○	◐	○	◐	◐
Manila	○	◐	○	◐	○
Cebu	○	◐	○	◐	○
Davao	○	◐	○	◐	○
Vietnam	◐	◐	○	◐	○
Hanoi	◐	○	○	◐	○
Ho Chi Minh	◐	○	○	◐	○
Da Nang	◐	○	○	◐	○
Lao PDR	◐	◐	○	◐	○
Vientiane	◐	◐	○	◐	○
Luang Prabang	◐	◐	○	◐	○
Cambodia	◐	◐	○	◐	○
Phnom Penh	◐	○	○	◐	○
Siem Reap	◐	◐	○	◐	◐
Battambang	○	○	○	◐	○

Source: JICA Study Team

5-4-3 Consideration of Phased Approach

As mentioned in the section on smart city early adopter's cases in Chapter 3, an overview of the process of smart city initiatives in Europe and other leading cities shows that, roughly speaking, policies and organizations have been formed over a period of about 15 to 20 years since the 2000s based on various social implementation experiences and other factors. In other words, when ASEAN cities promote smart city initiatives, they should not aim for a cutting-edge smart city in a single step, but rather take a medium- to long-term perspective based on the readiness (in terms of policy, organization, system, technology, and operation) of the country or city, and develop and implement a smart city framework as necessary. In terms of the smart city framework, it is not necessary to establish a new policy system or organization dedicated to smart cities. Instead, incorporating them to existing policy systems or making good use of existing organizational structures and frameworks could also be useful.

In promoting smart city development in each country and in each city, we propose a readiness assessment and a phased approach, divided into three patterns depending on the status, as shown in the figure below.



Source: JICA Study Team

Figure 5-6 Approaches Based on Smart City Readiness

Based on the status of efforts in smart cities in each country and city, the following three patterns of phased approaches are generally presented.

(1) Countries/ cities where framework is in place

Image of Smart City Diagnosis Results

- Policies and organizations at the national level are in place to some extent, and efforts are being made in each city (municipality) based on the framework established at the national level.
- By city, some cities (mainly large cities) are moving ahead, while others (mainly regional cities) are moving forward with smart city initiatives.

Table 5-11 Diagnosis Results: Countries/ Cities where Framework is in Place

Evaluation criteria	Diagnostic results of initiatives at national level	Diagnostic results of initiatives at city level
Policy	●	●/○
Organization	●	●/○
System	●/○	●/○
Technology	●/○	●/○
Operation	●/○	●/○

Source: JICA Study Team

Guidelines for Approaches and Initiatives

- The goal is to further accelerate smart city initiatives and form a successful model through demonstration experiments, etc., in line with the vision and policy system of the country/ city, with a view to expanding to regional cities.
- In addition, a platform for sharing knowledge and technologies will be formed in order to efficiently develop smart cities in the countries and cities concerned.
- Aim for a comprehensive smart city through cross-sectoral and cross-organizational efforts.
- Aim for a self-sustaining and self-developing smart city by promoting voluntary efforts by the private sector, research institutions, and citizen groups (e.g., formation of institutional frameworks and eco-systems).

Main target countries:

Malaysia, Thailand, Indonesia

(2) Countries / cities where framework is being developed

Image of smart city diagnosis results

- Policies and organizations have been developed at the national level to a certain extent, but they have not yet been implemented practically or are only partially implemented.
- Based on the framework established at the national level, efforts are being made in each city (municipality) on a pilot basis.
- Smart city initiatives are underway in major cities, but awareness of these initiatives has yet to be fostered in regional cities.

Table 5-12 Diagnosis Results: Countries/ Cities where Framework is being Developed

Evaluation criteria	Diagnostic results of initiatives at national level	Diagnostic results of initiatives at city level
Policy	●/○	●/○
Organization	●/○	●/○
System	●/○	●/○
Technology	●/○	●/○
Operation	●/○	●/○

Source: JICA Study Team

Guidelines for Approaches and Efforts

- Establish a framework (system) for promoting smart city development and an

organizational structure for cross-organizational and cross-disciplinary collaboration.

- Enhance the functionality of the above-mentioned mechanisms and organizational structures while promoting verification experiments of smart technologies and services.
- Focus on certain sectors and areas, such as high priority sectors and cities, while scaling up.

Main target countries:

Philippines, Vietnam

(3) Countries/ cities where need to develop a framework in the future

Image of Smart City Diagnosis Results

- Policies and organizations at the national level have not yet been established and are under consideration or are planned to be considered in the future.
- Projects that call for smart cities are being promoted by local governments or specific areas (led by private companies) in advance.
- Major cities and regional cities have yet to develop awareness of the need for such initiatives.

Table 5-13 Diagnosis Result: Countries/ cities where need to develop a framework in the future

Evaluation criteria	Diagnostic results of initiatives at national level	Diagnostic results of initiatives at city level
Policy	●/○	●/○
Organization	○	●/○
System	○	●/○
Technology	○	●/○
Operation	○	●/○

Source: JICA Study Team

Guideline for Approaches and Efforts

- In addition to starting with the utilization of ICT infrastructure and digital transformation, which are the prerequisites for smart cities, efforts will be made to create a vision and concept that defines the objectives and plans for initiatives to become a smart city.
- It is also effective to establish a foothold in a smart city by building on successful experiences (small start and quick win) in high-priority measures and service areas with high needs, while utilizing existing technologies and assets, and starting from where can be tackled.

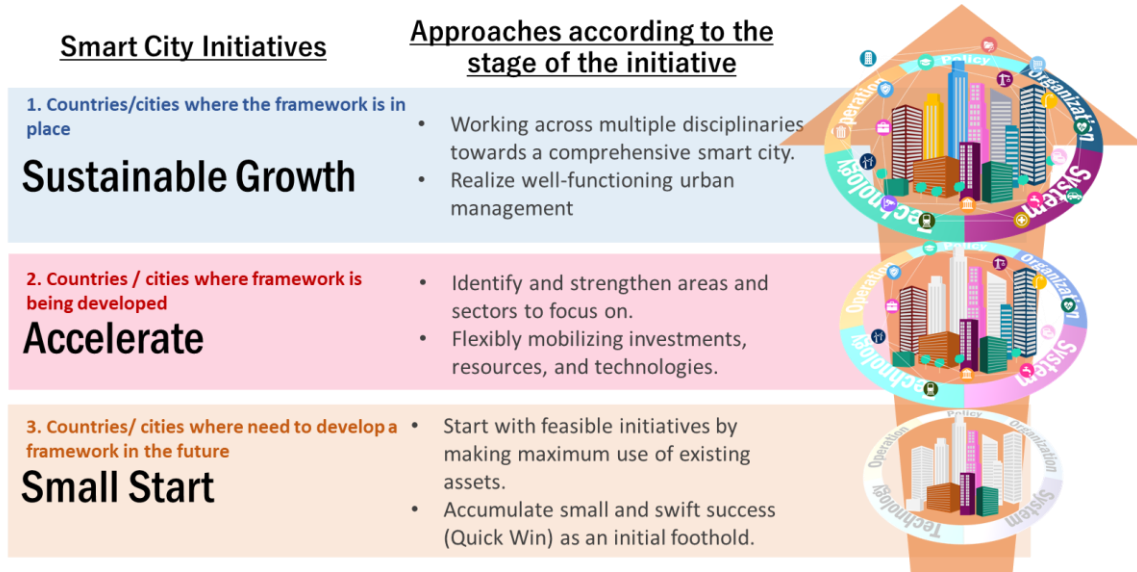
Main target countries:

Laos, Cambodia

(4) Overall concept of a phased approach

The following diagram schematically illustrates the concept of the step-by-step approach and directions described above.

It is important to assess the status of smart city initiatives and readiness in line with the five smart city elements: “Policy,” “Organization,” “System,” “Technology,” and “Operation”, and then to consider appropriate initiatives. In this process, it is effective to strengthen the smart city elements step by step while implementing specific smart city projects.

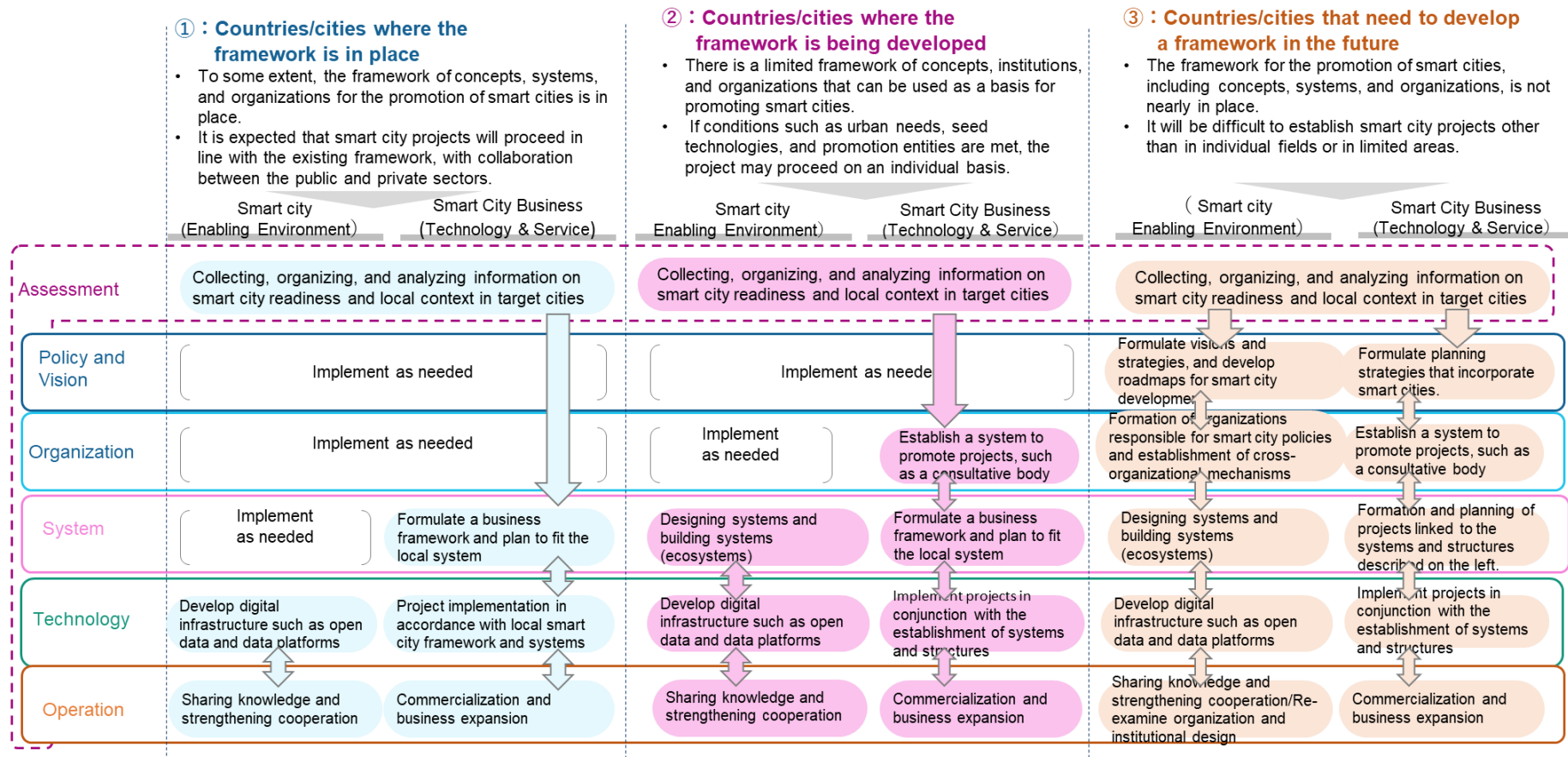


Source: JICA Study Team

Figure 5-7 Concept of approaches for smart cities by readiness

(5) Image of a Phased Approach

The figure below shows the approaches and guidelines described above, organized by the readiness status of the country or region for smart cities.



Source: JICA Study Team

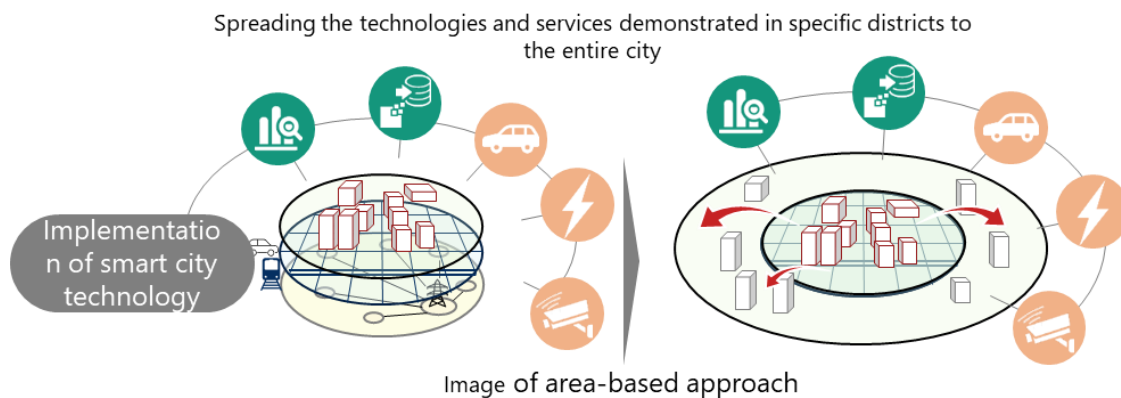
Figure 5-8 Approaches and concrete directions for smart cities by readiness

(6) Methods for Scaling up smart cities

As for the starting point and deployment method of introducing technologies and services as smart city projects, they can be divided into two categories: the area-based approach, in which technologies and services are introduced in a specific area, and the service-based approach, in which a specific service would be the core and is gradually expanded through collaboration with other services.

1) From Introduction in A Specific Area to Expansion to the Municipal or National Level

- This is a pattern of smart city development in which the development (redevelopment) of a specific area is accompanied by the development of the underlying infrastructure to create an integrated smart city.
- This district could be positioned as a test bed/living laboratory to demonstrate advanced technologies and services, and then be extended to the entire city.
- This will be an effective tool to promote the application of the deregulation system (sandbox), incentive systems such as investment incentives, and Land Value Capture business models such as the BID system to the district.

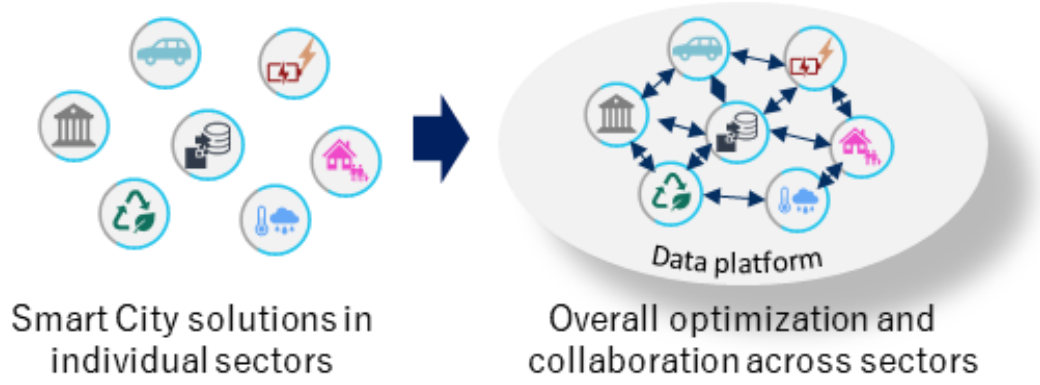


Source: JICA Study Team

Figure 5-9 Image of The Area-Based Approach

2) From Introduction in A Specific Sector to Development into A Cross-Sectoral System

- A smart city pattern in which a specific technology or service is at the core and is linked to various services and systems in a step-by-step manner, aiming for an integrated system in the end.
- A possible approach would be to install sensors in existing facilities and link them with efforts to digitize various services, and to gradually link data with an open data platform and open API.
- In conjunction with the digitization of government services and e-government initiatives, the construction of a data platform based on data held by government agencies is an effective step.



Source: JICA Study Team

Figure 5-10 Image of Sector-Based Approach

5-5. Points to be Noted When Implementing the Smart City Approach

In line with the aforementioned framework, the typical issues and points to be considered in the smart city approach in ASEAN are summarized by conducting a gap analysis between the cases of early adopters and the cases of ASEAN countries and cities.

5-5-1 Vision and Policy

Issues and Points to Consider in Setting Philosophy and Vision

- There are some cases where smart city initiatives are taken opportunistically without setting out a philosophy, strategy, or vision for smart cities.
- It is necessary to come up with a legitimate concept as a means to solve the problems faced by the nation and the city, to realize the future vision, and to realize the well-being of the citizens.
- It should be noted that uncertainty (uncertainty of demand, uncertainty of values (policy priorities can easily change), and uncertainty of decision-making) is extremely high, especially in developing countries, and flexibility to social changes over the medium to long term should also be taken into account.

Issues and Points to be Noted Regarding Comprehensiveness of Vision and Policy

- There are cases of one-off efforts in individual fields or technologies.
- It is important that visions/strategies/policies are formulated that cover not only the interests of individual fields and organizations, but also issues and measures for the country and city as a whole.

Issues and Points to be Noted Regarding the Consistency of Smart City Visions and Policies

- In many cases, especially in countries where smart city initiatives have just started, the digital strategies of the ministries and agencies in charge of information and communication are independent of the economic growth strategies and urban planning.
- In particular, it is desirable to organize the consistency with existing spatial planning, urban planning, and digital/ICT planning (e.g., DX strategy) and how smart city policies are related.

Issues and Points to be Noted Regarding the Concreteness of Visions and Policies

- Even in countries and cities where visions and policies have been formulated, there are still few cases where implementation plans for specific programs and projects have been presented.
- In order to ensure the feasibility and reliability of these plans, it is desirable to institutionalize them (e.g., budgeting or administrative approval procedures for plans).
- It is also desirable that specific numerical targets such as KPIs be set for smart city initiatives, and that evaluation methods and operational systems such as monitoring be explicitly stated.

Issues and Points to be Noted Regarding the Feasibility and Sustainability of Visions and Policies

- There are few cases in which the financial flow (public budget or business model including PPP system, etc.) for smart city development has been presented.
- With regard to the above, it is desirable that a PPP system or other public-private cost-sharing model or system be established through demonstration projects.

5-5-2 Organizational Structure

Issues and Points to be Noted Regarding the Sharing and Establishment of Visions, Values, and Concepts

- Even though smart city visions and strategies have been formulated, there are cases where they do not penetrate the relevant organizations and players and are not effective.
- As a basis for cooperation and collaboration, it is important to foster a common understanding among all entities regarding the direction to take regarding smart cities through smart city visions and policies.

Issues and Points to be Noted Regarding the Entities Promoting Smart Cities

- In some cases, the entities promoting smart city initiatives and where the responsibility lies are unclear.
- It is important to establish an organization and system that can supervise and manage smart city initiatives from a bird's eye view, and deal with various issues such as technologies, systems, and funds to implement policies and strategies. In addition, it is desirable that the roles of each entity and the demarcation of the scope of responsibility are clearly defined in the smart city initiatives.

Issues and Points to be Noted Regarding Collaboration Between Industry, Government, Academia, and the Private Sector

- Due to the lack of experience in collaboration between industry, government, academia, and the private sector, there are cases where the foundation for communication and collaboration has not been established or is not operating smoothly.
- In the case of collaboration between industry, government, academia, and the private sector, it is important to have a specific lead role and a specific mechanism or platform for such collaboration.

Issues and Points to be Noted Regarding Organizational Capacity

- In some cases, the formulation of plans and the implementation of measures have been delayed due to a lack of personnel who are familiar with the latest ICT technologies in the government organizations that should be leading smart city policies.
- It is necessary to appoint a specialist (e.g., Chief Technology Officer) within the organization to be in charge of selecting, demonstrating, evaluating, and promoting the latest technologies, or to form a specialized team, or to establish a mechanism to collaborate with external specialized organizations.
- In particular, it is necessary for local governments to control specifications and operation methods according to their own needs, rather than delegating everything to companies that have the technology.

5-5-3 System

Issues and Points to be Noted Regarding the Establishment of An Ecosystem

- In the process of research and development, verification, and commercialization of smart city technologies and services, there is no system for cooperation and collaboration among players.
- It is important to have an open mechanism and platform that allows various actors from industry, government, academia, and the private sector to collaborate with each other on a cross-sectoral basis.

Issues and Points to be Noted Regarding Trust Building

- In general, there is a lack of sufficient understanding among local governments, businesses, and citizens regarding the legal system for smart city initiatives, the feasibility of the projects, and the benefits to citizens.
- While addressing specific issues from a medium- to long-term perspective, it is important to have a perspective that aims to build mutually beneficial relationships among the parties concerned, in other words, to build trust.

Issues and Points to be Noted Regarding the Establishment of Laws and Systems

- In many cases, the tools (such as incentive systems and deregulation systems) that promote smart city initiatives have not been institutionalized, or even if they have been established, there are few cases where they are being operated smoothly.
- It is desirable to establish clear procedures and processes, create an open and fair market environment, and design appropriate incentive systems.

Issues and Points to be Noted Regarding Citizen Co-Creation

- The bottom-up approach in which citizens participate in administrative processes and city planning is limited.
- It is important to have a mechanism to incorporate citizens' voices into the administrative process or to participate in the co-creation process in order to foster citizens' understanding of and satisfaction with the smart city approach.

Issues and Points to be Noted Regarding Cross-Disciplinary Approaches

- Although the implementation of individual initiatives in each field is progressing, the number of cross-disciplinary initiatives is still limited.
- It is important to incorporate an organization or a mechanism to supervise and manage the entire smart city approach from a bird's eye view and to coordinate among the fields.

5-5-4 Technology

Issues and Points to be Noted Regarding Urban Data Platforms

- There are still few examples of actual progress being made regarding the construction of data collaboration infrastructure and the development of data platforms (urban OS).
- It is important to collect and organize various types of data, such as static and dynamic data, geographic data, and personal data, in order to promote the utilization of data with a view to urban OS and data collaboration infrastructure.

Issues and Points to be Noted Regarding the Utilization of Data

- Only a limited amount of data, including data held by local governments, has been made available as open data. In addition, guidelines for the protection of personal information are not sufficiently established, and citizens do not have a high level of understanding.
- It is desirable to promote the utilization of personal information through demonstration projects, etc., while gaining the understanding of citizens regarding the significance, convenience, and safety of such utilization. It is also important that data be shared and utilized across fields and organizations, and that technologies and services be provided from a multi-solution perspective.

Issues and Points to be Noted for Ensuring Cyber Security

- There are still few examples of practical cyber security measures.
- The national government and local governments should take the lead in promoting cyber

security in an integrated manner, as it is an issue that should be addressed in a common manner, with little difference in regional characteristics.

Issues and Points to be Noted Regarding the Design and Implementation of Smart Technologies

- Although some countries and regions are making progress in demonstrating smart technologies and services, in many cases the initiatives are private sector driven and individualized.
- It is important that technologies and services that are appropriate to the issues and the current state of the city are introduced based on a comprehensive analysis of urban issues. It is also important that companies (including start-ups) that resonate with the vision and values of the city and are committed to the development of the region are involved.

5-5-5 Operation

Issues and Points to be Noted Regarding Securing Resilience and Flexibility

- There are still few examples of systematic operation of smart city initiatives, and the responses are often ad hoc. In addition, there are many one-off initiatives that pursue short-term returns.
- As technological innovation in the ICT and digital fields continues at a rapid pace, it is necessary to consider operational plans that include updating, as the technologies and services introduced may soon become outdated. Since smart city initiatives are new, they often do not work out in a single implementation. It is important to allow for the possibility of failure and have an attitude of learning from and improving upon failures.

Issues and Points to be Noted Regarding the Strengthening of Cooperation and Partnership and PR

- The cooperation system is rigid and there is no open environment for sharing information and knowledge among the entities. In addition, the organization like Enabler that connects the entities and its operation are limited.
- In order to maximize the effects of smart city initiatives, it is important to create an open environment for sharing information and lessons among various entities. In order to promote co-learning and co-creation, it is important to establish organizations and structures that can serve as Enablers for matchmaking and knowledge sharing.

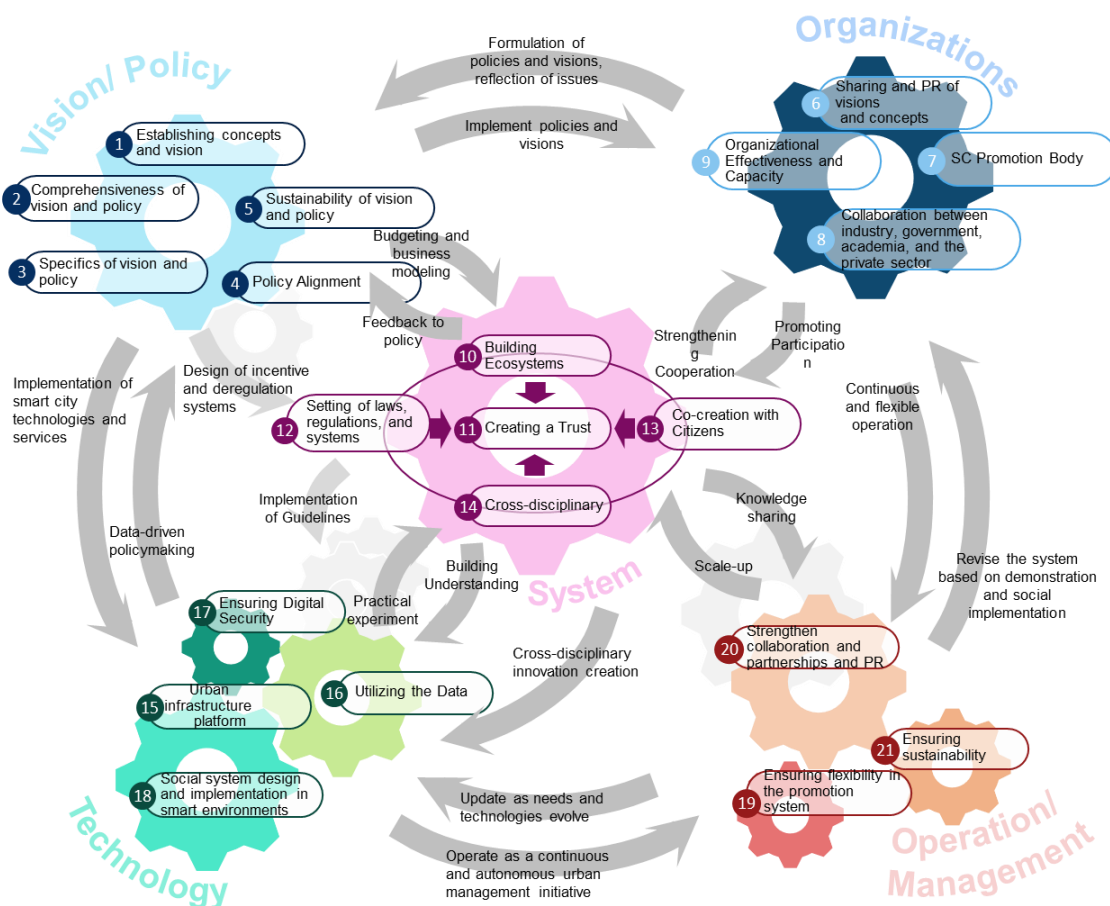
Issues and Points to be Noted Regarding Ensuring Continuity

- Many countries and cities are still in the process of building smart city ecosystems, and there are concerns about their sustainability.
- While it is important to utilize the technological capabilities of global companies and IT companies, it is also important from the perspective of sustainability and revitalization of the local economy to grow as a city together with local companies and other partners.

5-5-6 Function as a Whole

With regard to the above-mentioned smart city components (five domains) and key factors (21 elements), it is necessary to take a holistic approach, taking into consideration the relationships among the elements, rather than isolating each element and working on each of them individually.

The figure below shows a conceptual diagram of the interactions among the five elements: vision/policy, organizational structure, systems (institutions), technology, and operations. It is important to strengthen and expand each element as the project progresses, and to ensure the linkage and consistency among the elements so that the smart city functions as a whole. In particular, it is important to foster trust in the entire smart city process, based on a solid concept and plan, and through repeated experience in demonstrations. On top of that, it is important to consider the balance between public interest, social welfare, and corporate profits in the implementation of smart technologies and solutions in a dynamic relationship between government, local governments, corporations, and citizens, and to have a management perspective that does not fall into partial optimization.



Source: JICA Study Team

Figure 5-11 Conceptual Diagram of Interrelationships among Smart City Components

6. Mechanisms and Business Models Related to Smart Cities

In Chapter 6, directions for building a business model for smart cities, taking into account the situation in developing countries are organized.

6-1. Potential Factors for Establishing a Business Model for Smart Cities

Potential factors for establishing a functional smart city business model are explained as outlined below.

Conditions and structures aligned and applied from early adopters for promoting smart cities

From the discussions regarding the origins and background of smart cities that were explained in Chapter 1, and the smart city initiatives outlined in Chapter 3, it can be argued with confidence that “people-centered” approach is the key objective of the smart city initiatives in the select cities. Among the early adopters, many have emphasized on building a participatory mechanism to capture the needs of their citizenry and to reflect their opinions into policies. We have also learned from developed countries that there is opportunity to promote smart city policies through cooperation among the public, private, and academic sectors. In other words, with these participatory and collaborative mechanisms in place, it is believed that the actual implementation could be sustained without deviating greatly from the original policy or plan. What was conventionally a one-way exchange between G (Government) to C (Citizen or Consumer), or B (Business) to G (Government) could evolve into a more interactive collaboration process under the so-called smart city business model.

Regarding smart cities-related businesses, not only cities in developed countries but also emerging cities in ASEAN countries are actively seeking opportunities and implementing smart city solutions in various fields, as demonstrated in Chapter 4. However, the differences in business models are expected to emerge particularly in terms of the potential between developing and developed countries, and in terms of the balance of the cost and responsibilities to be shared by the public and private sectors.

Potential factor No. 1:

A mechanism to capture the voices of citizens and a promotion system for collaboration between private, public, and academic sectors is in place, which enables to form connection between the policy and business.

Differences in sustainability of business with regards to the speed of diffusion of the business models

In developing countries, there are wide income disparities, as could be inferred by indicators such as the Gini coefficient. There are also large differences between urban and rural areas in terms of accessible services, and the range and the variety of demand is thought to be much wider than that of developed countries. On the other hand, there are considerable disparities in the degree of acceptance and satisfaction with the level of services. The speed in which the smart city-related businesses expands is expected to be pretty much the same in developed cities and in emerging cities in ASEAN as far as the middle and high income citizens are concerned. However, the speed at which they widely penetrate to the general public (including people in rural area or low-income group) could largely differ. Therefore, if business models are not able to secure a certain level of profit and maintain business

sustainability immediately after the service starts or at an early stage, there is a concern that the business model would fail before the service is widely available to the wide public.

For this reason, it is necessary to consider the speed of penetration of business or services as a risk and to provide support and mechanisms that can guarantee business continuity, rather than relying too much on private sector. For example, in Nordic countries where resources are limited, the future exit strategies, the speed of dissemination, and the associated profitability of the business are incorporated in the smart city business plan. It is customary to proceed with social implementation only after the business continuity can be guaranteed.

Potential factor No. 2:

Support mechanisms should be in place to guarantee business sustainability, while taking into account the speed of business penetration.

Ease of creating business models related to smart solutions

Various evidence such as the Global Entrepreneurship Monitor¹ hypothesizes that a country's economic development is closely related to its entrepreneurial activities. As is also shown in the analysis of statistical data from Japan's Ministry of Economy, Trade, and Industry, the Cabinet Office, and other sources^{2,3}, there is a positive correlation between GDP growth and the rate of entrepreneurship. The GDP growth in ASEAN countries is expected to stagnate in 2020-2021 due to the COVID-19 pandemic, but the recovery could be expected depending on the pandemic situation, which will encourage business activity. We could expect entrepreneurship including companies that will eventually become unicorn companies (meaning unlisted start-ups that have been in business for less than 10 years, have a corporate valuation of more than \$1 billion, and possess technological capabilities).

If smart cities are considered as a field of business, IoT is expected to be utilized and many new businesses could be created. On top of that, the competition and selection of businesses would naturally occur in ASEAN countries.

Also, in developed countries where rigid laws and regulations are formulated through the course of gradual digital transformation process, it often takes time for new technologies and related services to be deregulated, and for legal systems to undergo revision before they can be commercialized. On the other hand, in developing countries where there is typically less regulation and allow more flexibility for the systems, there is a potential for development of innovative business models that are impossible in developed countries, allowing for a leapfrogging type of transformation. This is already exemplified by cases of Grab in Singapore and Gojek in Indonesia, which are dominating last one-mile mobility services and have also been outstanding in terms of business performance. In summary, the relationship between economic development and entrepreneurship suggests that the government is required to take the lead in creating a new business environment in which the entrepreneurs and public authorities cooperate with each other, including creating appropriate legal systems for promoting new business activities.

¹A sample survey is being conducted led by Babson College in the U.S. and the University of London in the U.K.
Reference: <https://www.gemconsortium.org/>

² Ministry of Economy, Trade and Industry, White Paper on Small and Medium Enterprises in Japan
<https://www.chusho.meti.go.jp/pamflet/hakusyo/h23/h23/index.html>

³ Cabinet Office, Japan Economy (Summary), <https://www5.cao.go.jp/keizai3/2015/1228nk/15youyaku.pdf>

Potential factor No. 3:

Leveraging the increase in the rate of entrepreneurship, regardless of the size, smart city business should be promoted. In addition, new emerging markets in each country and city are to be explored with the aim of a leapfrog-style transition.

Smart City Businesses and Profitability

The profitability is another aspect that needs to be focused on in order to increase the feasibility of the business models. When assessing the feasibility of smart city business models, the first phase would be providing testing field or test beds and conducting Proof-of-Concept experiments. Traditionally, this is the phase in which a company conducts the demonstration as part of its internal marketing efforts. However, the initial investment costs account for a large portion of the total investment costs, which makes a difference in the time it takes for the business to stabilize. In many developed countries, governments and public incubation support organizations are deeply involved in this stage and provide financial support for the cost. Upfront investment which is made by the government in anticipation of the introduction of services reduces the initial investment of private sector, which has a great impact on ensuring profitability immediately after the start of operations.

Traditionally, proof-of-concept experiments were mostly conducted by companies on their own, and in most cases, companies completed the products they had set development goals and put them on the market. On the other hand, for smart cities, if the target field has a social impact, and if there are many public elements involved, those who introduce technologies and services must go through comparative studies and safety verification based on trial use, making the participation of public organizations in the proof-of-concept experiments inevitable. In addition, it is crucial to introduce the product on a trial basis to assess the feasibility of the service from the perspective of the government agencies and citizens. It is also very useful to identify the revenue break-even point, estimate the service demand and profitability, and decide an appropriate service level as a public service so that the service costs do not become too expensive.

In contrast, in urban areas where the government is less involved and the private sector takes the initiative in promotion, or in special zones established by the government, the smart services are expected to contribute to increase asset values, such as higher land prices. The Nordic smart city model is also a good reference in this regard. The Nordic countries are welfare states with well-developed social security systems, where the basic public services and the IT infrastructure are originally provided to citizens by the national government and public institutions. In this smart city model, basic services for the citizens are provided by public institutions, and additional services are supplementally provided by private companies. Although the Nordic style is not possible to be introduced directly, governments could provide energy, water, and healthcare as social infrastructures to be provided by the public sector, while private sector could be responsible for other smart solutions such as transportation, industry, and agriculture in the smart cities. In some ASEAN countries, especially in cities where infrastructure is not well developed, other new models with smart solutions could be established.

Potential factor No. 4:

Financial support in the initial stages including support for proof-of-concept experiments is available, based on which, the profitability is correctly determined.

Potential factor No. 5:

Public organizations such as government agencies can participate from the proof-of-concept experiment stage to properly explore the positioning of the service as a public service, without creating excessive profits for the public sector.

Potential factor No. 6:

There is potential that the introduction of smart city technologies would increase land prices and asset values, thereby indirectly increasing profitability and viability of the project.

As described above, it is difficult to identify appropriate models for smart cities due to the wide variety of business types. There are many potentials for smart city business in developing countries, as is indicated by the factors such as: the diversity of demand in the city (diversity of user attributes); potential entrepreneurship associated with future economic growth; margins for flexibly adjusting the legal system; the fact that there are still many unexplored markets; among others. Thus it is vital that the public authorities participate in the smart city development from the proof-of-concept experiment phase, while considering the right balance for share of responsibility between the public and private sectors, and determine the level of services to be offered, in order to enable creation of a functional business model and to maximize the potential for business opportunity presented by the smart city.

6-2. Support for Implementing Smart Cities: Roles for Public and Private

As mentioned in the previous section, establishing a functional business model is vital, but it is such a difficult task that even the cities in developed countries are struggling with. This entails collaboration between public and the private sectors and also requires a long process of Proof of Concept and demonstration projects. There is an actual example of this in Barcelona, where a garbage collection project has been implemented, but already been terminated as a result of proof-of-concept. In addition, even in developed countries, there are likely to be many cases where planned services do not proceed beyond proof-of-concept experiments or do not complete (it is worth noting that many failures end quietly without being publicized). After proof-of-concept experiments, to ensure stable social implementation, it is necessary to be aware that the division of roles between the public and private sectors and the contents are different between developing and developed countries, especially in terms of service providers. In developed countries, the public sector is mainly responsible for formulating the concept and vision, under which the private sector would participate, while in developing countries, the private sector might be requested to actively propose the concept, vision, as well as technology. This would provide many opportunities for the public administration to learn from the private sector and absorb knowledge.

The way these public and private sectors are involved will also relate to other areas. Since developing countries may not be able to provide sufficient administrative support in terms of finance, it may become difficult to allocate as much of their public-private partnership resources on supporting proof-of-concept experiments as developed countries can. On the other hand, for local companies including start-ups seeking to raise funds and make efforts toward the target services, the approach of narrowing down target users (demand) and “starting from whatever they can do” is probably optimal. This trend could be observed in some real estate development projects in Thailand and Vietnam, where services are being developed for specific residents, narrowing down to users of specific activities such as tourists. It is conceivable that proof-of-concept experiments might be conducted using these as sites for demonstration, and with feedback from users, these might be transformed into better services. In addition, by proposing this approach to the government, it may lead to establishing the model as the standard for that country or city, which would be beneficial for local governments with tight budgets.

Accordingly, a business model approach represented in the phrase “agile development” which entails capturing specific users in the initial phase, having the private sector demonstrate the service’s effectiveness, continuously improving the service before its adoption as a public service by acquiring approval from the government, and then having the private sector continue to provide the service is optimal in terms of speediness and is especially desirable when human resources on the government side are inadequate.

Whenever there is a proposal from a private-sector company, the government needs to carefully control the overall concept and ensuring adaptability for data collaboration and service integration on the data platform (city OS) for the future—for example, by providing guidance on open APIs, considering collaboration with other companies, and coordination with government support services.

Putting the above into context, the table below reiterates the differences between developing and developed countries in five perspectives of the government side: service providers, financing, specification review, data integration, and proof-of-concept experiments.

Table 6-1 Government's Role in Social Implementation in Developed and Developing Countries

	Developing countries	Developed countries
Service providers	Private sector-led & initiative type (government has personnel shortages, and knowledge is still lacking)	Public management type at national/city level, private efforts such as PPP
Finance	Appropriate PPP efforts that rely on the private sector but correctly do not lock in specific companies in a proper public manner.	Support for promotion of proof-of-concept experiments, etc., with criteria for judging efforts toward appropriate practical applications, and funding that contributes to broader business models, such as expansion to other countries
Review of specifications	Private-sector proposals followed by adoption by the public sector	Determining private sector service level through identification and analysis of issues by the public
Integration of data	Prioritizing individualized efforts and responding to demand as early as possible	New business construction is required from a data integration viewpoint (with some demand for city OS)
Proof-of-concept experiments	Preliminary trials in areas with large scale and potential demand, such as private land owned by private-sector developers	Implementation by deregulation of public spaces by the government or the third sector, etc.

Source: JICA Study Team

In this chapter, an analysis of the potential for business model creation and the division of public and private sector partnerships were discussed. Based on these considerations, the following four types of business model patterns can be outlined.

Table 6-2 Types of Business Models and Potential Financing

Business models	Overview	Finance
(1) Government-dependent model	A model promoted exclusively by the government without the involvement of the private sector. It is managed through taxation and other means.	Taxes, grants, and donations
(2) Public-Private collaboration model: Infrastructure development by the government (taxes), and service by the private sector	The government covers the initial investment and other costly areas, as well as basic services that should be handled by the public sector. Based on the infrastructure established, the private sector adds attractive services and secures revenues from those services. This is a public-private system in the broadest sense.	Taxes, grants, and donations + PPPs, including private investment, outsourcing costs, SIB ⁴ , and SC funds

⁴ SIB: Social Impact Bond. A mechanism whereby private investors provide project funds to a business, and the municipality pays a performance fee to the business based on the results of the project.

<p>(3) Public-Private collaboration model: Government-led vision, and service provision by private sector</p>	<p>A private company, which has been granted sole business rights by the government, develops, and provides the infrastructure and secures revenues from operating costs. If a good service can be built, that part will also be an income. Assumes BOO (Build Own Operate) or BOT (Build Operate Transfer).</p>	<p>PPP, outsourcing costs, SIB, SC funds, real estate income</p>
<p>(4) Private proposal model</p>	<p>Under the government's basic policy formulation, private companies collaborate in such things as area management, BID (Business Improvement District), TIF (Tax Increment Financing), and as data providers in composite solutions to further attract other businesses and enrich their services. The synergistic effect of services raises the value of the region itself, besides the direct revenue from services, and indirectly raises revenue through an additional model due to rising land prices, etc. If new revenue sources are obtained in the future through the creation of data distribution services or urban data exchange markets, this could become a mainstream model.</p>	<p>BID, TIF, real estate income</p>

Source: JICA Study Team

7. Smart Cities in COVID-19/Post COVID-19 Era

7-1. Social Impacts of COVID-19 Pandemic

7-1-1 Social Changes Induced by COVID-19 Pandemic and Responses

With the spread of COVID-19 pandemic, people have experienced city-wide lockdowns, telecommuting and remote learning, and new tools and systems for communication and collaboration have evolved. In Japan, social norms and customs that were previously taken for granted changed drastically (commuting, business trips and job transfers, stamps, business cards, cash), and new lifestyles, unconventional businesses, and unprecedented new values appeared.

In a post-COVID-19 society, the shift to digital is expected to be the starting point for the construction of a decentralized society more considerate of sustainability. It is assumed that services will be provided to meet the diverse values of each individual while successfully integrating both real and virtual spaces.

It will also be important to promote a poly-centric urban transformation that differs from the mono-centric concentrations of the past and emphasize creating interactions with the adjacent area, based on the formation of a circular economy at the local (regional) level, instead of conventional economic structures reliant on external demand.

Furthermore, responses to the SDGs and responses to the COVID-19 pandemic share a strong affinity (i.e., they confront similar issues), and the SDGs framework provides an effective reference for imagining how societies and cities will be in the wake of the COVID-19 pandemic.

Table 7-1 Examples of New Social Ideals and New Social Values

Item	Details
Digital shift	<ul style="list-style-type: none"> • Infection risk notification systems using AI and location information systems • Promoting remote working and automation of routine tasks <ul style="list-style-type: none"> - Identifying the human resources indispensable for driving business • Revitalization of non-contact technologies such as robotics, unmanned logistics, and cashless society • Promotion of cloud computing will lead to concentration of information with specific companies (AWS, etc.) holding big data <p>< The value of things that cannot be digitized (analog) will increase ></p> <ul style="list-style-type: none"> • Experience, empathic values, and human sensitivity determine the value of things: the value of real things increases—performance, music, art • Value of things made directly by human hands (brand value): Traditional crafts, luxury watches, designer products
Changes in the industrial structure	<p>< Improvement of communications infrastructure, given the continuation of remote working and online education ></p> <ul style="list-style-type: none"> • There is an urgent need to develop infrastructure and reinforce our communications (cloud computing, information protection, improving speed and reducing latency, multiple simultaneous connections) <p>< Realizing a sustainable society ></p>

	<ul style="list-style-type: none"> • Constructing social systems for control of CO₂ emissions • Changes in travel: Minimizing overseas travel, decrease in commuting due to general spread of telecommuting • Breaking away from mass production and mass consumption: Setting expectations for recyclable materials and products
Changing from centralized to decentralized	<ul style="list-style-type: none"> • Shifting from centralized cities to decentralized and networked cities: Shifting from 20th-century style (centralized) offices, factories, and cities to new cities (digital, borderless) <p>< Advantages of distributed network models ></p> <ul style="list-style-type: none"> • Working styles: Achieving free, flexible working styles through remote working, and societies that prioritize balancing work with family, child-rearing, and nursing care obligations (work-family “decentralized systems”) • Housing: Collaborating and co-operating with greater metropolitan areas even in regional zones, and decentralizing regional layouts of offices and workplaces (city-regional “decentralized systems”) • Levels of happiness are higher in a regional decentralized system than in a centralized urban system (AI simulation results: Hyogo, 2050)
Changes in human behavior	<p>< Seeking new values and ways of living through the rise of digital technology ></p> <ul style="list-style-type: none"> • Fusion of real with virtual: 5G, VR, AI, IoT, etc. <ul style="list-style-type: none"> - Sharing of space, sense of being present • Changes in the state of the service industry <ul style="list-style-type: none"> - Changes in restaurants, bars, home deliveries, and welfare in office districts <p>< Relationships between individuals are important ></p> <ul style="list-style-type: none"> • Mental impact of working from home: Blurring lines between work and private life, increased stress <ul style="list-style-type: none"> - Issues of working from home = Loneliness, communication and collaboration • Physical and mental burdens upon essential workers: infection risk, responding to complaints, discrimination <ul style="list-style-type: none"> - Need for understanding and consideration for those who play important roles in society

Source: NEDO TSC “Social changes and expected innovations following the COVID-19 pandemic”

Reference : AI-based Public Policy Studies and the Vision of Localization Society (Kyoto University and Hitachi, Ltd.)

(some content excerpted and edited)

The direction “from urban concentration to rural decentralization” is the most important axis when thinking about post-COVID-19 society

- It is worth noting that the number of deaths from COVID-19 in Germany was relatively small. In the case of Germany, the entire country can be strongly characterized as a “decentralized” system, with small- and medium-sized cities, towns, and villages scattered over a wide area, resulting in a “multipolar” spatial structure.

- The present-day situation in Japan is not one of “unipolar concentration in Tokyo,” but rather one of “low-polar concentration” (population growth rates in Sapporo, Sendai, Hiroshima, Fukuoka, etc. are as high as the Tokyo metropolitan area), which is a structure that poses high risks in terms of infectious diseases.
- To cope with pandemics such as COVID-19, it is crucial to shift to more “decentralized” systems (to national structures that can be described as “multipolar”).

A society oriented toward the environment, sustainability, local economic circulation, and symbiosis, and then builds up from there to the national and global levels

- The world today is starting to see the “beginning of the end of globalization” in various ways, and we are entering an era in which “localization” will get underway.
- In countries such as Germany and the Scandinavian countries, instead of thinking in the direction of “starting from the global economy and moving down to national and local economies”, people are aspiring to and realizing societies that “start from the local regional economy and build up to the national and global economies.”

Digitalization is a “means to an end”—and we need a more proactive vision of what the future may bring for the industrial sector and for the human activities that will serve as the content of digitalization

- The development of “life-related industries” (such as (1) health and medical care, (2) environment, (3) livelihood and welfare, (4) agriculture, and (5) culture), which have a strong local character and close ties to local regions, corresponds to the trend of regional development, while at the same time, contributing to the revival of local economic cycles and local communities, and resonating with decentralized societies.
- In addition, the concept of “life” will become a central theme for scientific and technological aspects, as well as the aspects of economy and society.

Reference : Proposals for local development SDGs and countermeasures against COVID-19(Cabinet Office)

(some content excerpted and edited)

Problems and issues that became apparent amid the COVID-19 pandemic

- One major problem that became apparent during the COVID-19 outbreak was the serious trade-off between economic, social, and environmental issues—as evident from (countermeasures against infection) x (restrictions on behavior) x (economic stagnation)—which has resulted in stronger recognition of the importance of balanced and integrated efforts to address economic, social, and environmental issues.
- In every community, urgent measures aimed at the “new normal” of coexisting with COVID-19 are underway, including measures to combat the 3Cs (closed spaces, crowds, close contact). In a sense, avoidance of the 3Cs encourages

the shift from centralization toward decentralization, and significantly impacts urban planning and construction (e.g., the trade-off between ensuring social distancing and a city's prosperity).

- New issues are being raised with local government administrations, including how to maintain community ties while avoiding the 3Cs.

Overcoming the COVID-19 pandemic offers a vision of the future of local government

- In addition to taking countermeasures against COVID-19, local governments need to consider a medium- to long-term sustainable vision for the future, with a view to the post-COVID-19 era and with reference to the SDGs. (This is an opportunity to delineate the future of local governments, in reference to predictions about which aspects of the new normal are here to stay.)

< 6 major trends and 11 points to consider for sustainable urban development >

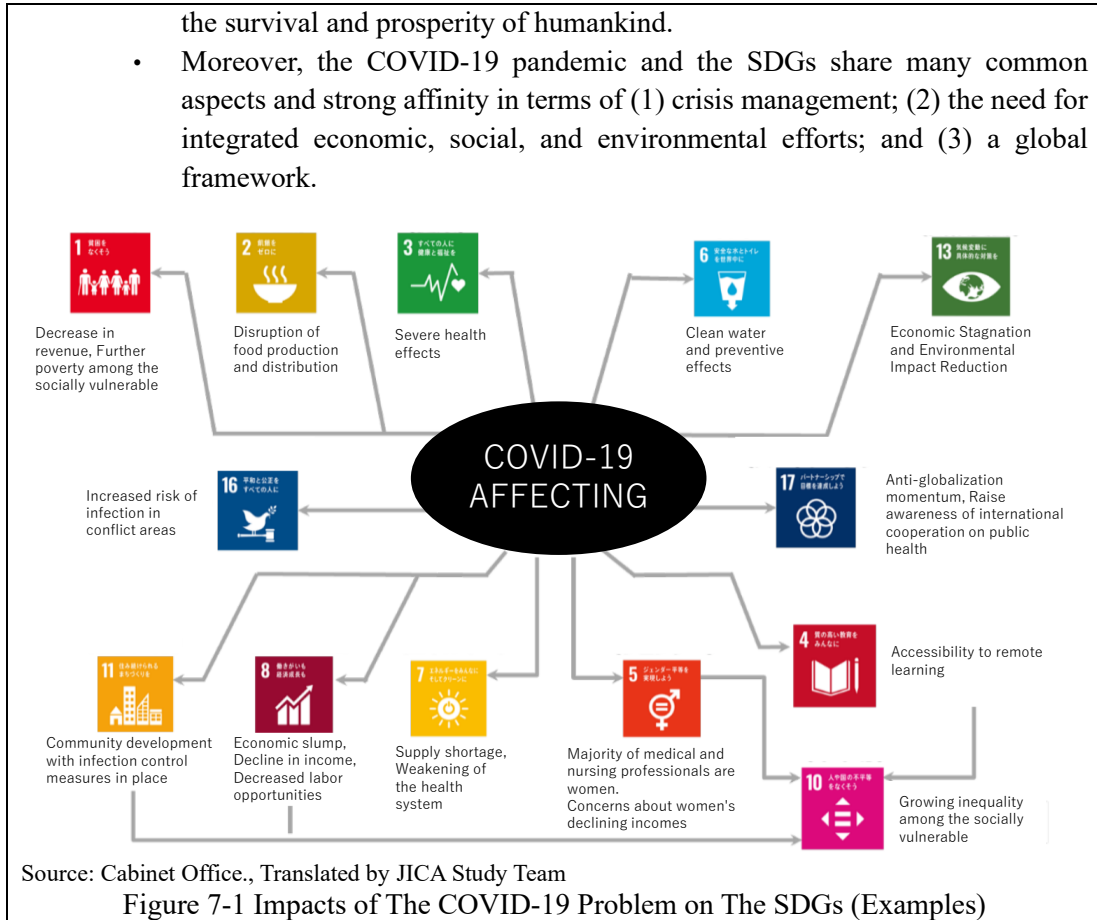
1. Digitalization
 - (1) Transition to Society 5.0 and the accelerated construction of digital platforms (changing opportunities for face-to-face work)
 - (2) Expansion of e-commerce and e-services
2. Future working styles
 - (3) Intensified needs for reskilling (response to the new normal, increased awareness of reskilling due to progress of digitalization)
 - (4) Increasing importance of remote work
 - (5) Shift from membership-based to job-based employment (allowing more flexible work styles and a society in which a diverse range of people, including seniors and people with disabilities, can work)
3. Changes in consumer demand
 - (6) Responding to demand for non-face-to-face consumption
 - (7) Importance of risk management (risk management not only for pandemics but also for natural disasters and international conflicts will become more apparent.)
4. Resilience
 - (8) Focus on the resilience of healthcare systems (expansion of acceptance of primary medical care and expansion/diversification of sources for medical supplies will get underway)
5. Environmental and social/public goals
 - (9) Expand social and public agendas (focus on measures to facilitate better recovery from economic shocks by prioritizing ESG finance)
6. International and domestic interactions
 - (10) Supply chains will enter an era of change that goes beyond improving efficiency (increasing emphasis on business continuity planning (BCP) in anticipation of disruptions to international supply chains)
 - (11) Movement of people (promotion of sustainable tourism, etc., based on COVID-19 countermeasures, and the possibility of in-country migration from urban to rural areas as well as increases in interacting populations)

Links between COVID-19 countermeasure and SDG initiative as an issue of sustainable development

- It is appropriate to position the COVID-19 pandemic as a “sustainable development issue” in the sense that it is a global policy issue that threatens

the survival and prosperity of humankind.

- Moreover, the COVID-19 pandemic and the SDGs share many common aspects and strong affinity in terms of (1) crisis management; (2) the need for integrated economic, social, and environmental efforts; and (3) a global framework.



7-1-2 Changes in Urban Planning, Development, and National Land Structures

In the COVID-19/Post COVID-19 era, the importance of conventional city policies of taking advantage of the merits of urban concentration remains unchanged.

On the other hand, to respond to people's diversifying lifestyles under the constraints of severe financial circumstances and sustainability—which are particularly pronounced in Japan—it is essential to maximize the use of local resources and existing stock, and we can assume that considering various measures utilizing digital technology and data will be necessary.

Reference: How should new urban policies respond to the new normal? Human-centered, citizen-oriented, and agile urban development through maximized utilization of city assets (MLIT)

(some content excerpted and edited)

Urban policy issues in the wake of the COVID-19 crisis

- In recent years, one of the main cornerstones of urban policy has been upgrading city functions at the city or regional level in order to maintain and demonstrate the benefits of urban concentration. (Compact plus network: Typical measures include guiding city functions to certain areas and creating public transportation networks)
- During the COVID-19 crisis, there has been a strong need to avoid the 3Cs (closed spaces, crowds, close contact), highlighting the issue of how to avoid the risks inherent in urban overcrowding while at the same time taking

advantage of the benefits of urban concentration. (“Overcrowding” here does not refer to the concentration of city functions on the macro level, but rather overcrowding in the interior spaces of individual facilities from the perspective of controlling infectious disease.)

- Cities play a central role in economic activities by bringing together the funds, human resources, technology, etc. necessary for economic activities, as well as maintaining lifestyle service functions by sustaining a certain population density. However, the importance of cities possessing such functions has not changed.
- From an urban policy perspective, to work toward concentrated city functions, we must address the issue of how to respond to the new normal by ensuring ample office spaces, open spaces, etc.

Human-centered, citizen-oriented urban development

- To solve local problems and create value from the citizens' point of view in a relatively small area such as city blocks, efforts to promote human-centered urban development (such as the creation of comfort and prosperity by coordinating public space development with private sector efforts) are effective and they continue to be important in responding to the changes and diversification of attitudes and values regarding ways of working and ways of living brought about by the “new normal.”
- For this reason, given the current situation of a declining and aging population and severe financial (and other) constraints, it is especially important to maximize the use of the existing public and private sector stock that has accumulated over the years.

Directions to pursue in urban development (Deepening of human-centered and citizen-oriented urban development / Achieving agile urban development)

- In response to the changes and diversification of awareness and values brought about by the “new normal,” cities will further deepen their human-centered and citizen-oriented urban planning by making city living and city activities more convenient and comfortable, and by providing a diversity of options to support the needs of individual citizens more efficiently.
- Areas targeted for urban development should be established from the citizens' perspective, aligned with the actual circumstances of human living and activities, and various entities from the public and private sectors should work together, after first recognizing issues to meet the diversified needs of people.
- Since people's needs for cities change almost daily in response to social circumstances and technological progress, all the processes of urban development, including planning, social experiments, implementation, and verification, need to be carried out promptly. (Agile urban development that responds to problems in a dynamic, flexible manner)

Utilizing urban assets

- To accurately respond to the needs of individual citizens, it is important to flexibly utilize existing stocks of local resources as “urban assets” to contribute to improving the quality of urban life and the convenience of urban activities.

- Moreover, we must maximize the use of these urban assets to conduct flexible urban development in the face of challenges such as the declining and aging population, severe financial constraints, and the achievement of carbon neutrality by 2050.
- It is important to maximize the use of existing public and private stocks (urban assets) that exist as local resources to meet the needs of citizens.



Source: MLIT., Translated by JICA Study Team

Figure 7-2 Direction of Initiatives (Image)



Source: MLIT., Translated by JICA Study Team

Figure 7-3 Specific Initiatives (Image)

In addition, from the perspective of national land structures and city structures on a macro level, we need to classify city functions in a broad sense into those that can be shifted online and those that must be delivered on-site, and reconsider the best way to decentralize functions.

It is also important that we consider what kind of substantive changes will occur in local economies and societies as a result of shifting functions online, and what the negative implications of going online may be.

Reference: National land and city structures Amidst & Post-COVID-19 era(RECAJ)

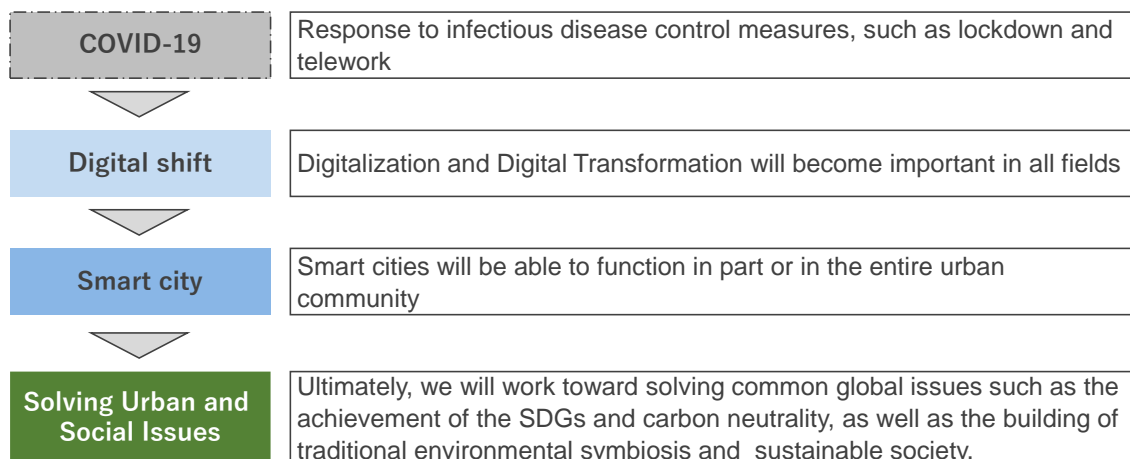
(some content excerpted and edited)

- Need to redefine the meaning of “concentration” by classifying city functions into those that can be shifted online and those that must be delivered on-site.
- Cities are made up of headquarters functions that perform daily on-site essential activities, urban centers where specialized service functions that support these functions are located, and suburban areas where jobs and residences are in close proximity.
- We will see movements to find an “optimal solution” to divide the roles between the base office as a real site, decentralized satellite offices, and remote working such as telecommuting.
- Considering future urban development, it is important to discuss and analyze how substantive changes in local economies and societies might be created from online meetings, etc., and whether the loss of high density and face-to-face communication and the loss of urban amenities, will be negatively received.

7-1-3 Directions for Urban Digitalization

As mentioned above, COVID-19 has caused urban society to rapidly move toward digitalization; however, the need to respond to social issues such as the SDGs and the preferred ideal image of cities will not change significantly, and conventional concepts such as effective use of local resources and construction of recycling-oriented, sustainable societies will continue to be the direction cities should aim for. In order to build desirable urban societies like this, smart city initiatives—human-centered urban policies that utilize digital technology and data—are extremely effective.

For this reason, the digitization of cities, including IT infrastructure, especially in areas where there is a shortage of such infrastructures, should be promoted as soon as possible (although questions remain as to how much digitization is necessary). When the digital society has reached a high level of maturity, various city activities, including not only urban design but also urban governance, will be carried out utilizing data.



Source: JICA Study Team

Figure 7-4 Connection Between Social Change and Smart City Due to COVID-19

7-2. Data Collection in the COVID-19 Era

At present (as of December 2021), no city or society is successfully coexisting with COVID-19. Even after analyzing large amounts of data, with solid evidence for regulatory controls and limits on human movement, such as lockdown based on national policies, at present it is difficult to gain the understanding and agreement of citizens. On the other hand, in the field of infectious disease control, efforts to help integrating cyberspace and physical space (such as spatial infection control and visualization through applications that utilize anonymized smartphone data) are in the realm of practical application, and the range of applications of data to physical space is expanding. The following perspectives may be considered for data utilization efforts.

1. Information on population density in cities
2. Congestion and actual usage of transportation (including public transportation)
3. Future predictions based on the collected data

In the future, it may become possible to conduct more detailed simulations by sharing grouped data from various services, starting with smartphone data (collectively referred to as “big data”), and at the same time, identifying the real-time situation of COVID-19, which may open up data-oriented policies for infectious disease control.

In the COVID-19 pandemic, infectious disease control measures in which data play such an active role have been considered extremely valuable. At present, the main purpose of data utilization is to control the spread of infection. When the value of applying data such as a basis for simulations becomes widely accepted by the public, then it could be deemed as a major achievement.

7-3. Urban Concepts and Approaches in the Post-COVID-19 Era

In the future, it may become possible to conduct more detailed simulations by sharing data from various services, which may lead to data-oriented policies for infectious disease control.

This will be most effectively applied in cities in the post-COVID-19 era. The use of data in the COVID-19 pandemic is the result of a trial-and-error process that has led to uncovering best practices, and this is believed to constitute ample reference material for urban planning and development. Post-COVID-19 cities are expected to implement data-oriented urban planning, development, and attraction of functions based on the valuable data obtained during the COVID-19 period. The following are some plans that seem particularly effective.

1. Reconsideration of traffic shares: Maximum value of change for traffic share due to declarations of a state of emergency, etc., effectiveness in suppressing peak traffic volumes
2. Planning for appropriate density and distribution of city functions in compact cities
3. Decentralization of public facilities, etc., and appropriate coefficients for calculating appropriate scale
4. State of road space in the post-COVID-19 era, in relation to the above (utilization of pedestrian and vehicular space, new design guidelines, etc.)
5. Setting of incentives based on peak distributions and commuting distance (calculation of willingness to pay)

These offer new suggestions for conventional urban planning, design, and architectural planning, and for traffic, we believe that the way in which the road space is used could change. This may extend to the possibility of creating open spaces in road space, and the securing space for sidewalks and bicycle paths.

In addition, to make proposals such as these based on a wide range of public-private partnerships, the national and local governments need to take the initiative to collect and manage the various data collected in the wake of the COVID-19 pandemic and provide it to the private sector in a fair manner. By doing this, more integrated analysis and advanced proposals can be obtained.

It will also be possible to request more optimized design proposals by incorporating the results of data analysis as evidence for the design of public spaces and facilities. This can provide useful references for detailed planning studies by replacing intuitive reasoning with actual measurements.

8. Scope of Smart City Assistance and Strategy for JICA

Chapter 8 presents general policy and direction for JICA's support on the smart city approach, building upon the findings of the study. It also elaborates support menu based on “vision and policy,” “organizational structure,” “system,” “technology,” and “operation” as well as a step-by-step phased support process.

Furthermore, the outline of smart city support by other donor institutions is reviewed as reference for cooperation for smart cities.

8-1. Basic Direction for Supporting Smart City Initiatives

8-1-1 Strengthening the “Process” for Advancing Smart City Initiatives

As mentioned in the previous chapters, the general benefits of smart cities include the realization of a sustainable society through the promotion of green transitions, the creation of resilient cities for the post-COVID-19 era, the promotion of sustainable economic growth and the enhancement of city’s competitiveness, and the improvement of people's quality of life and well-being. Smart cities can be an effective approach for cities in developing countries as a means to solve local and unique problems faced by each city, for example, to address environmental and climate change issues that are on the global agenda, and to achieve the SDGs.

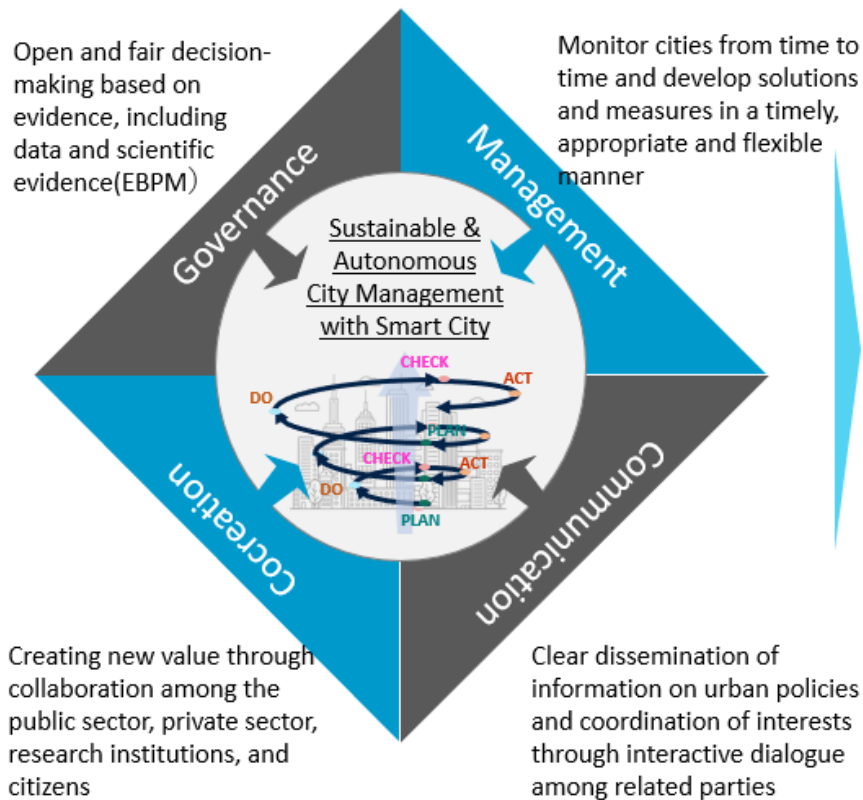
Regarding smart city initiatives, attention tends to be focused on advanced solutions using digital and ICT technology, but if we focus on the internal processes that lead to the creation of such solutions, in other words, the operating principles that support the functioning of smart cities, the following four elements are considered to be important.

- ❖ **Governance:** Open and fair decision-making based on various data, scientific evidence, etc.
- ❖ **Management :** Identify urban issues as needed and develop appropriate and flexible measures and solutions in a timely manner.
- ❖ **Communication :** Clear message dissemination and interest adjustment through interactive dialogue among various stakeholders
- ❖ **Co-creation :** Effective utilization of the resources of not only the public sector but also private companies, research institutions, and citizens, and creation of value through collaboration. In addition, an important prerequisite for all of this is the development of trust in smart city initiatives.

The elements described above are directly related to autonomous and sustainable urban management, that is, the ability of cities to formulate solutions based on their understanding of the issues, and to properly operate the process of implementing, continuously evaluating, and operating the solutions with qualified partners. Therefore, the support for smart cities in developing countries should not only include the provision of technologies and solutions, but also governance, management, communication, co-creation, and trust-building as a foundation (Enabling Environment) to ensure effective and high-quality support. The figure below illustrates autonomous urban management based on the smart city approach and its benefits.

Autonomous Urban Management through Smart City

It is important to enhance sustainable and autonomous urban management (the ability of cities to identify and solve their own problems).



Source: JICA Study Team

Benefits of Smart City

Through smart city initiatives and autonomous urban management, we aim to achieve urban sustainability, improve the quality of life for citizens, and achieve economic growth, as well as realize our vision for the city and achieve the SDGs.

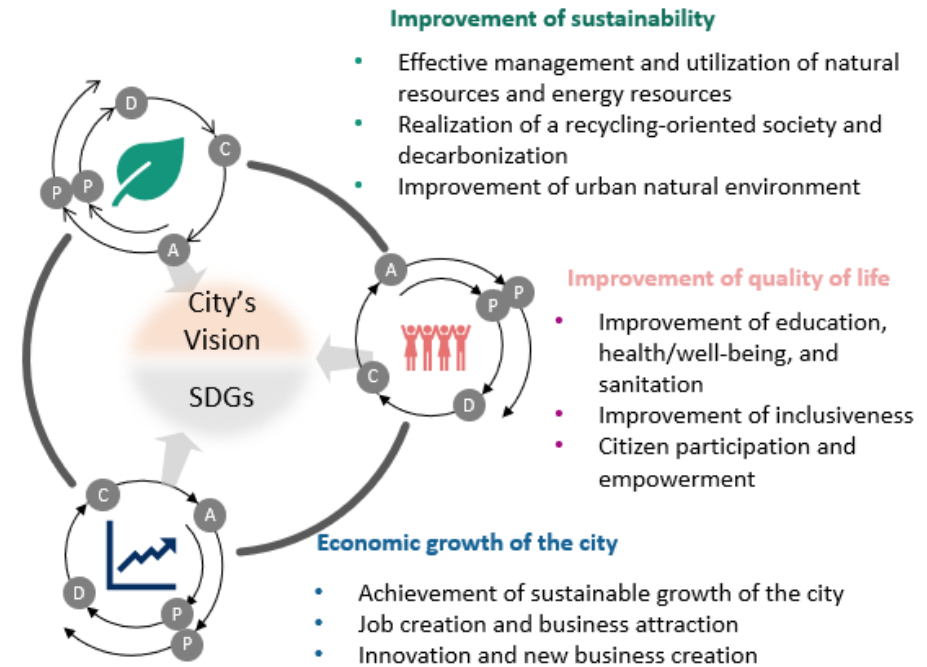


Figure 8-1 Autonomous Urban Management and Benefits Through Smart Cities

8-1-2 Co-creating the ASEAN Smart City Model

When we look at the efforts made by the early adopters in the smart city (e.g. Europe: Spain, France, the UK, Germany, the Netherlands, Denmark, Finland; North America: the US and Canada; Asia: Japan, South Korea, China, Singapore), several typical models can be classified as per wide-ranging factors such as the implementing body and the data utilization method. In the following section, four models of smart city are classified as per the overview and analysis in this study. These classified models take into account the representative elements in general terms, to highlight the uniqueness of each type considered, thus are not intended as a depiction of the actual situation of a specific country or a city. It should be noted, therefore, that in reality, different cities in the same country may adopt different approaches or may adopt a multi-layered approach that combines the several notable features from the various models presented.

Table 8-1 Classification of Smart City Models

Model	Tech-Driven	Participatory	Problem-Oriented	Centrally Driven
Features	Companies with capital and technological capabilities take the lead in providing value to citizens and users.	Focus on the welfare of society as a whole through initiatives led by local governments and citizens' groups	Governments and local governments form ad hoc partnerships.	Emphasis on realizing public interest and social inclusion through government and other initiatives
Main theme	Creation of innovation, economic promotion	Value co-creation, citizen-centered	Addressing specific urban issues	Ensuring public interest and social inclusion
Initiative	Mainly private companies	Mainly local governments and citizens' groups	Local governments, civic organizations, research institutions, etc.	Focus on national and local governments
Principles and mechanisms	Competition and efficiency through market principles	Openness, citizen participation	Sharing of assets and information, citizen participation	Coordination based on the management of the government, etc.
Data Utilization	Leverage data held by platform companies	Open and utilize (with citizens' consent) data from local governments, etc.	Information is coordinated and utilized by all relevant entities according to the purpose.	Centralized management and utilization of data by nations, cities, etc.
Typical tools for promotion	Partial outsourcing and deregulation of public services based on the public-private partnership system	Social experiments involving citizens, etc., and sharing of knowledge and expertise	Formation of cluster organizations and platforms	Intensive capital investment, including large-scale development, and active encouragement of specific technologies
Advantages	Sustainable growth through activities of the private sector	Autonomous growth of cities, empowerment of citizens	Efficient response to urban challenges	Speedy implementation of projects
Potential shortcomings	External diseconomies (e.g., environment), economic disparity, and lack of consideration for the vulnerable	Decision-making is costly and time-consuming.	Cross-sectional effort is likely to be limited.	Opportunities for companies and individuals to participate are likely to be limited.

Source: JICA Study Team

When considering support for smart city initiatives in the ASEAN countries, it is important to consider the urban challenges as well as the existing policy, social systems, cultures, climates, and histories of each country and city, instead of solely focusing on the precedents for analysis. In addition, the speed of policy development and the ability to implement it on the part of the government, as well as the stability of the government, which is

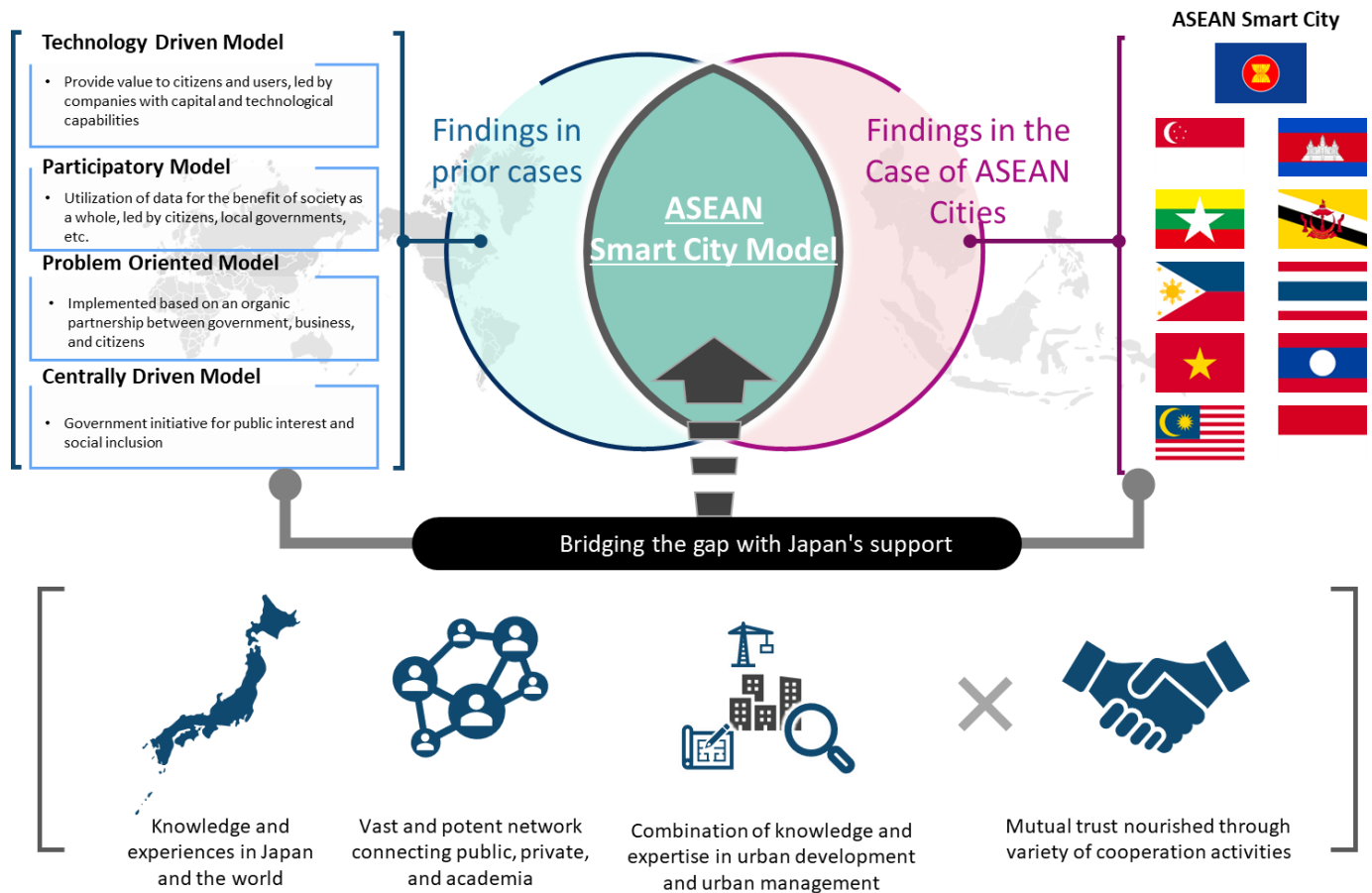
generally attributed to political risk, are also considered to have an impact. The following figure shows the functions and roles required of smart cities, the general common points indicated by the precedents, the points that require special attention in the ASEAN context, and the measures for ASEAN smart cities based on these points.

Discussion Points		Functions and Roles of Smart City		Implications for Smart City Strategies in ASEAN
		Common roles indicated by precedents (Common Matters)	Important role in the ASEAN context (Additional Matters)	
	Formation of Urban Space	<ul style="list-style-type: none"> Creating a space where citizens can live comfortably and safely Provide a place for community building and promotion 	<ul style="list-style-type: none"> + Promote orderly development even during rapid urbanization and expansion of urban areas + Maintain and promote urban communities that are unique to each country 	<ul style="list-style-type: none"> Promote Smart City based on a clear and appropriate vision, economic growth strategy, and urban planning with the involvement and leadership of the government and local governments Aim for inclusive Smart City where necessary services, social capital, and benefits are equitably provided to all, regardless of residential area, social class, personal attributes, education, or income level Sustain economic growth without exceeding natural resource and environmental tolerances Maintain a diverse and rich natural environment Complementing infrastructure development (hardware) and systems (software) with ICT and digital technologies to control investment costs and maximize benefits Sharing of technology, know-how, and assets through an organic framework of cooperation among various entities, including public-private partnerships Quick-win, small start businesses to build up success experience in a short period of time Formation of platforms and ecosystems for co-creation of solutions within ASEAN
	Sustainable Economic Growth of Cities	<ul style="list-style-type: none"> Sustainable growth of the city through the creation of new industries and innovations Job creation 	<ul style="list-style-type: none"> + Alleviating economic disparities within and among cities 	
	Citizen's Life and Urban Services	<ul style="list-style-type: none"> Utilizing digital technology to provide convenient and attentive urban services to citizens 	<ul style="list-style-type: none"> + Provide basic urban services to all citizens, irrespective of digital access or digital literacy in an efficient and inclusive manner. 	
	Sustainability	<ul style="list-style-type: none"> Decarbonizing Green Transition Encourage responsible economic activity, energy use, and consumption behavior by citizens and businesses 	<ul style="list-style-type: none"> + Balancing economic growth and reducing environmental impact 	
	Crisis Response and Resilience	<ul style="list-style-type: none"> Responding to risks that threaten the survival of society, human life, and assets, including climate change 	<ul style="list-style-type: none"> + Responding to Increasingly Severe Water Disasters and Earthquakes 	
	Infrastructure Development	<ul style="list-style-type: none"> Efficient operation using data on the effective use of existing infrastructure stock 	<ul style="list-style-type: none"> + Respond quickly and efficiently to infrastructure demands due to urban population growth, even within a limited budget 	
	Urban Management	<ul style="list-style-type: none"> Transparent and fair decision-making and implementation of policies based on the use of data 	<ul style="list-style-type: none"> + Continuous political commitment and budget security 	
	Partnership	<ul style="list-style-type: none"> Bring together the technologies and know-how of diverse entities to effectively solve urban issues 	<ul style="list-style-type: none"> + Addressing ASEAN-specific urban issues (transportation, environment, natural disasters, etc.) 	

Source: JICA Study Team

Figure 8-2 Functions and Roles Required for Smart Cities and Measures In ASEAN

In this regard, it is important to collect and utilize examples and knowledge of smart cities that have been tried out in ASEAN countries and to take the stance of co-creating an “ASEAN smart city model” with Japan and ASEAN, rather than simply applying the models of advanced countries to ASEAN. The figure below shows an image of the development of an ASEAN smart city model.



Source: JICA Study Team

Figure 8-3 Image of The Establishment of ASEAN-Type Smart City Model

The following table summarizes the key points of smart cities and the perspective for supporting smart cities described above.

Table 8-2 Key Points of Smart Cities and Important Perspectives for Support

Key points of smart cities	<ul style="list-style-type: none"> • Position “smart cities” as a “tool” or “means” for realizing better cities. • Promotion of evidence-based policymaking (based on data and scientific evidence) • Co-creation of value through the establishment of an implementation system based on industry-government-academia-private collaboration • Promote understanding among various actors including citizens and reflect their needs in urban policies • Fostering “trust” among stakeholders such as government, residents, and business.
Important perspectives for support	<ul style="list-style-type: none"> • Co-creation of ASEAN smart city model, incorporating the experiences in Japan and other cases around the world • Support through back casting approach to find the shortest distance from the “current situation” to the “ideal situation” • Support for continuous efforts by the “public” (local and regional governments) to take the initiative (ownership) and for the establishment of an implementation system to realize these efforts • Support for initiatives that can be accepted by users and residents and capacity building for residents • Pay attention to economic, social, digital infrastructure (including digital access) and digital literacy disparities, and support for efforts toward inclusive smart cities that reduce disparities • Support for the development of physical infrastructure, rather than focusing too much on ICT infrastructures. • Creation of mechanisms and business models that enable sustainable growth • Respect the diverse nature of emerging cities and develop initiatives based on the values of citizens and local needs, considering the history, background, and environment of the city • Maximizing the effect of support (leverage effect of ODA)

Source: JICA Study Team

8-1-3 Tailored Support based on the City’s Needs and Characteristics

Through the collection of information and analysis, it was found that the challenges and directions to be pursued differ greatly depending on the population, economic level, and characteristics of each country and city, as well as their awareness of “smart cities” and the maturity of their efforts also differ greatly from country to country and city to city.

Typical Issues by Classification of Cities	Classification of Cities by Characteristics			District/ Street
	Metropolitan Area			
Classification by Economic Scale	A	B	C	D
		Metropolises and Representative Cities Metropolises that represent ASEAN and economic center cities of the country	Core Regional Cities Local cities and core cities that have a certain size in terms of population and economy (excluding the major cities in A)	Cities specializing in specific industries Cities with specific industries (agricultural areas, industrial cities, tourist cities, etc.)
	Common Issue <ul style="list-style-type: none"> Traffic problems (traffic congestion) Deterioration of urban environment Generation of urban poor 	Common Issue <ul style="list-style-type: none"> Traffic problems (traffic congestion) Generation of urban poor Improvement of quality of life 	Common Issue <ul style="list-style-type: none"> Strengthening of the production base Improve convenience of living 	※Often unaffected by the economic scale of the country or city
1 LEADING GROUP (Singapore), (Burunei), Malaysia, Thailand [GDP per capita: 7,500 USD+]	Issue : <ul style="list-style-type: none"> To strengthen international competitiveness Expansion of maintenance and management of urban infrastructure City : Bangkok, Kuala Lumpur	Issue : <ul style="list-style-type: none"> Expansion of urban amenities Development of infrastructure for sustainable growth City : Johor Bahru, Kuching	Issue : <ul style="list-style-type: none"> High value-added industries Human resource development and attraction City : Kota Kinabalu, Chonburi, Phuket	Issue : <ul style="list-style-type: none"> Improvement of quality of life Provision of high-quality infrastructure services
2 TRANSFORMING GROUP Indonesia, Philippines, Vietnam [GDP per capita: 2,500 USD+]	Issue : <ul style="list-style-type: none"> Enhancement of urban productivity Improvement of quality of life City : Jakarta, Manila, Hanoi, Ho Chi Minh City	Issue : <ul style="list-style-type: none"> Deterioration of urban environment Inclusive provision of infrastructure and urban services City : Makassar, Danang	Issue : <ul style="list-style-type: none"> High value-added industries Increased environmental impact (due to inappropriate resource management) City : Cebu, Davao	City : Bangkok (Bangsoo), Chonburi (AMATA)
3 EMERGING GROUP Lao PDR, Cambodia, Myanmar [GDP per capita ~2,500 USD]	Issue : <ul style="list-style-type: none"> Leading economic growth Development of basic living infrastructure City : Vientiane, Phnom Penh, Yangon	Issue : <ul style="list-style-type: none"> Development of basic infrastructure Secure livelihood infrastructure for residents City : Mandalay, Nay Pyi Daw	Issue : <ul style="list-style-type: none"> Industrial development Weak industrial base Secure livelihood infrastructure for residents City : Siem Reap, Luang Prabang, Battambang, Banyuwangi	

Figure 8-4 Extracting challenges based on the characteristics of cities and the economic level of countries (replicated from Chapter 4)

Table 8-3 Readiness of ASEAN and major cities for smart cities (replicated from Chapter 5)

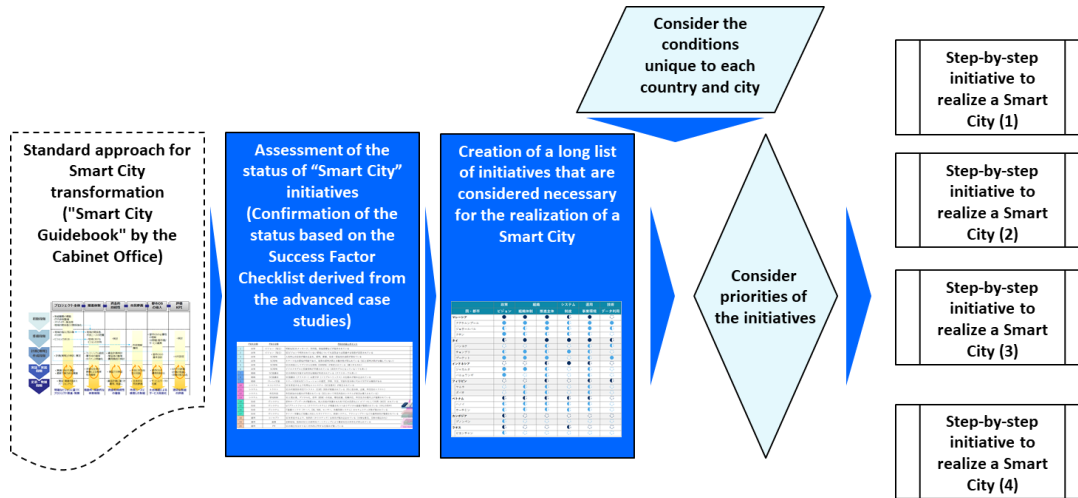
● Prepared ◐ Partially ○ Not prepared

Country and City	Policy and Vision	Organization	System	Technology	Operation
Malaysia	●	◐	●	◐	●
Johor Bahru	●	●	●	◐	●
Kuala Lumpur	◐	◐	◐	◐	◐
Kota Kinabalu	●	◐	◐	◐	○
Kuching	●	◐	◐	◐	○
Thailand	●	●	●	◐	◐
Bangkok	○	◐	◐	◐	○
Phuket	●	●	◐	◐	◐
Chonburi	◐	◐	●	◐	◐
Indonesia	●	◐	●	◐	◐
Jakarta	◐	●	○	◐	◐
Makassar	◐	◐	◐	◐	○
Banyuwangi	◐	◐	◐	◐	○
Philippines	○	◐	○	◐	◐
Manila	○	◐	○	◐	○
Cebu	○	◐	○	◐	○
Davao	○	◐	○	◐	○
Vietnam	◐	◐	○	◐	○
Hanoi	◐	○	○	◐	○
Ho Chi Minh	◐	○	○	◐	○
Da Nang	◐	○	○	◐	○
Lao PDR	◐	◐	○	◐	○
Vientiane	◐	◐	○	◐	○
Luang Prabang	◐	◐	○	◐	○
Cambodia	◐	◐	○	◐	○
Phnom Penh	◐	○	○	◐	○
Siem Reap	◐	◐	○	◐	◐
Battambang	○	○	○	◐	○

Source: JICA Study Team

As for specific support for smart cities, flexible support should be provided according to the needs of the target countries and cities at the level of “policy,” “organization,” “system (institution),” “technology,” and “operation” that they particularly want to enhance. In doing so, due consideration is needed to the above-mentioned perspectives of improving the capacity for autonomous urban management, the situation of each

country and city, and the key points when assisting developing countries.



Source: JICA Study Team

Figure 8-5 Procedure for considering smart cities in developing countries (replicated from Chapter 5)

8-2. Organization of JICA's Support Scope and Proposed Measures

8-2-1 Consideration of JICA's Support Menu

By utilizing JICA's current project framework such as Technical Cooperation, ODA Loans, ODA Grant, Public-Private Partnerships projects, etc., various possibilities of support can be considered depending on the target country and city.

This section provides examples of possible support measures in line with the five categories of “Assessment,” “Policy and Vision,” “Organization,” “System,” “Technology,” and “Operation,” which were set as the framework for smart city initiatives in this survey.

(1) Assessment

Support for Identification of Current Status, Future Plans and Needs, And Formulation of a Roadmap for Their Realization

- Comprehensive analysis and evaluation of the target country's master plans; urban development vision, strategy, and plan; and urban policy systems, institutions, and organizations related to smart cities; as well as current issues and future plans for infrastructure and urban services.
- Formation of a roadmap for promoting smart city initiatives.

(2) Policy and Vision

Support for Formulation/Revision of Urban Vision and Strategy

- National level: Support for the formulation of smart city strategies and policies, and digital strategies (DX strategies), and integration of those strategies with urban policies, construction of knowledge-sharing platforms, etc.
- Local government level/district: Support for the formulation of smart city strategies and visions for local governments or smart city districts, support for the formulation of development plans integrated with urban policies, etc.

(3) Organization

Support for Building/Strengthening Organizational Structures for Smart City Promotion

- National level: Formation of a platform for industry-government-academia collaboration (JICA could be involved here), support for the establishment and human resource development of smart city promotion organizations, support for start-up development, etc.
- Local government/district level: Formation of project implementation organizations, support for human resource development, support for procurement of services including technology support, preparation of TOR, technology evaluation, contracts, etc.

(4) System

Support for The Design/Strengthening of Smart City Systems (Institutions)

- National level: Support for the establishment of an ecosystem, including support for the formulation of smart city incentive systems and deregulation systems, and support for the design of evaluation and operation systems for technologies and solutions.
- Local government/district level: Support for setting and operating smart city KPIs, and support for building an ecosystem (including fund flows and business models) in local governments

(5) Technology

Support for Building an Environment for Data Utilization

- National level: Support for building an architecture that defines data collection, coordination, and utilization; support for establishing policies for data utilization; support for setting guidelines for personal information protection; support for cyber security measures
- Local government/district level: Support for promoting digitization, support for building an architecture for data

Support for Building IT Infrastructure and Open Data Platforms

- National level: Support for development of IT infrastructure
- Local government and district level: Support for building urban OS and IT infrastructure

Support for Providing Smart City Solutions

- (Common): Support for building smart city technologies and services

(6) Operation

Support for Providing Smart City Solutions

- (Common): Support for demonstration and dissemination of smart city technologies and services, support for building and operating a platform for sharing information and knowledge on smart city projects, and support for business matching, etc.

(7) Summary of Smart City Support

The following figure summarizes the support measures and contents for smart cities described above.

	Country Level	City · Municipality / District Level
Assessment	<p>Data collection survey: Understanding the current situation, plans, and needs, and formulating a roadmap for implementation</p> <ul style="list-style-type: none"> • Comprehensive analysis and evaluation of the target country's upper-level plans, visions, strategies, and development plans of cities, as well as urban policies, systems, and organizations related to Smart City (SC) • Diagnostic assessment of current issues in infrastructure and urban services, and future plans • Formulation of a roadmap related to SC 	
Policy	<p>Masterplan formulation survey, technical cooperation: support and dispatch of experts to Smart City organizations</p> <ul style="list-style-type: none"> • Formulating visions and strategies related to Smart City (SC) and Digital Transformation (DX) • Building a national SC investment strategy (business model) 	<p>Masterplan formulation survey, technical cooperation: support and dispatch of experts to Smart City organizations</p> <ul style="list-style-type: none"> • Formulating urban/ spatial development plans that incorporate SC and DX, and support for human resource development • Formulating SC-related infrastructure (including ICT, city OS, etc.) development plans
Organization	<p>Technical cooperation: Support and dispatch of experts to Smart City organizations</p> <ul style="list-style-type: none"> • Establishment of SC promotion organizations (promoting agencies, cross-ministry organizations) • Human resource development for ICT related organizations • Building an organizational structure for private, public, and academia; collaboration and human resource development 	<p>Technical cooperation: Support and dispatch of experts to Smart City organizations</p> <ul style="list-style-type: none"> • Establishment and human resource development of SC promotion organizations (committee, supervisory organizations) for local governments and projects • Procurement of services (technologies), such as: preparation of Terms of Reference, technical evaluation, contracts
System	<p>Technical cooperation : Support for operation of SC, dispatch of experts</p> <ul style="list-style-type: none"> • Establishment of institutional framework for SC (evaluation system, incentives, deregulation) • Establishment of ecosystem (including funding system) 	<p>Technical cooperation : Support for operation of SC, dispatch of experts</p> <ul style="list-style-type: none"> • Establishment of institutional framework (evaluation system, demonstration project scheme) for SC in local governments • Formulating business plans and schemes
Technology	<p>Technical cooperation : Support for SC technologies, dispatch of experts</p> <ul style="list-style-type: none"> • Supporting policies for data utilization and data governance • Cyber security measures • Implementation of national-level initiatives (e.g., E-Government) 	<p>Technical and Financial assistance / SME Partnership and SDG Business program: Feasibility and Verification survey, infrastructure support</p> <ul style="list-style-type: none"> • Building data platforms and city OS • Procurement of technologies for SC implementation and support for establishing testbed • Infrastructure development and smart service demonstrations
Operation	<p>Technical cooperation : Building a platform for knowledge sharing</p> <ul style="list-style-type: none"> • Sharing of knowledge and lessons learned, while strengthening of cooperation among relevant entities • Modification and improvement of systems, organizations, and mechanisms • Establishment and strengthening of wide-area relationships including other cities (including expansion to other cities) 	

* SC = Smart City | DX = Digital Transformation

Source: JICA Study Team

Figure 8-6 Support measures for smart cities

8-2-2 Scope of JICA’s Support and Measures

It is important to approach the five elements of smart city “policy and vision,” “organizational structure,” “system,” “technology,” and “operation” in a holistic manner rather than individually.

On the other hand, it is not realistic to implement everything in parallel at one time, and it is desirable to provide flexible support according to the needs of the target countries/cities at the level to be strengthened. The order of implementation will vary depending on the situation of each country/city, and priorities for implementation should be determined based on a thorough understanding of the situation in each country/city.

As mentioned above, it is difficult to say the specific initiatives or support should be taken, but the initiatives will likely differ to some extent depending on the maturity of smart city initiatives in the country/city. The figure below illustrates the differences.

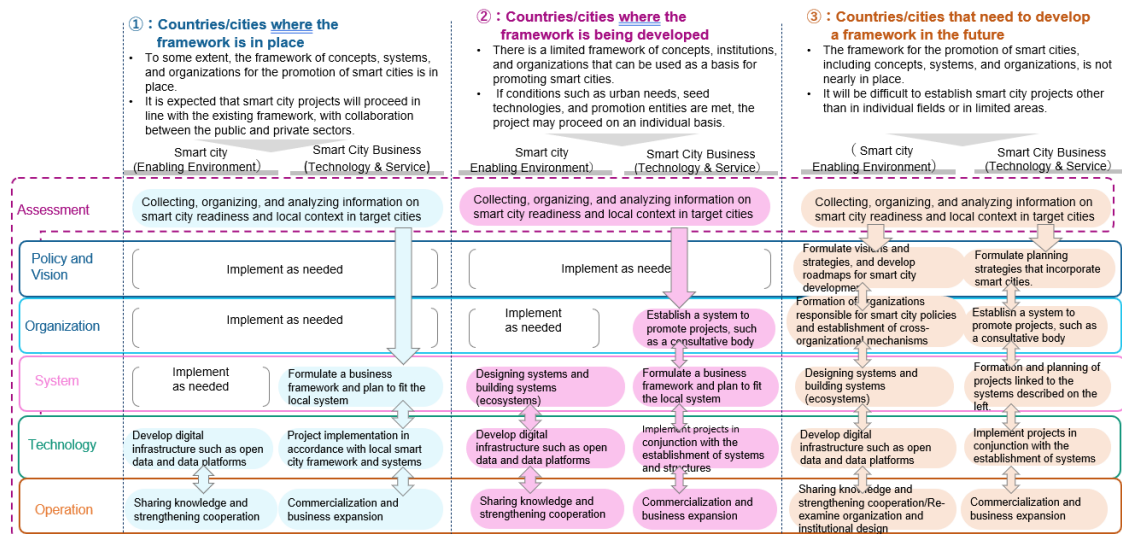


Figure 8-7 Approaches and directions for smart cities by readiness (replicated from Chapter 5)

For countries and cities that have already established a framework for smart city initiatives to some extent, the support in the areas of “institutions (systems),” “technology,” and “operation” could be effective. For countries and cities that are in the process of developing the frameworks for smart city, there is a potential for support in the areas of “policy and vision” and “organizational structure. For countries and cities that do not yet have a framework in place and are in the process of developing one, it could be possible to work with them to create a “policy and vision” (for some countries and cities, it also could be possible to provide small-scale support from the perspective of “technology” and “operation” and then link this to “policy”). It is also important that smart city initiatives evolve in a continuous and long-term sustainable manner, and support for smart city initiatives (or support for the implementation of related projects, introduction of technologies, etc.) should be provided under a long-term and integrated program.

8-3. Case Study on Smart City Support by Other Organizations

In developing countries, there are many countries and cities already receiving support from countries and organizations for the realization of smart cities. When implementing smart city support in developing countries, it is necessary to pay attention to the consistency with these initiatives.

8-3-1 Korea “The K-City Network Program”

(1) Overview

A G2G program launched in 2020 that supports the discovery and development of smart city projects and the packaged transfer of technology to overseas cities. The program consists of urban development type and solution type.

Implementing Entity

Ministry of Land, Infrastructure and Transport (MOLIT) of Korea

Secretariat

Korea Overseas Infrastructure and Urban Development Corporation (KIND;
www.kindkorea.or.kr)

Contents

The following three programs are prepared.

1. Smart City Planning

Overview

A project to jointly discover and develop projects with the host national government for smart city development proposals selected by MOLIT to conduct technical exchange and seek to cooperate in future projects.

Contents

1) Supporting the implementation of the basic concept, master plan, and preliminary FS/FS of smart city projects promoted by the host government. A Korean contractor/consultant will be dispatched to the host government for each project, and basic investigations/plans will be formulated through consultations with the host government and MOLIT.

2) Implementation of training in South Korea to share knowledge and experience on smart city development in South Korea.

Target of Support

- Central Government (Central Ministries Overseeing Smart City Development Project)
- Local governments (municipalities, provinces, local governments, and other governments governing smart city development projects)

Target Project

- Medium-and large-scale smart city projects (e.g., Newtown, industrial park, house district) that require the development and operation of smart city solutions

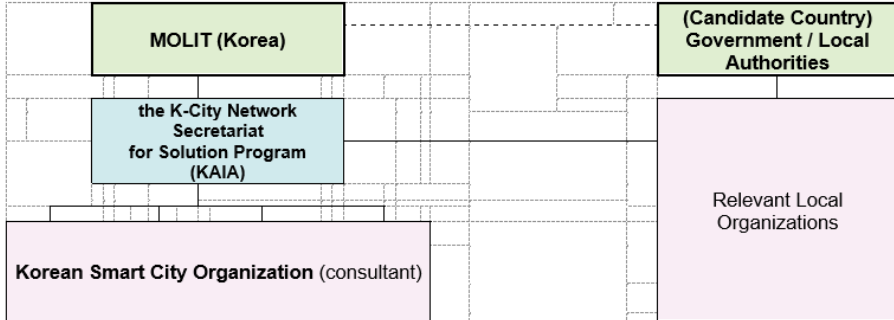
*Projects intended for construction only or those implemented for research purposes cannot be applied for. Projects with proposals included in the higher-level formula development plan or with the necessary budget are given priority.

*Existing projects that are being promoted jointly with public corporations and organizations in Korea are also subject to application.

Funding

USD 0.4 million to USD 0.6 million per project

*Funding is carried out by the consultants employed in each project.

<p><u>Number of Cases</u> Max. 4 cases (2021)</p>
<p>2. Smart Solution Planning</p>
<p><u>Overview</u> A project to support the planning of developing and applying Korea's smart city solutions to smart city projects that foreign governments are considering and implementing.</p> <p><u>Contents</u> 1)Project planning support for developing smart city solutions (services, platforms, and systems) to solve urban problems such as traffic and the environment. 2)Proposing smart solutions and supporting FS implementation to solve major urban problems based on present condition analysis of cities 3)For projects with high feasibility as a result of FS, incentives are provided when applying to the smart city solution demonstration project in the following year.</p> <p><u>Target of Support</u> · Central and local government bureaus, agencies, and public bodies</p> <p><u>Target Project</u> · Projects with comprehensive plans (concept design, master plan, FS, etc.) and budgets for smart cities rather than just infrastructure development and research and development</p> <p><u>Funding</u> USD 0.3 million per project *A Korean consultant is adopted for each project. The budget is implemented by MOLIT.</p> <p><u>Period</u> Up to 10 months</p> <p><u>Number of Cases</u> Max. 4 cases (2021)</p> <p><u>Example of Implementation System</u> - 《Implementation Structure (example)》</p> <p>* The Structure may be subject to change over the course of the program.]</p>  <pre> graph TD MOLIT[MOLIT (Korea)] --- KAIA[the K-City Network Secretariat for Solution Program (KAIA)] KAIA --- KSCO[Korean Smart City Organization (consultant)] MOLIT --- CCGA["(Candidate Country) Government / Local Authorities"] CCGA --- RLO[Relevant Local Organizations] </pre>
<p>3. Smart Solution Demonstration</p>
<p><u>Overview</u> Provides opportunities to demonstrate solutions developed by Korean companies in countries other than Korea. This program began since 2021.</p> <p><u>Contents</u> 1)Support for demonstration activities such as field surveys and demonstrations of Korean-type smart city solutions in overseas cities, deployment and dissemination of technologies, and selection of test sites</p>

2) Follow-up support for outstanding projects through international joint programs, including matching funds, to further expand solutions and improve technologies.

Target of Support

Korean organization or company that retains a smart solution developed in Korea and has demonstrated (or is in preparation) overseas

*When applying, it is necessary to form a consortium with an international partner organization.

Target Project

1) A foreign city suitable for demonstrating smart city solutions developed in Korea and willing to integrate Korean smart city technologies

2) Smart-city solutions developed in Korea to demonstrate overseas (services, platforms, and systems that ensure the quality of life of citizens and contribute to efficient urban operation in various aspects of urban life, such as traffic, energy, environment, security, and urban administration) that are stand-alone or packaged.

Funding

USD 0.4 million to USD 0.6 million per project

Period

Up to 11 months

Number of Cases

Max. 3 cases (2021)

Example of Implementation System



* The above shows a sample structure to pursue the project that may vary upon the proposal.

(2) Implementation Status

Status of Applications for 2021¹

- According to MOLIT, there were 111 applications in 2021 from 39 countries. The breakdown is as follows. The selection results will be announced on June 23.
 1. Smart City Planning: 57 cases (from Vietnam, Philippines, and Botswana, requests for cooperation in the development of smart cities; from Uzbekistan to the construction of satellite cities; from Belarus to the designation of development areas; and from Paraguay to the development of industrial parks).
 2. Smart Solution Planning: 40 cases (13 cases of traffic, 4 cases of urban management, 5 cases of environmental protection, 5 cases of safety)
 3. Smart Solution Demonstration: 14 cases (3 cases in the traffic field, such as smart parking and streetlights, 4 cases in the water management field, 2 cases in the safety field, and 2 cases in the communication field)

¹<https://pulsenews.co.kr/view.php?sc=30800022&year=2021&no=405338> (accessed on 5/18/2021)

Fiscal 2020 Results

Of the 80 applications from 23 countries, 12 projects from 11 countries were selected. The list of projects is as follows.

1. Smart City Development Projects

Country Name	Project Name	Classification	Overview
Indonesia	Smart City Project for Indonesian New Capital City	Basic Plan Formulation	Establish three basic plans for smart traffic, waste management, and water resource management in East Kalimantan, which is the construction site of the new capital.
Malaysia	Kota Kinabalu Smart City Project	Master plan formulation	The results of the basic plan obtained in the first G2G project will be further developed, and a master plan will be formulated to solve urban problems such as the residence of illegally occupied persons and traffic congestion.
Myanmar	Development Project of a priority development zone in Dala New Town	FS	Implement FS for smart city development and smart solution introduction (traffic management solutions, disaster management solutions, etc.) in priority development areas within the New Town premises.
Peru	Smart City Development Project for Astete Airport Area	Master plan formulation	To cope with the high population density and traffic congestion, which is becoming an urban problem because it is close to the tourist site Machu Picchu, a master plan on smart city development around Astete Airport will be formulated.
Russia	Smart city concept on the example of Bolshoy Kamen urban district in Primorsky Territory	Concept Plan Formulation	Develop smart city strategies in Bolshoy Kamen as part of extensive development plans in the Far East, such as the Zvezda Shipyard Project.
Vietnam	Technical Assistance for development Smart City Development in the Mekong Delta Region Pilot Program	Formulated pre-FS	Conduct a pre-feasibility study to present an urban model that is resistant to climate change as a pilot smart city project in the Mekong Delta region

2. Smart Solution Development Projects

Country Name	Project Name	Classification	Overview
Colombia	Establishment of the National Intelligent System for Infrastructure, Transit, and Transport	Master plan formulation	Formulate a master plan for the project for building the “National Intelligent System for Infrastructure, Transport and Transportation” (inter-city network of the Traffic Information Center) in Bogota.
Laos	Vientiane Urban	Master plan	To cope with water problems such as

	Drainage System Improvement Project	formulation	floods and pollution that occur frequently in Vientiane, a basic plan for improving urban wastewater systems will be formulated.
Mongolia	Ulaanbaatar City Urban mobility smart platform	Basic Plan Formulation	A basic plan for urban mobility platform development in Ulaanbaatar City will be formulated, and cooperation for ITS to the city, which has already introduced public transport card systems and bus information systems of Korea, will be expanded.
Thailand	Khon Kaen Smart City Mobility Master Planning	Master plan formulation	Formulate a master plan for smart city mobility system development projects in Khon Kaen.
Turkey	Gaziantep Smart City Data Coordination Centre	Master plan formulation	To improve urban traffic flow, safety, and security, develop a master plan for the project to establish the Smart City Data Coordination Center in Gaziantep for integrated management of urban data.
Turkey	Disaster Prevention Management DSS Smart City Project in Ankara	Basic Plan Formulation	To strengthen the preparedness and response to disasters of Ankara City, a basic plan on developing disaster prevention control systems will be formulated.

8-3-2 ADB's Smart City Initiatives

(1) About livable cities

Livable cities are a concept that puts people and community happiness at the heart of urban development and decision-making, and ADBs set “making cities more livable” as one of the seven priorities set out in the “Strategy2030”.

- ADB’s have developed an Operational Plan for their seven priorities and illustrated the direction and approaches of support.
- Initiatives toward smart cities are described as one of the concrete support activities in the Operational Plan.

The outline of operational plan of livable cities is as follows.

1) The Livable Cities Operational Plan 2019-2024 (2019)

Purpose

- ADB has established a direction and methodology for supporting the creation of environmentally friendly, competitive, comprehensive and resilient cities in developing member states (Developing Member Countries: DMCs).
- Strategic priorities are set in implementing support for the development of appropriate systems, policies, and environmental arrangements for DMCs cities to become more residential.

Priority areas and results

1. Improving the quality, efficiency, and reliability of services in urban areas

Results 1. Improved performance of urban (society) service providers

Results 2. Improvement of urban infrastructure and services

2. Strengthening Urban Planning and Urban Financial Sustainability

Results 1. Improvement of regulations and legal system environment for comprehensive planning

Results 2. Implementing reforms and policies to improve financial sustainability in urban

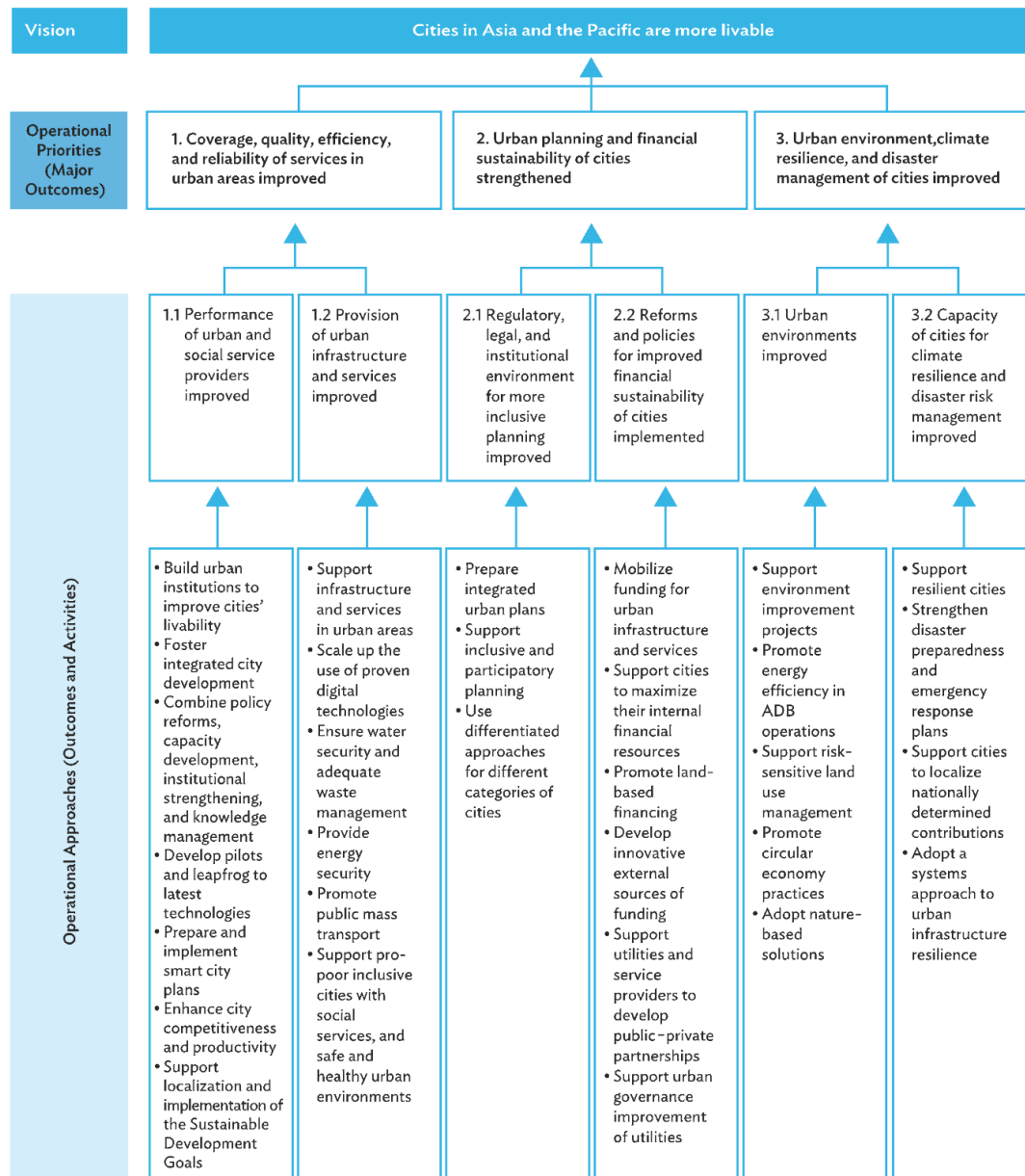
3. Urban environments, resistance to climate change, and improved and reinforce disaster management

Results 1. Improvement of urban environment

Results 2. Urban capacity improvement for climate change and disaster risk management

Operational Plan framework is illustrated in the figure below.

**Figure: Framework of Operational Priority 4 of Strategy 2030
Making Cities Livable: Vision, Operational Priorities, and Approaches**



Source: Asian Development Bank.

Source: <https://www.adb.org/sites/default/files/institutional-document/495966/strategy-2030-op4-livable-cities.pdf>

Figure 8-8 The Livable Cities Operational Plan Framework

(2) Initiatives in Smart Cities

Support activities to improve the performance of urban service providers include the development of smart city plans and support for their implementation. Specifically,

- Supporting the development of systems for making data-driven decisions toward the implementation of smart city plans
- Support for the development of comprehensive smart city plans to build technical and organizational capacities to benefit from new technologies and digital solutions.

Smart City (Technology)-Related Projects

1. Intelligent Transport System in Guizhou (2019, China)

ADB signed a \$ 200 million grant in 2019 to develop an intelligent transport system in Guizhou Province, China that aims to improve transport safety, mitigate air pollution, and mitigate traffic congestion.

In this project, monitoring of traffic volume and weather in real-time, management and operation center of complex traffic system, integrated traffic operation, safety and emergency management system, etc. will be improved. Sustainable transport infrastructure will also be developed, such as clean energy buses and bus stations, and charging stations for electric vehicles.

2. Piloting Smart Devices for Drinking Water Management in Dhaka (2018, Bangladesh)

As part of the “Smart Drinking Water Management in Southern Asian Cities,” smart water devices were introduced on a trial basis in major cities such as Dhaka in Bangladesh. The program aims to improve the capacity of water utilities and increase their operational efficiency and financial sustainability. In the test stage, twelve smart meters, one base station and one monitoring station were installed.

8-3-3 The World Bank's Perspectives to Smart City

The World Bank shows the direction to smart cities as follows.

1. A technology-driven city where sensors are installed everywhere, and information collected in real-time from thousands of interconnected devices provides a very efficient public service. For example, garbage bins have sensors that indicate they are full, trash collectors follow specific routes based on that information, and all buildings become “intelligent” with smart meters and energy-saving systems, and do not suffer from the use of transport, etc.
2. Cities that use available technology to foster better relationships between citizens and administrators. It relies on feedback from citizens to help improve service provision and creates a mechanism to collect that information. For example, citizens more actively manage their own areas. Open governance data is used by civil society to jointly create smartphone applications (or SMS services). Also, if you report that the bin is full, the trash collector can change the route based on that information.

(1) Smart City Development Framework²

The World Bank presents five components as Smart City Development Framework:

Smart Governance Roadmap

- The starting point is not only to understand existing infrastructure, but also to lay the way for realizing smart city models in the next five to ten years. Based on this future-oriented diagnosis, action plans and investment roadmaps tailored to the circumstances of each city are proposed.

Identification of Urban Priorities

- In parallel, dialogue sessions with major stakeholders are also held. Communities of civil society organizations, local universities, software developers, public officials, and experts in each area will gather together to discuss main needs and priorities, centering on what can be solved with technology. Sharing examples of other countries and cities to further clarify problems.

Co-Creation of Solutions.

- There are several options in cities for identified challenges. For example, they can develop specific applications directly, participate in events such as hackathons and app challenges to cloud-sourcing solutions, or promote innovation and entrepreneurial spirit. It is also possible for interdisciplinary teams to co-develop solutions in an innovative approach through collaboration with academia and private companies. Such activities aim to create prototypes and concepts, test them on-site (in this case, cities), create a favorable cycle of feedback from citizens and adaptation and response from the administration, and create new or improved services.

Urban Innovation Laboratory

- Maintaining the traction and momentum created by this co-creation process will require space to facilitate the continuous exchange of all of the above stakeholders and to test new ideas and solutions in a fail-safe environment. This Urban Innovation Laboratory leads the future iteration of the proposed process and supports stakeholders to think of problems and solutions to improve the quality of life in their cities.

Networked Cities.

- Finally, cities that have undergone such processes can build networks to share

² <https://www.worldbank.org/en/topic/digitaldevelopment/brief/smart-cities>

applications and practices. That way, we can not only learn from other experiences and build solutions, but also maximize their value by sharing the developed solutions with their colleagues. Such networks can also collaborate with networks already present in Europe and the United States (such as the European Network of Living Labs and Open Cities initiative).

(2) Ongoing Initiatives Related to Smart Cities

The following are some of the initiatives that the World Bank has implemented or is currently implementing related to smart cities.

1) Global Smart City Partnership Program (GSCP) (Korea)³

Overview:

The purpose is to strengthen the ability to plan and implement smart city projects by utilizing best practices and networks of smart city implementers and experts around the world.

Component 1) Just-in-Time (JIT) Technical Assistance and Operation Support

- Support for project preparation and implementation:
- Provide JIT technical support to the World Bank team and customers.
- Incorporate Smart City elements into World Bank projects.

Component 2) Knowledge sharing and its popularization

- Support for business development:
- Providing online hubs for networking and learning
- Providing cross-sectoral knowledge resources
- Support for strategic knowledge and learning activities
- To promote Peer-to-Peer learning opportunities

Implementing entities:

- World Bank (dispatch of experts),
- Korea (funding and technical contributions)

Funding:

- Ministry of Land, Infrastructure and Transport (MOLIT) of Korea
- Korea-World Bank Partnership Facility (KWPF)

Contribution:

US\$1,900,000(KWPF)

Content:

Expanding the concept of smart cities to the world and utilizing what we have learned from Korean experience to support the development of best practices for selective smart cities as components for sustainable urban development. It aims to improve public engagement accountability and to improve urban planning, management, and service provision by making full use of data, technology, and available resources. This initiative will also support smart city frameworks and approaches using practical examples and concrete how-to tools.

³ <https://www.worldbank.org/en/programs/korea-world-bank-group-partnership-facility/brief/kwfp-smart-city-support>
https://olc.worldbank.org/system/files/3_GSCP-Hyoung%20Gun%20Wang.pdf

LINK 4 PLAYERS OF GLOBAL SMART CITY NETWORK



Source: JICA Study Team

Figure 8-9 Networking of GSCP

2) Smart Cities Mission (SCMs) (India)⁴

Overview:

The Indian Government (GoI) launched Smart Cities Mission (SCMs) in June 2015. SCM aims to “develop compact areas sustainably and comprehensively and construct reproducible models that will serve as a reference for other ambitious cities”. A total of 100 smart cities will be targeted and selected smart cities will be provided with subsidies of Rs 50 billion each from Indian and state/urban municipalities (ULBs).

Implementing entities

- Government of India (GoI),
- World Bank

Funding:

- Government of India (GoI),
- State Government/Urban Local Body (ULB),
- Ministry of Housing and Urban Affairs (MoHUA)

Contributions:

USD 500 million (ISCP described below)

Content:

In SCM, cities were selected through a two-stage process. In the first stage, the state government selected candidate sites for smart cities based on the standards, and in the second stage, each city remaining in the final selection made a smart city proposal (SCP), which was evaluated and ranked in a nationwide urban challenge competition. The selected smart cities will establish a special purpose company (SPV) jointly owned by ULB and state governments and begin implementing the plan. Ministry of Housing and Urban Affairs (MoHUA) also began (MoHUA-World Bank India Smart Cities Program (ISCP as a performance-based incentive-type subsidy). In this program, smart cities with excellent performances can receive additional grants from MoHUA. The total budget for ISCP is US\$500 million, of which approximately \$480 million is available as a performance-based incentive subsidy, with the remainder to support capacity building and project administration on-demand at the state and SPV levels.

⁴ <http://mohua.gov.in/upload/uploadfiles/files/Detailed%20Note%20on%20the%20program.pdf>

8-3-4 UN Habitat's Smart City Initiatives

People-Centered Smart Cities

Launched in 2020, UN Habitat's flagship program "People-Centered Smart Cities" acknowledges the transformative potential that digital technologies can have for sustainable urban development. Through the People-Centered Smart Cities flagship program, UN-Habitat provides strategic and technical support on digital transformation to national, regional and local governments.

UN-Habitat has compiled best practices from government, the private sector and civil society into five pillars of people-centered smart cities.

(1) 5 Pillars of People-Centered Smart Cities

5 pillars and the activities of the people-centered smart cities are shown below.

1) The Community Pillar

This pillar addresses how local governments can work to place people and their needs at the center of smart city development.

Activity 1: Center smart city activities on people's needs

Activity 2: Ground smart city infrastructure and services in Digital Human Rights by maximizing community participation, representation, transparency and control.

Activity 3: Provide digital public goods that are open, transparent, accessible, interoperable

2) The Digital Equity Pillar

This pillar addresses how to build equitable access to ICTs with a focus on internet connectivity, digital skills, and digital devices

Activity 4: Build a foundation of universal access to affordable internet, digital skills and digital devices.

3) The Infrastructure Pillar

This pillar addresses how to drive inclusive digital transformation by developing systems, processes and policies for managing data and digital services.

Activity 5: Improve the convenience and accessibility of services by digitizing them.

Activity 6: Create a data governance framework that sets standards and responsibilities for effectiveness, accountability and inclusivity.

4) The Security Pillar

This pillar addresses how local governments and national governments can work in unison to achieve secure smart city assets including data and infrastructure in order to improve public trust.

Activity 7: Safeguard public trust by protecting smart city assets

5) The Capacity Pillar

This pillar addresses how to develop multi-stakeholder partnerships and build organizational capacity that better facilitates people-centered smart cities.

Activity 8: Collaborate with diverse stakeholders to build smart city projects, infrastructure and services.

Activity 9: Expand the capacity of city staff for digital transformation.

Activity 10: Evaluate the need for technology and address equity, environmental justice and social justice in smart city initiatives.

(2) Initiatives of Flagship Program” People-Centered Smart Cities” By UN-Habitat

1) Program Goals

1. POLICY TRANSFORMATION

Increased focus and mainstreaming of people-centered, sustainable and inclusive digital transition as a critical policy topic in high-level political forums and global dialogues on smart cities.

2. FINANCING DIGITAL URBAN INNOVATION

Increased investment and financing for people-centered smart cities to accelerate the achievement of the SDGs with a specific focus on developing countries, small and medium-sized cities and grassroots urban communities.

3. DIGITAL EMPOWERMENT & CAPACITY BUILDING

Enhanced capacity of governments at all levels to adopt a people-centered, privacy-enhancing, and rights-preserving approach to digital technologies for inclusion and sustainable urban development in the achievement of the SDGs.

2) Timing and Milestones

This flagship program is intended to run for at least 8 years and provides an overall umbrella that will include a variety of pilot projects, coordination mechanisms, policy and normative tools, technical advisory services and the financing facility.



Source: https://unhabitat.org/sites/default/files/2021/01/fp2-people-centered_smart_cities_04052020.pdf

Figure 8-10 Timeline of “People-centered Smart Cities” program

3) Regional Projects

Potential locations for the roll-out of the flagship program include: Bahrain; Brazil; Cambodia; Côte d’Ivoire; Egypt; France; India; Indonesia; Jordan; Kazakhstan; Kenya; Lao PDR; Lebanon; Malaysia; Mexico; Myanmar; Nigeria; China; Republic of Korea; Russian Federation; Rwanda; Saudi Arabia; Senegal, South Africa; Spain; Sweden; Thailand; Vietnam; Zimbabwe.

4) Budget

The flagship program,” People-centered Smart Cities”, given its scope (global, regional, national and local) and the range of activities, is estimated at around USD 30 million over

10 years. UN-Habitat will drive the development, implementation and monitoring of the program in conjunction with a wide range of credible and experienced partners.

The purpose of the multi-stakeholder digital urban innovation fund and challenge-driven innovation program is to create a proposition that is sufficiently interesting and relevant for member states and private sector companies to join forces. The aim is to raise USD 10 million in funding and get soft commitments of an additional USD 1 billion from development banks, philanthropists and private capital that can be invested in identified bankable projects.

Appendix:

Promotion Leaflet

JICA'S SUPPORT

JICA's approach : Cooperation for smart cities through "Co-creation" based on "Trust"

JICA will work together with a variety of partners - public, private, academia, and citizens - leveraging on the mutual trust developed through various cooperation activities, to facilitate the necessary initiatives for a sustainable smart city.



Leveraging knowledge and experiences in Japan and the world



Diverse domestic and international networks across industry, government, and academia



Combination of knowledge and expertise in urban development and management



Mutual "trust" developed through variety of cooperation activities

Specific cooperation

Below are the examples of supports and activities for smart city to be provided by JICA.

Country Level

City • Municipality / District Level

	Country Level	City • Municipality / District Level
Assessment	Data collection survey: Understanding the current situation, plans, and needs, and formulating a roadmap for implementation <ul style="list-style-type: none"> Comprehensive analysis and evaluation of the target country's upper-level plans, visions, strategies, and development plans of cities, as well as urban policies, systems, and organizations related to Smart City (SC) Diagnostic assessment of current issues in infrastructure and urban services, and future plans Formulation of a roadmap related to SC 	
Policy	Masterplan formulation survey, technical cooperation: support and dispatch of experts to Smart City organizations <ul style="list-style-type: none"> Formulating visions and strategies related to Smart City (SC) and Digital Transformation (DX) Building a national SC investment strategy (business model) 	Masterplan formulation survey, technical cooperation: support and dispatch of experts to Smart City organizations <ul style="list-style-type: none"> Formulating urban/ spatial development plans that incorporate SC and DX, and support for human resource development Formulating SC-related infrastructure (including ICT, city OS, etc.) development plans
Organization	Technical cooperation: Support and dispatch of experts to Smart City organizations <ul style="list-style-type: none"> Establishment of SC promotion organizations (promoting agencies, cross-ministry organizations) Human resource development for ICT related organizations Building an organizational structure for private, public, and academia; collaboration and human resource development 	Technical cooperation: Support and dispatch of experts to Smart City organizations <ul style="list-style-type: none"> Establishment and human resource development of SC promotion organizations (committee, supervisory organizations) for local governments and projects Procurement of services (technologies), such as: preparation of Terms of Reference, technical evaluation, contracts
System	Technical cooperation: Support for operation of SC, dispatch of experts <ul style="list-style-type: none"> Establishment of institutional framework for SC (evaluation system, incentives, deregulation) Establishment of ecosystem (including funding system) 	Technical cooperation: Support for operation of SC, dispatch of experts <ul style="list-style-type: none"> Establishment of institutional framework (evaluation system, demonstration project scheme) for SC in local governments Formulating business plans and schemes
Technology	Technical cooperation: Support for SC technologies, dispatch of experts <ul style="list-style-type: none"> Supporting policies for data utilization and data governance Cyber security measures Implementation of national-level initiatives (e.g., E-Government) 	Technical and Financial assistance / SME Partnership and SDG Business program: Feasibility and Verification survey, infrastructure support <ul style="list-style-type: none"> Building data platforms and city OS Procurement of technologies for SC implementation and support for establishing testbed Infrastructure development and smart service demonstrations
Operation	Technical cooperation: Building a platform for knowledge sharing <ul style="list-style-type: none"> Sharing of knowledge and lessons learned, while strengthening of cooperation among relevant entities Modification and improvement of systems, organizations, and mechanisms Establishment and strengthening of wide-area relationships including other cities (including expansion to other cities) 	

* SC = Smart City | DX = Digital Transformation

*This material is prepared based on the Study: "Data Collection Survey on Application of Smart City Approach." Full report is available through JICA Library Portal Site. (<https://www.jica.go.jp/english/about/organization/library/index.html>)



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Japan International Cooperation Agency (JICA) is in charge of administering all Japanese ODA such as technical cooperation, Finance and Investment Cooperation and Grants in an integrated manner. JICA, works in over 150 countries and regions and has some 90 overseas offices.



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www.jica.go.jp/activities



SMART CITY APPROACH TOWARDS SUSTAINABLE URBAN MANAGEMENT

An approach for transforming the emerging cities into smart cities



JICA'S MIND

Cities in developing countries are undergoing rapid urbanization and this poses numerous urgent challenges in terms of infrastructure, basic services, economy, health, education, security, and natural resources, among others.

In addressing these challenges, while also ensuring sustained and inclusive economic growth; social and cultural development; and environmental protection, improvement of the city management is vital.

Smart cities – urban management practices utilizing ICT and urban data - are increasingly drawing attention to their potential to transform how cities provide infrastructure and basic services, enhance citizen participation, strengthen city governance, and enable leapfrogging evolution. On the other hand, the disruptive innovations brought about by these initiatives must not be undesirable to the citizens; the security and reliability of the data must be ensured.

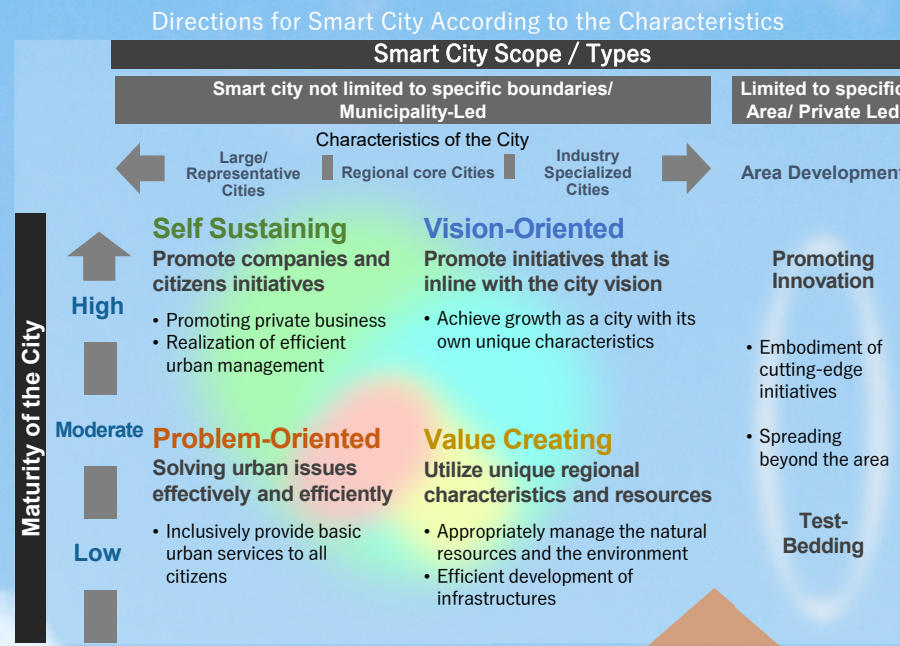
In the context of emerging cities, it is important to emphasize: making sure infrastructure and basic services are equally and inclusively provided to all citizens; catalyzing new solutions through co-creation among various stakeholders including the public, the private, the academia, and the civic; and facilitating mutual communication between citizens and government. JICA envisages that the initiatives towards the smart city will help to nurture trust among the stakeholders and in the system itself, thereby creating a firm foundation for sustainable urban management.



WHERE IS YOUR POSITION

Directing development according to the unique characteristics and challenges of each city

The situation of each country and city varies in economy, size, and attributes, among others. It is important to identify and implement initiatives based on the individual situation to resolve challenges under a shared vision with various actors and the citizens. The content of the initiatives shall also differ greatly depending on the implementing entities (national government, local government, private sector, etc.), therefore it is important to consider approaches tailored to the given situation.



Action!

Smart city approaches according to their stage

After assessing the status of the city in terms of five smart city domains of "policy", "organization", "system" "technology", and "operation", as well as the conditions unique to each city, the optimal initiatives shall be implemented. Appropriate programs shall be considered for cities that are just starting their smart city initiatives.

Countries and cities that already have the basic elements

Sustainable Growth

Working across multiple disciplines towards a comprehensive smart city. Realize well-functioning urban management

Countries and cities where initiatives are ongoing

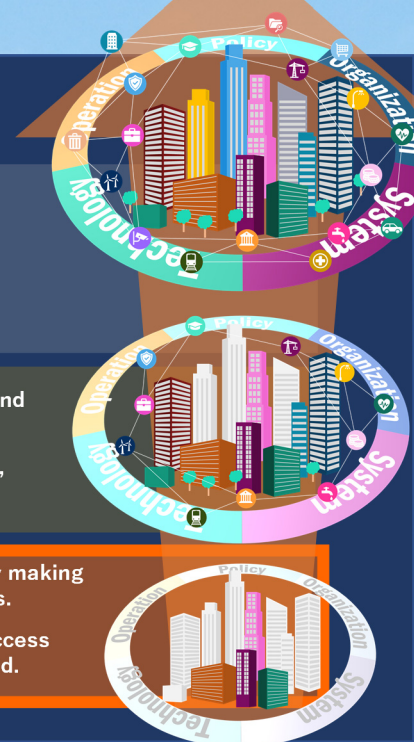
Accelerate

Identify and strengthen areas and sectors to focus on. Flexibly mobilizing investments, resources, and technologies.

Countries and cities where initiatives are being launched

Small Start

Start with feasible initiatives by making maximum use of existing assets. Accumulate small and swift success (Quick Win) as an initial foothold.



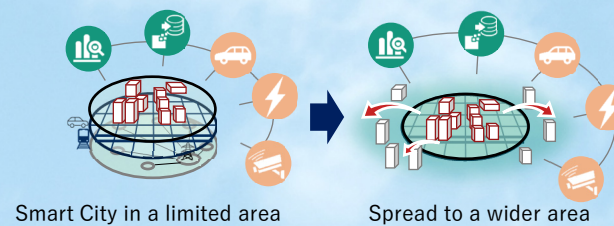
HOW TO SCALE-UP

Two perspectives in scaling-up smart cities

There are two perspectives in scaling-up smart cities: area-based approach and sector-based approach. These two approaches could be combined.

AREA-BASED APPROACH TYPE

Spreading to a wider area
This approach entails realizing smart city solutions or technologies in a specific area, and then spreading the system or the knowledge over to a wider area.



SECTOR-BASED APPROACH TYPE

Connecting and extending the sector
This approach entails starting with a specific sector (e.g., government services, mobility services, etc.) and gradually connecting and extending through open API or data platforms.



WHAT ARE SMART CITY ELEMENTS

Using the smart city elements as reference

It is vital to strengthen the enabling environment for efficient urban management and urban transformation along the smart city framework presented in 5 domains consisting of 21 elements shown below:

Policy	01	Philosophy and Vision of Smart City	The philosophy and the vision are envisaged to create new value for the city, improve the wellbeing of its citizens, and achieve sustainable development.
	02	Comprehensiveness of Vision and Policy	The vision is positioned as a strategic and comprehensive approach that encompasses multiple disciplines.
	03	Specifics of Vision and Policy	A clear message, purpose, direction, and measurable targets for smart city are presented.
	04	Policy Alignment	The target domain of smart city is clear and consistent with urban planning and Digital Transformation strategies.
	05	Sustainability of Vision and Policy	Sustainability of the policy is ensured by adequate budgeting plan and functional business models.
Organization	06	Sharing and Promotion of Visions and Concepts	Each related entity, including the citizen, shares and support the concept, vision, and values of smart city.
	07	Promotion Body	A competent organization or organizational structure is in place to take on a leading and pivotal role in the implementation of smart city strategies and policies.
	08	Triple / Quadruple Helix Partnership	A triple-helix system of public, private, and academia (or quadruple-helix, adding citizens to this) is incorporated into the smart city ecosystem.
	09	Organizational Effectiveness and Capacity	An internal or an external organization capable of drafting specifications; managing selection and steering implementation is in place.
System	10	Building Ecosystems	An effective, functional, and sustainable ecosystem has been formed to promote Smart City.
	11	Creating Trust	Trust is established among stakeholders relevant in process of planning, implementing, operating, and promoting a smart city.
	12	Setting of Laws, Regulations, and Systems	Norms regarding legal and administrative processes necessary for smart city is clearly defined, and incentive mechanisms and facilities for promotion are in place.
	13	Citizen Participation and Co-creation	A mechanism for citizen participation and co-creation is considered and is in place.
	14	Cross-disciplinary	Smart City is linked to decarbonization, digitalization, economic growth, environmental consideration, crisis response, and improvement of the quality of life of citizens.
Technology	15	Urban Infrastructure Platform	ICT platform (City OS) that connects the infrastructure for the Smart City solutions and data collaboration is planned or established, either partially or at full scale.
	16	Data Utilization	City open data is organized and is being used (or being planned to be used) as big data for Smart City, while also sufficiently accounting for data privacy.
	17	Digital Security	ICT infrastructure (servers, database, network, sensors, various control systems) is secure from cyber attacks and contingencies.
	18	Social Systems Design and Implementation	The aspect of social design is introduced in the formulation of a smart city, and the selection and implementation of smart technologies are harmonized with civil society.
Operation	19	Flexibility of Promotion System	A system is designed to flexibly accommodate and respond to changes in the political situation, social environment, and technological trends, as well as to the needs of citizens.
	20	Strengthening Collaboration and Partnerships	Inter-city partnerships with neighboring regions and other countries to share the latest knowledge is established.
	21	Ensuring Sustainability	A mechanism for making medium- to long-term commitments to smart cities is established.

MAKING SMART CITIES SUSTAINABLE

APPROACH for your SMART CITY