

Knowledge Exchange Sector Guidebook: Urban, Land & Transport

**WORLD BANK GROUP
KOREA GREEN GROWTH TRUST FUND**



ABOUT THIS BOOKLET

This booklet serves as a companion to help you explore green growth in Korea's urban, land, and transport sectors. It provides relevant information and a directory for reference, guidance and comprehension. Inside you will find details of past experiences that have shaped the sectors, as well as recent green growth practices and the frameworks and government institutions that support Korea's advanced urban, land, and transport sectors.

All figures are current to the best of our knowledge at the time of publication, November 2020

PART 1

- 04 What is a Technical Knowledge Exchange And What You Will Experience?
- 08 What We Do

PART 2

- 12 Why Korea?
- 16 Green Growth Case Study: Cheonggye-cheon Restoration Project (CRP)
- 18 Overview of Korea's Green Growth Approach

PART 3

- 26 Organizational Charts for Korea's Governance Framework
- 28 Institutional Roles and Functions in Korean Governance

PART 4

- 32 Korea's Green Growth Approach to Urban, Land, and Transport
- 44 Foundations for Green Growth
- 52 Integrated Green Growth is Economical, Environment-Friendly & Sustainable
- 68 Enabling Environment for Public Good and Innovation
- 76 Green Growth: Technology and R&D Investments

PART 5

- 90 Key Institutions in Korea's Urban, Land, and Transport Sector
- 98 Site Visits and Locations
- 108 Annex: Sources and Links

PART 1



What is a Technical Knowledge Exchange

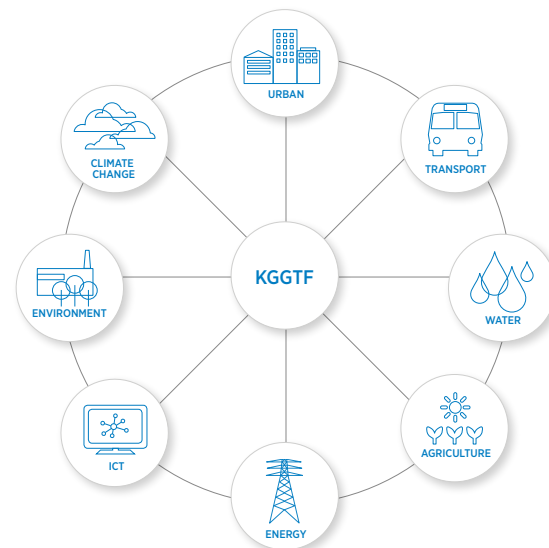
And What You Will Experience?

TECHNICAL KNOWLEDGE EXCHANGE

The KGGTF Technical Knowledge Exchange is where ideas, strategy and action come together. Facilitating the sharing of green growth best practice and technical expertise through on-site learning is part of what makes the Korea Green Growth Trust Fund unique.

This week brings together leading experts from the fields of: urban, transportation, environment and energy, agriculture, water and air. Their technical expertise includes everything from recent technological advances in smart grids, to monitoring and analysis, ICT integration, smart-card deployment to effective policy incentives and governance best practices and to facilitate wide-stakeholder engagement and support green economic growth policy and investment.

You will meet with key government ministries, institutes, multi-lateral organizations and companies relevant to your field. Site visits will provide a unique opportunity to see green growth in action first-hand, and to ask country specific and technical questions.



Sector Integration and Multiple Wins

KGGTF is passionate about tackling infrastructure challenges with integrated Green Growth approaches and methodologies. We seek to support countries in their sustainable growth strategies and investments by promoting collaboration across multiple sectors, and when appropriate, multiple scales, to create a multiplier effect that positively impacts quality of life.

“The exchange itself was very insightful and carefully planned and directly relevant to our work program. We learnt a lot from Korean experience and hope to bring good lessons learned from there to India.”

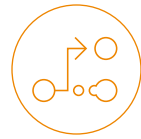
SURBHI GOYAL, WORLD BANK

During This Knowledge Exchange You Will Experience:



POLICY IDEAS

- In depth learning with policy makers and industry experts.
- Discussion on financial and policy incentives for innovative partnerships.
- Innovative governance structures that support transparency and interdepartmental collaboration.
- Policy development and coordination with municipal and central government, public institutions, private sector and local communities.



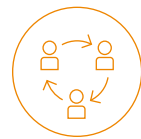
IMPLEMENTATION STRATEGIES

- Policy safeguards to ensure project funding withstands changes in political party and priority shifts.
- New frameworks for decision-making and problem solving.
- Strategy sessions on financial and technical solutions.
- Role of technical and policy think-tanks in policy setting and technical dissemination.



CAPACITY BUILDING

- Behind-the-scenes infrastructure site tours led by technical specialist.
- Learn how to avoid common and costly mistakes.
- Discover how synergies between the government, business and academia can speed the implementation of large projects.



GREEN GROWTH COMMUNITY

- Develop a network of key thought leaders working on innovative projects.
- A network of key thought leaders working on innovative green growth projects.

Be prepared to explore, ask questions and engage with leaders changing the world.



What We Do

The Korea Green Growth Trust Fund is a partnership between the World Bank Group and the Republic of Korea, established in 2011 to support client countries as they shift to green development path. Both partners share a common goal to reduce poverty and promote shared economic prosperity in an environmentally responsible and socially inclusive way.

KGGTF AT A GLANCE

\$138
MILLION FUND

144
GRANTS TO DATE

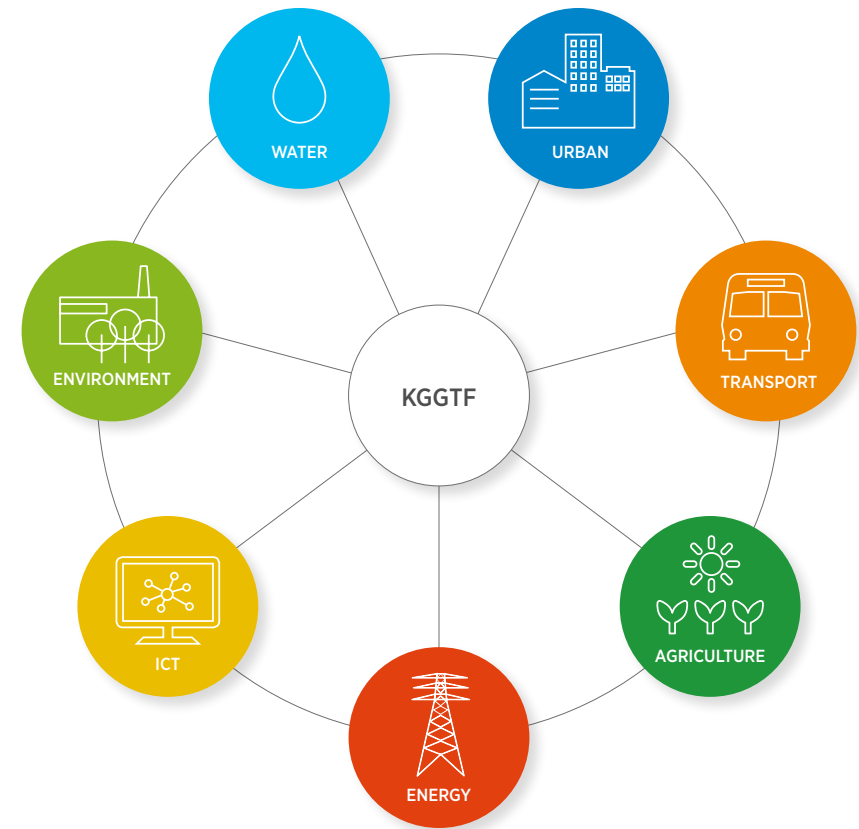
THROUGH 2026

SECTORS



The Trust Fund finances on-the-ground programs as well as knowledge exchange activities, and to date has approved 144 programs in the urban, transport, digital development, energy, environment, water, climate and agriculture

sectors. Based on strong performance, as well as increasing demand for collaborative development implementation programs, the fund has grown from US\$40 million to US\$138 million WBG programs through 2026.



The trust fund facilitates green growth programs across the urban, transport, digital development, energy, environment, water and agriculture sectors. Many of its programs are multi-sector, integrating two or more sectors at both the planning and implementation stages. This provides opportunities that allow for cost savings, data collection, citizen engagement and new forms of transparency and governance.

Knowledge sharing and network building are an integral part of green growth implementation. Facilitating the sharing of green growth best practice and technical expertise through on-site learning, and through the development of practical learning tools is part of what makes the Korea Green Growth Trust Fund unique.

Fund, manage, coordinate and monitor WBG KGGTF funded programs.

Aggregate, facilitate, and leverage Green Growth knowledge and learning.

Institutionalize global knowledge sharing to promote sustainable economic development.

PART 2

Why Korea?

Impact of War ¹

CIVILIAN CASUALTIES

Around 1 million people

DAMAGED INDUSTRIAL BUILDINGS

44%
of the total industrial buildings
(as of August 1951)

DAMAGED ELECTRICITY GENERATION CAPACITY

80% of the capacity

DEVASTATED SCHOOLS

4,800 schools

GROSS NATIONAL INCOME PER CAPITA (1953) ²

US \$67

GROSS DOMESTIC PRODUCT ²

US \$1.35 billion



South Korea's remarkable recovery from war and poverty provides case studies with specific solutions for economic advancement, creation of employment opportunities, and sustainable infrastructure development that is highly relevant for any country planning to transform or rebuild its economy.



Currently

RANKING ³

12th

largest economy
in the world

GROSS NATIONAL INCOME PER CAPITA (2018) ²

US \$33,564

GROSS DOMESTIC PRODUCT (2018) ²

US \$1.7 trillion

Source: Global Knowledge Exchange and Development Center (GKEDC), 2019

1953-1960

Post-war Korea faced varieties of hardships and challenges — a weak industrial base, dearth of natural resources, increasing population, and political instability. Foreign aid began to dwindle while poverty remained widespread.

1961-1979

The government embarked on an ambitious industrialization program as embodied in a series of Five-Year Economic Development Plans. The program relied on exchange rate reform, export subsidies, investment in economic infrastructure, expansion of schooling and training, and selective choice of strategic industries in later years.

1980-1996

Inflation and overcapacity created by the state-led industrialization in the 1970s were gradually resolved with stabilization policies in the early 1980s. The government pursued conservative fiscal and monetary policies to stabilize prices and rationalize the overly expanded industries. Economic liberalization gained speed in the 1990s.

1997-PRESENT

An extensive restructuring in the wake of the Asian financial crisis enabled Korea to avoid sovereign default, overhaul institutions and practices in its economy, and grow into one of the world's richest countries. Various efforts are now being made to meet the new challenges in the 21st century.

Seoul's Transformation Over The Last 50 Years (1970-2020) ⁴

Rising through the destruction and turmoil left by the Korean War, the city of Seoul has transformed to a global megalopolis in only 50 years. Seoul underwent several phases to overcome significant urban challenges and become a model smart city full of urban development best practices.



Photo: Seoul Photo Archives

1960s-1980s

To accommodate increasing population and address inadequate social infrastructure, the Seoul Metropolitan Government formulated urban development plans and implemented projects tailored to address the city's urban challenges.

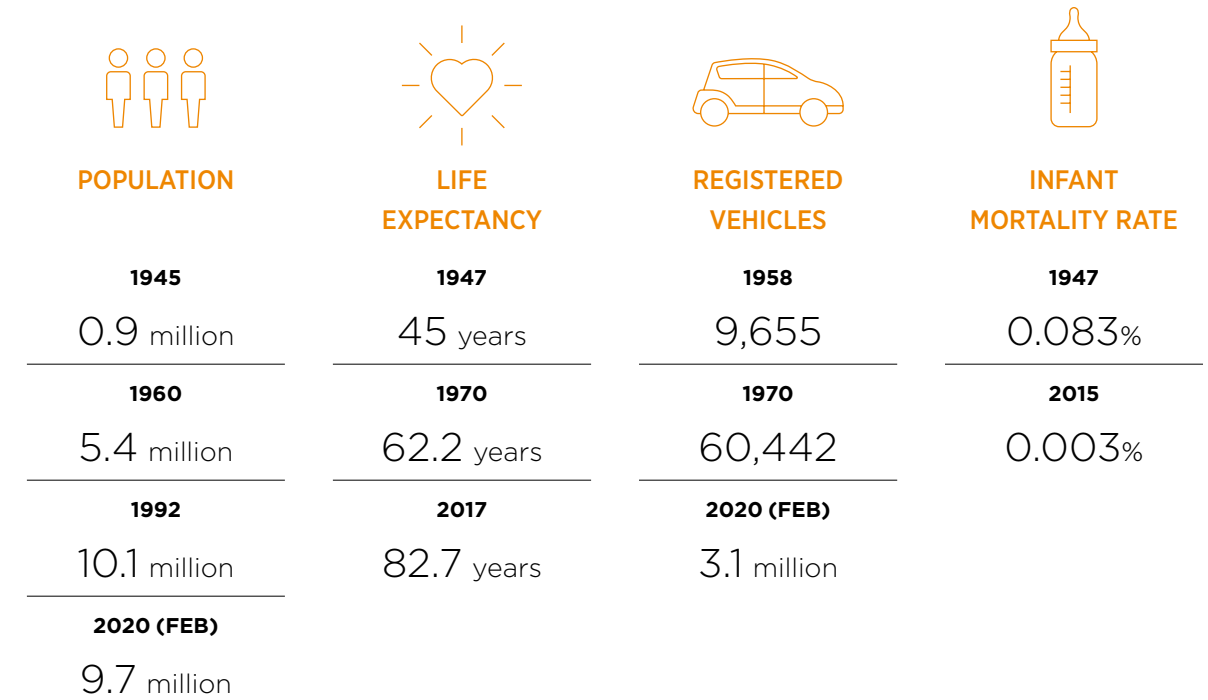
1980s-2000s

Extensive urban development planning continued, and policies were put in place to beautify the city. Subsequently, Seoul's infrastructure network flourished with quality transport, water and sewage systems.

2000-PRESENT

Seoul adapted a software-centered approach to its urban management policy. The use of advanced information technology helped Seoul facilitate a sustainable city and improve the well-being of its residents and visitors.

The implementation of extensive development projects spurred demographic change across the city of Seoul, providing a quality living environment for its nearly 10 million residents.



Cheonggye-cheon Restoration Project (CRP)

Cheonggye-stream was once a symbol of the culture of the people of Seoul, a place where traditional celebrations were held, where women did their washing and where children played. Over time the poor built settlements and shanty

towns and pollution became an issue and serious problem. In 1958 the decision was taken to cover the stream for public safety and from 1968 to 1978 an expressway was constructed over the covered stream.

The area became the most overcrowded part of the city with 60,000 businesses, 200,000 shopkeepers and over 1 million people per day passing through causing severe congestion and crime. The business district underneath the expressway became synonymous with Seoul's deterioration. For 40 years the covering of the Cheonggye-stream to ensure public safety led to additional problems. The Cheonggye-stream

Restoration was a visionary approach to remake downtown Seoul. After city leaders held over 1500 meetings with local stakeholders the expressway was removed and the river restored. Now the river and pedestrian paths are a popular greenspace providing residents with a peaceful reprieve from city life. The project represents a new model for cities and city dwellers and the start of new evolution.



Photo (Left and Center): Seoul Museum of History; University of Seoul

MAJOR OUTCOMES

- Environment—average daytime temperature in the area dropped
- Economic vitalization
- Traffic—discouraged driving cars in the center, eased traffic flow, \$1 public transport system

PROJECT SPANNED

5.8 km



IMPLEMENTED OVER

1 year

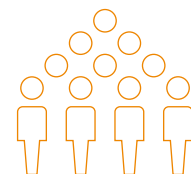
for planning and preparations

2 years & 3 months

for construction

TOTAL LABOR FORCE OF

700,000



TOTAL COST

\$305 USD million

Fully funded by Seoul Metropolitan Government (already owned most of the land used by the elevated highway redirected and earmarked funds for maintenance of deteriorated elevated highways).

DESIGN

\$1.7 USD million

CONSTRUCTION

\$294 USD million

LAND ACQUISITION

\$2.3 USD million

PROJECT MANAGEMENT

\$6.1 USD million

ADMINISTRATION

\$0.5 USD million

Overview of Korea's Green Growth Approach



Initiated by the necessity to adopt sustainable practices, Korea underwent a development paradigm shift from quantity to quality-oriented growth, and from fossil fuel-dependent to energy independent growth and sustainability. Korea's green growth was propelled by the establishment of key institutional arrangements that created an enabling environment and laid the foundation for advancement through legislative, institutional and strategic frameworks. In 2008, Low Carbon, Green Growth was declared as a new vision and Green New Deal for the nation for the next 60 years, and the green growth action plan was promoted thereafter.

Countries around the world are finding the Green Growth model highly relevant.

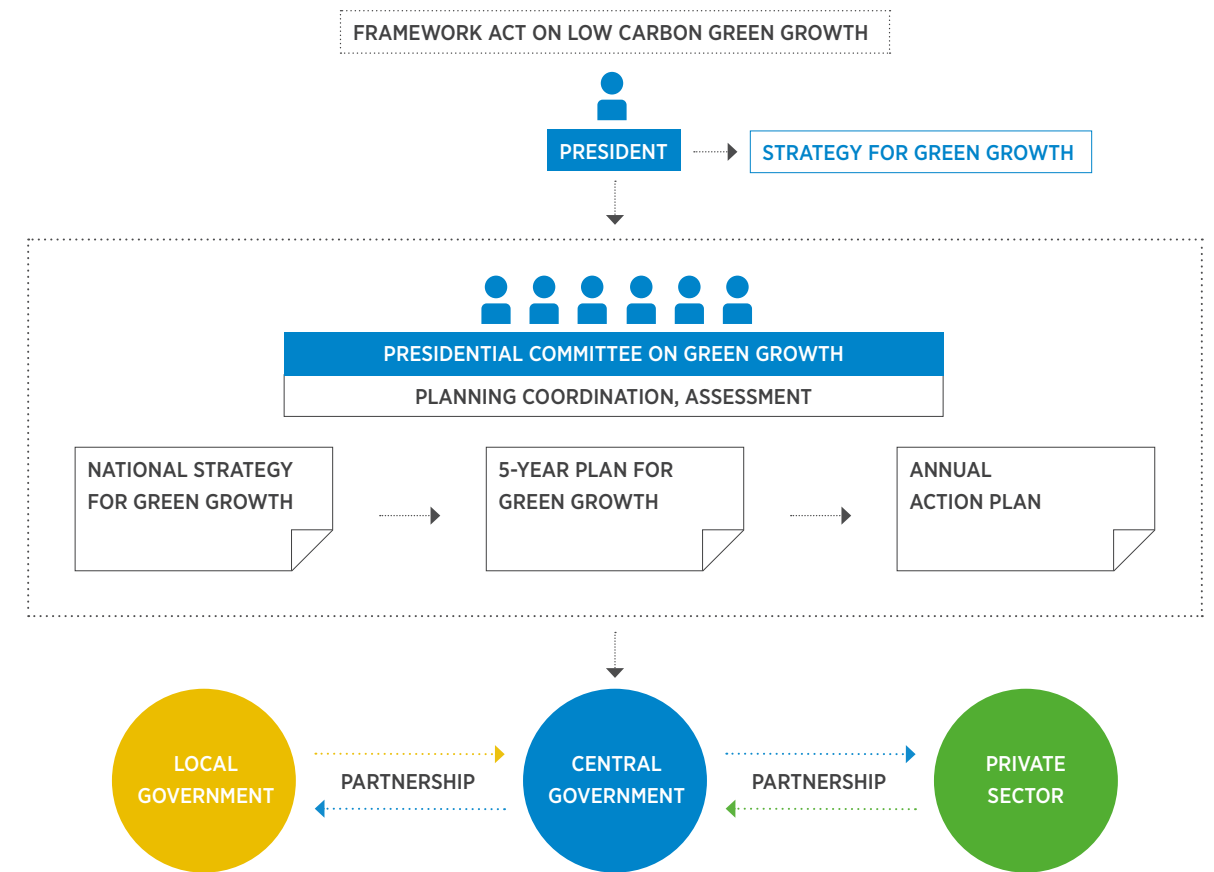
INSTITUTIONAL FRAMEWORK

The Presidential Committee on Green Growth (PCCG) was established in 2009 to spearhead Korea's Green Growth Transformation. Specifically, the PCCG developed and mandated the legal framework, strategic planning, and budget allocation for the National Strategy.

The Committee on Green Growth was instituted several years later in 2013 with the main function of deliberating matters concerning Green Growth. The Committee was comprised of 38 people: 21 Private Experts and 17 ministers, Co-chairs: Prime Minister and one Private Expert and 4 Sub-Committees focused on:

- Green Growth Strategy
- Climate Response
- Green Technology and Industry
- Energy

Figure 2 Institutional Framework for Green Growth



LEGISLATIVE FRAMEWORK

The Framework Act on Low Carbon Green Growth was enacted in 2010. It provided the legal basis for implementing measures to effectively address climate change and energy issues, promote sustainable development, build the implementation system for green growth (such as the establishment of the Committee on Green Growth), and revise a variety of institutional systems to promote low-carbon green growth in the region.

The major provisions in the Framework Act include:

- The realization of the green economic system, green technology and green industries.
- Policies on energy, sustainable development; the green life, the green homeland and the low-carbon traffic system.
- International negotiations and cooperation in relation to low carbon, green growth, including climate change.
- Procurement of financial resources, taxation, financing, training of human resources, education, and public relations activities necessary for low carbon, green growth.

STRATEGIC FRAMEWORK

The National Strategy for Green Growth (2009-2050), provides a comprehensive policy framework towards green growth. Launched in 2009, the strategy aims to promote eco-friendly new growth engines, enhance people's quality of life, and contribute to international efforts to fight climate change. To achieve the goals set in the National Strategy, South Korea rolled out a series of five-year plans with the following objectives:

Definition of Green Growth:

Growth that registers harmony between economy and environment that reduces climate change and environmental damage by saving and efficiently using energy and resources and creates jobs by exploiting new growth engines through R&D in clean energy and green technology.

*Article 2, Section 2 of Low Carbon Green Growth Framework Act (hereafter the Framework Act)

The government set a budget target to allocate 2% of GDP for Phase 1 (2009-2013)
Total: 107.4 trillion KRW (98.1 billion USD (1/1/2013))⁵

	Total	'09	'10-'11	'12-'13	Growth
Public Investment (trillion KRW)	107.4	17.5	48.3	41.5	10.2%
Adaptation to climate change	56.9	8.6	29.2	19.1	14.0%
New growth engine	28.6	4.8	10.8	13.1	9.4%
Better life quality	27.9	5.2	10.5	12.2	3.6%

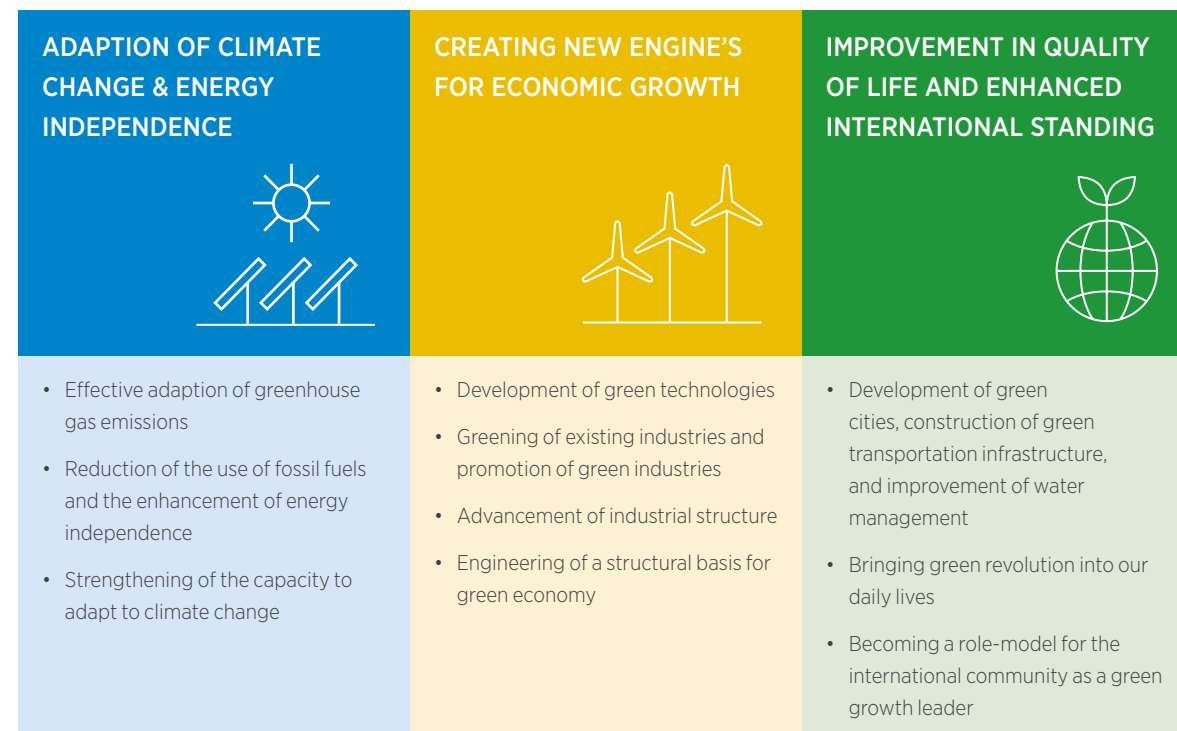
The 1st Five-Year Green Growth Plan 2009-2013

- Adaptation to climate change and energy independence
- Creating new engines for economic growth
- Improvement in quality of life and enhanced international standing

The 2nd Five-Year Green Growth Plan 2014-2018

- Establishing a low-carbon socio-economic infrastructure
- Achieving a creative economy through the convergence of green technology and ICT
- Building a pleasant living environment safe from the harms of climate change

Figure 1 Three Objectives and Ten Directions of Green Growth



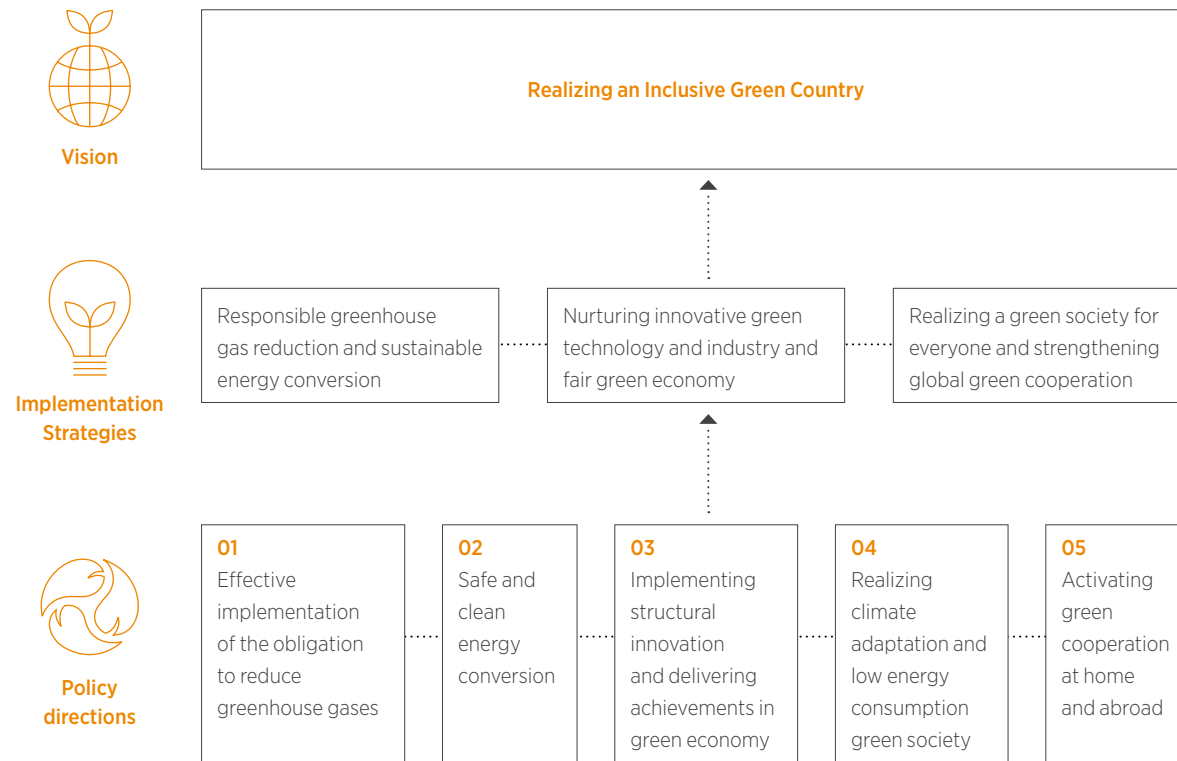
MAJOR ACHIEVEMENTS 2009-2019⁶

10 years of Green Growth Policy implementation has:

- Facilitated the adoption of Green Growth as an agenda for national development and the institutionalization of Green Growth promotion.
- Led to an increase in the supply of green products and efforts for actualizing green lifestyle.
- Aided in preparing the basis for preemptively setting the GHG reduction target and system.
- Enhanced national standing by setting green growth as a global agenda by establishing and engaging related internal organizations.
- Established the foundation for future growth engines through the development of green technology.

**The 3rd 5-Year
Green Growth Plan ⁷**
2019-2023

- Responsible greenhouse gas reductions and sustainable energy convergence
- Nurturing innovative green technology, industry and fair green economy
- Realizing a green society for everyone and strengthening global green growth cooperation



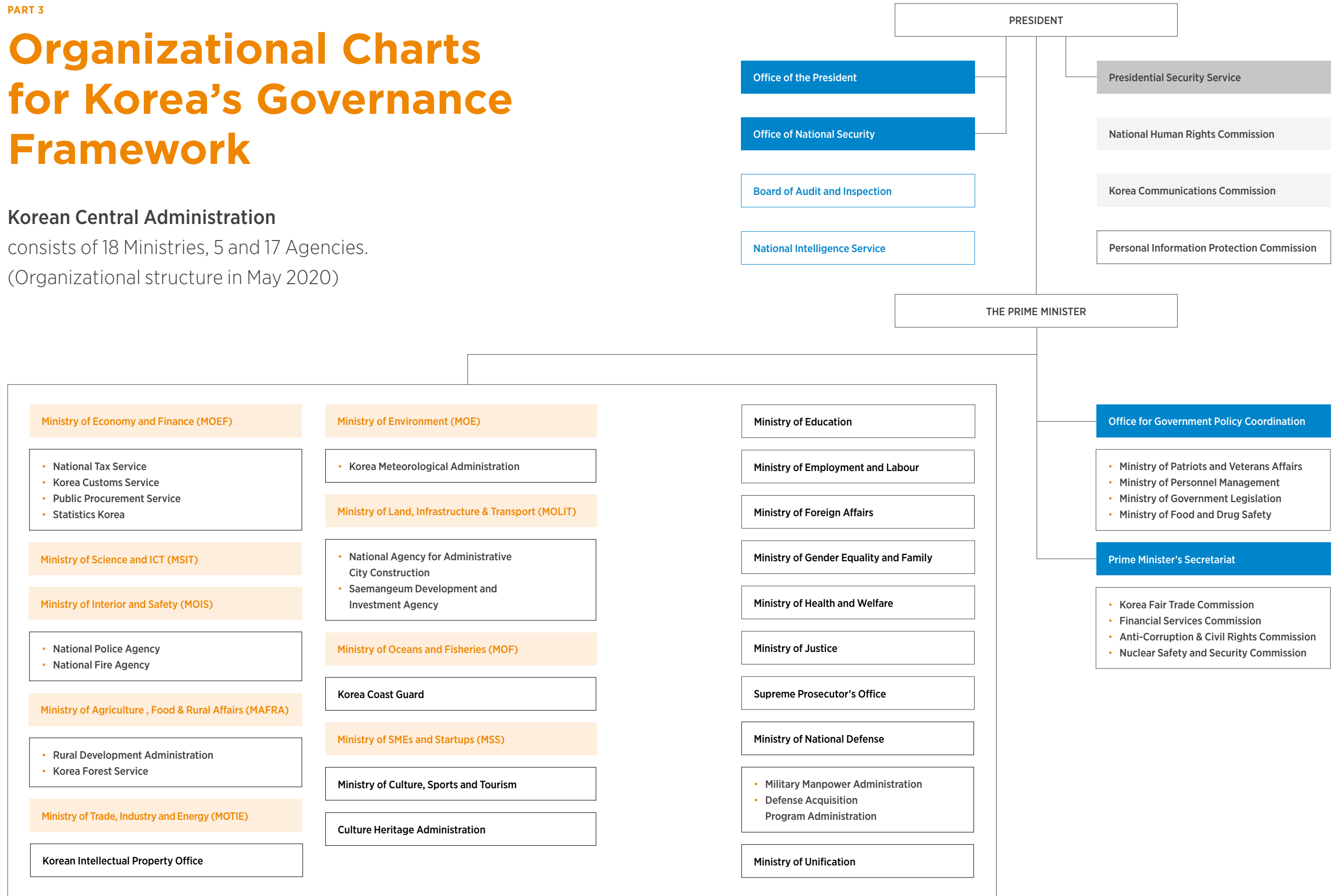


PART 3

Organizational Charts for Korea's Governance Framework

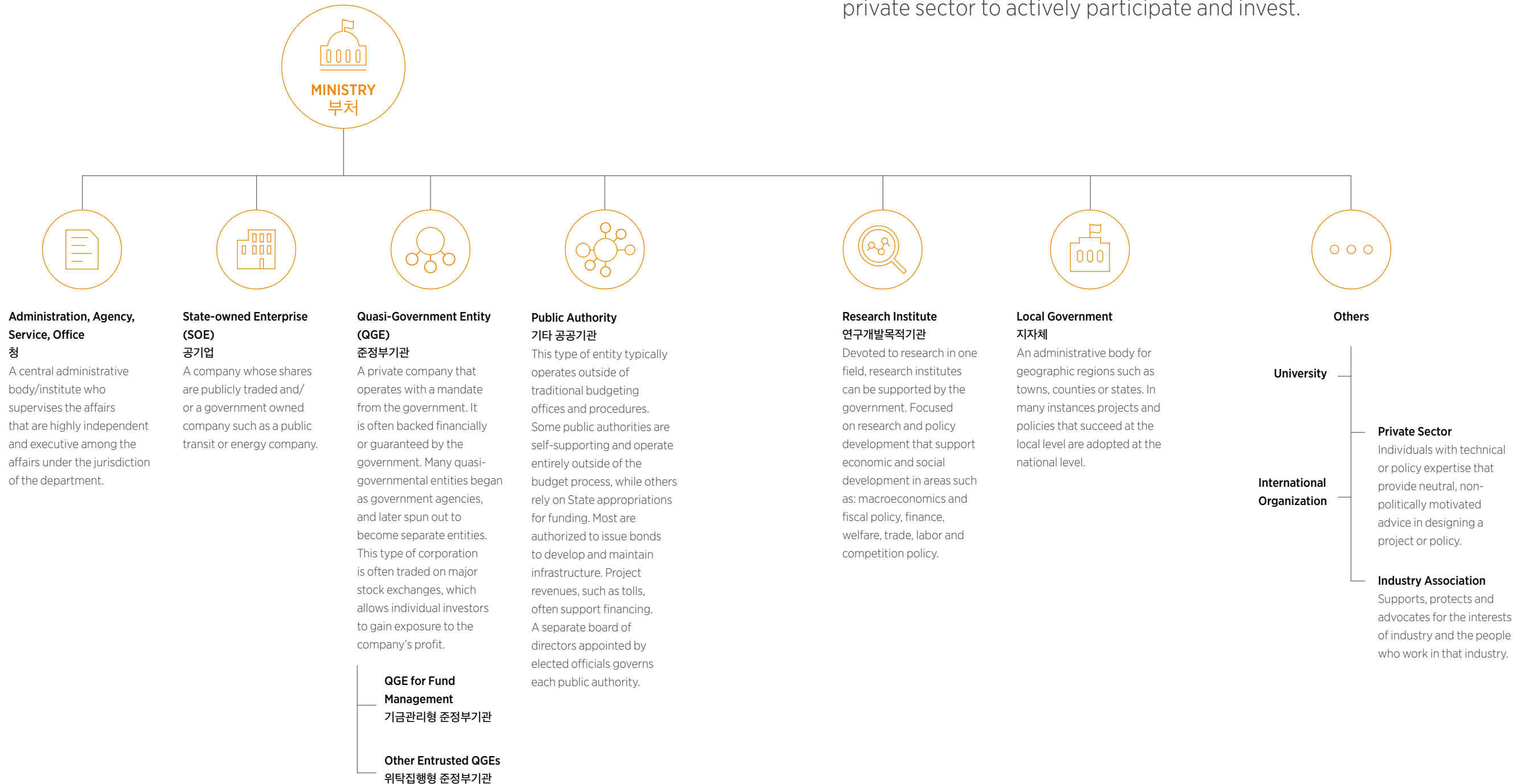
Korean Central Administration

consists of 18 Ministries, 5 and 17 Agencies.
(Organizational structure in May 2020)



Institutional Roles and Functions in Korean Governance

Much of Korea’s successful transformation from war-torn country to global leader is a direct result of institutional frameworks and strategically designed governing structures. Establishing effective institutional frameworks allows for long-term strategic planning and investments. When done correctly, such long-term planning can align citizens’ interests and nation building with clear opportunities for the private sector to actively participate and invest.



PART 4

Korea's Green Growth Approach to Urban, Land, and Transport

Having rebuilt from the ground up following the war in the 1960's, Korea's approach to land use provides insightful lessons and innovative approaches. After the war, the country went through many iterations of growth. Initially, low cost materials and speed were prioritized leading to shanty towns and limited resources which made it difficult to satisfy the growing housing demand. Recognizing these challenges, the Government of Korea decided to develop new towns and adopt land use policy instruments.

Through national efforts, budget allocation and donor support, Korea planned and leveraged public and international aid towards strategic national projects. Over the last few decades, Korea has taken an integrated approach to urban design, land-use, housing and transportation. This collaborative approach has facilitated innovative solutions for managing costly housing, land speculation, commute time and work. It has also improved the quality of life for the Korea's citizens.



ADMINISTRATIVE DIVISIONS ⁸

SPECIAL CITY

Seoul

METROPOLITAN CITY

Busan, Incheon, Daegu, Daejeon, Gwangju, Ulsan

SELF-GOVERNING CITY

Sejong

PROVINCE

Gyeonggi, Gangwon, Northern Chungcheong, Southern Chungcheong, Northern Jeolla, Southern Jeolla, Northern Gyeongsang, Southern Gyeongsang

SELF-GOVERNING PROVINCE

Jeju



GEOGRAPHY AND DEMOGRAPHY ⁸

AREA

100,364 km²

SEOUL AREA

605.2 km² (6%)

POPULATION (2019)

51.8 million

SEOUL POPULATION

9.8 million (19%)

POPULATION DENSITY

516 persons/km²

SEOUL POPULATION DENSITY

16,193 persons/km²



SEOUL TRANSPORT FEATURES ⁹

PASSENGER CARS

2,526,000

NUMBER OF BUSES

6,993

NUMBER OF TRIPS

32,248,000

trips/per day

ROAD LENGTH

8,246km

LAND SHARE FOR ROADS

22.72%

SUBWAY LENGTH

342.6 km
(9 lines)

BRT LENGTH

128.8 km

BICYCLE ROAD LENGTH

916 km



NATIONAL LAND FEATURES OF KOREA ¹⁰

PARCEL

39 million

CADASTRAL MAP

771,533 sheets

TYPE OF LAND USE

FOREST

65%

AGRICULTURE

21%

RESIDENTIAL & COMMERCIAL

3%

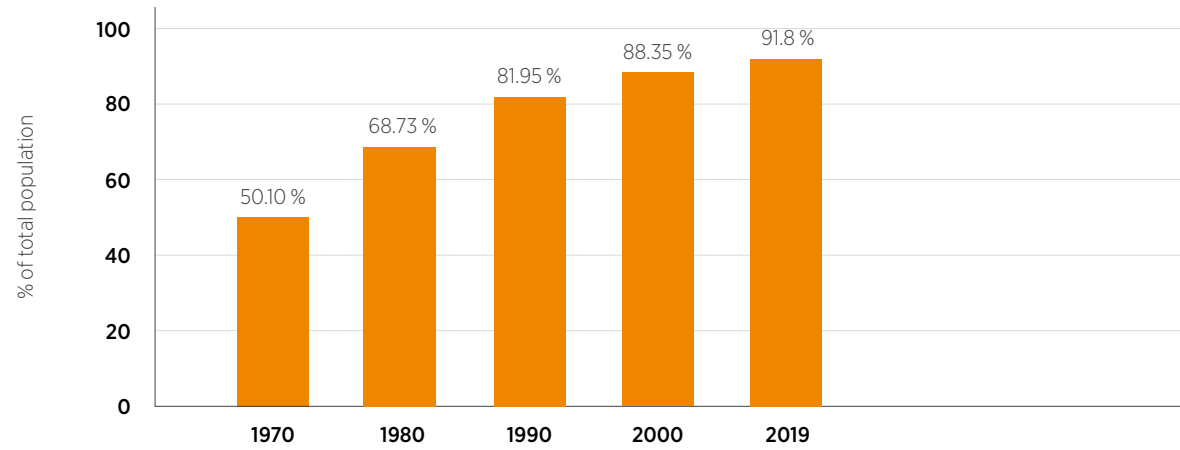
ROAD & RAIL

3%

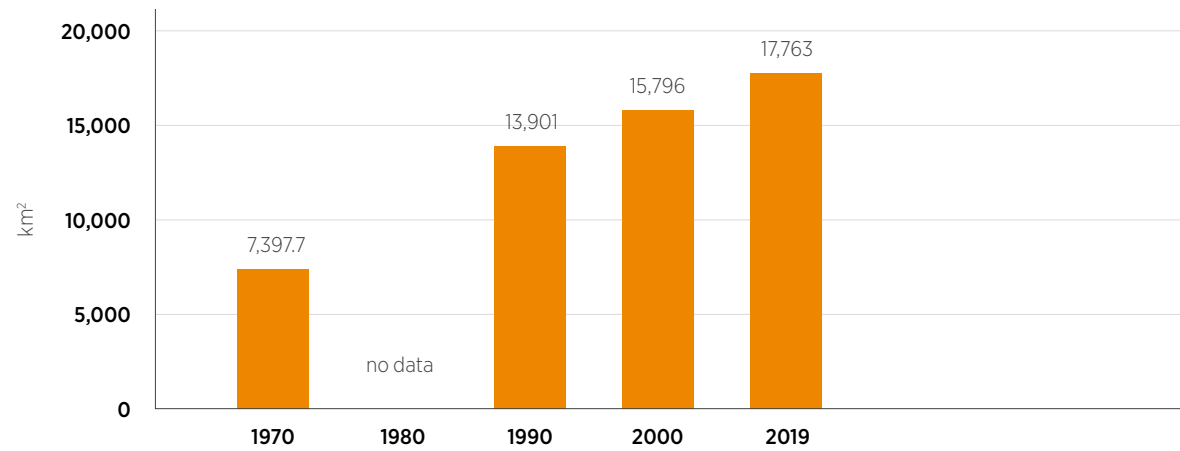
OTHER

8%

Urban Population

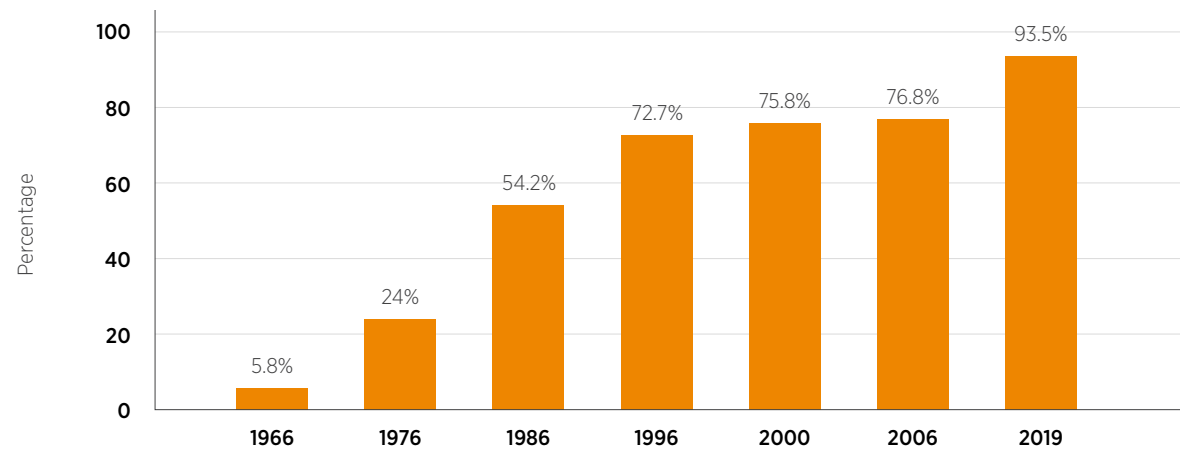


Urban Areas



Pavement Rate of Road and Highway

(including expressway, general national road, local road, municipal road)



Historical View and Interests of Urban, Land, and Transport Policies

Korea achieved economic growth and development through a state-led industrialization strategy post war. Urban policies in Korea evolved in response to changing urban issues. Transportation policies and the building of large expressways connecting the two largest cities was crucial in supporting the implementation of national economic growth strategies that included urban policies.



1960s-70s

SITUATION AND POLICY INTERESTS

Following the war, Korea launched a 5-year economic development plan (1962-1966), based on labor intensive industries that invested in large cities like Seoul and Busan.

They built industrial hub cities focused on heavy industry in line with the 1st comprehensive national territorial development plan (1972-1981).

- Gyeongin and Gyeongbu expressways connected Seoul to major export ports.
- Basic laws underlying the urban, land and transport sectors were enacted in the 60s.

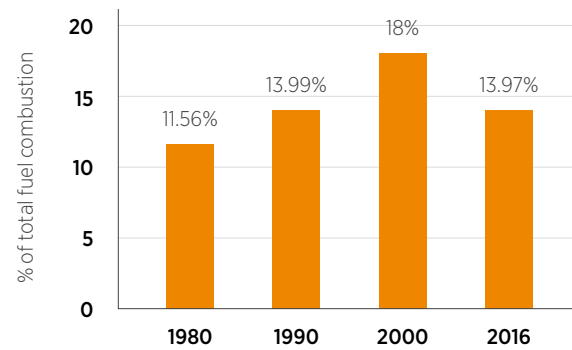
SEOUL METROPOLITAN DEVELOPMENT

As a result of extensive population inflow and lack of social infrastructure, Seoul experienced serious urban issues such as traffic congestion, housing shortages and an increase of illegal settlement areas.

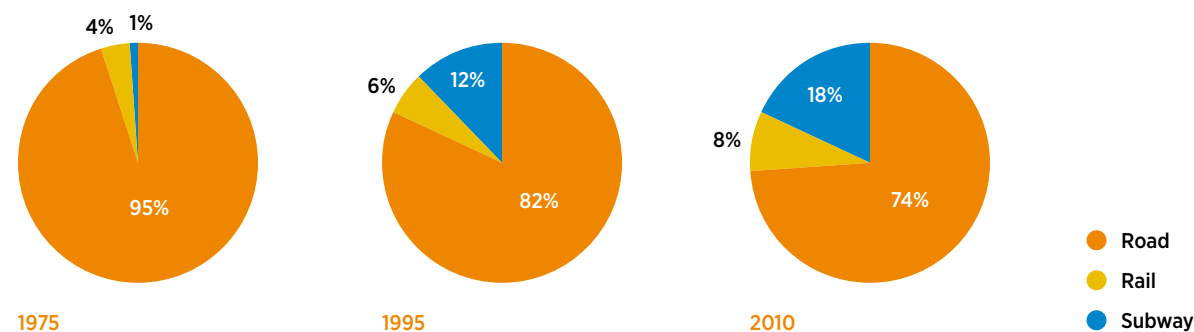
Seoul Metropolitan Government (SMG) prioritized the establishment of basic infrastructure by expanding roads, building apartment complexes, and developing new urban centers across the Han river.

- Downtown Seoul was surrounded by many overpasses including Cheonggye Overpass.
- New city centers Yeouido and Gangnam were developed through land readjustment projects.
- Eight bridges were constructed over Han River.

CO2 Emissions from Transport



Public Transport Share



Urban & Land

- 1961 Cadastral Act
- 1962 Urban Planning Act
- Building Act
- Land Expropriation Act
- Housing Corporation Act
- 1963 Act on Comprehensive Plans for Construction in the National Territory
- Housing and Urban Fund Act
- 1966 Land Readjustment Projects Act
- 1970 Local Industrial Development Act
- 1971 Introduction of Green Belt
- 1972 Act on Utilization of National Territory
- Housing Construction Promotion Act
- 1973 Industrial Base Development Promotion Act
- 1976 Urban Redevelopment Act
- 1978 Land Development Corporation Act

Transport

- 1960 Gimpo International Airport
- 1961 Road Transport Act
- Railroad Act
- Aviation Act
- Transport Service Act
- 1962 Road Transport Vehicle Act
- Korean Air Corporation Act
- 1968 Groundbreaking of Gyeongbu Expressway
- Completion of Gyeongin Expressway (Seoul-Incheon)
- 1969 Korea Expressway Corporation Act
- 1970 National Highway Act
- Completion of Gyeongbu Expressway (Seoul-Busan)
- 1978 Environment Conservation Act
- 1979 Traffic Safety Act

1980s-90s

SITUATION AND POLICY INTERESTS

The government focused on improving basic living facilities in response to the deteriorated environment and urban sprawl. Intensive investment continued until the 1997 financial crisis.

- Expressway extensions were doubled
- High-speed railway and new international airports were developed.

The combination of housing shortage and high housing demand caused extreme land and housing speculation. This led to the introduction of public land ownership concept and series of anti-speculation acts. At the same time, the government provided 2 million house units in 5 cities around Seoul.

The increase of automobiles caused rampant urban sprawl, traffic congestion and environmental pollution, which led to the introduction of comprehensive congestion mitigation policies.

SEOUL METROPOLITAN DEVELOPMENT

The Seoul Metropolitan Government (SMG) embarked on a series of active urban improvement and city beautification policies spurred by Korea hosting the 1986 Asian Games and the 1988 Olympic Games.

A comprehensive development plan was created for the Han River along with the construction of Gangbyeonbuk-ro (along north bank) and Olympic-daero (south bank) roads along the Han river.

The government built large-scale apartment complexes in Mok-dong, Godeok-dong, Gaepo-dong, and Sanggye-dong at the outskirts of Seoul to meet explosive demand in housing units for the growing middle class.

As a result of this extensive infrastructure development project, Seoul achieved high-standard urban infrastructure in a short period of time. Extensive networks of subways, roads, waterworks, and sewage systems were built.

However, explosive and increased development produced negative social and environmental costs, such as destruction of the natural environment, damage to historical resources, and the breakdown of communities.

Urban & Land

- **1980** Housing Site Development Promotion Act
- **1981** Establishment of National Housing Fund
- **1982** Seoul Metropolitan Area Readjustment Planning Act
- **1987** Constitution Amendment on Public Concept of Land Ownership
- **1989** Three Anti-Land Speculation Acts
 - Housing Land Ownership Limit Act
 - Development Profit Redemption Act
 - Land Excess Gain Tax Act
- **1989** Announcement of 1st New town development plan (2million units)
- **1991** Reintroduction of Local Autonomy System
- **1996** Completion of 1st New town development

Transport

- **1986** Urban Traffic Improvement Promotion Act
- Motor Vehicle Management Act
- **1988** Act on Special Accounts for Road Projects
- **1989** Korea Railroad Corporation Act
- **1990** Urban Railroad Act
- Introduction of Traffic Induction Charge
- **1992** Groundbreaking of High-speed Railway and Incheon International Airport
- **1994** Introduction of Fuel Tax, Heave Occupancy Vehicles in Expressway
- **1995** Act on Special Accounts for Transport Facilities
- Act on Promotion of the Use of Bicycles
- **1996** Congestion Toll Collection
- **1998** Promotion of Private Capital into Social Overhead Capital Investment
- **1999** Transportation Systems Efficiency Act

2000s - 2010s

SITUATION AND POLICY INTERESTS

After the 1997 financial crisis, the government supported IT startups and led public IT projects to create jobs. Land ownership data, underground infrastructure information, and further public administration data were digitized.

Intensive investment in the IT sector, located in the metropolitan area resulted in the economic growth. The government promoted the localization strategy and established a comprehensive plan that included the following targets:

- Balanced national development
- New administrative capital development
- Strengthening local government authority

In 2012, Sejong administrative city was constructed, and the ministries and public institutions were relocated across 10 innovation cities.

Korea's economic growth rate slowed down after 1997, resulting in negative impact on society and the environment. Aging infrastructure further constrained growth. As part of a solution, Korea undertook a paradigm shift in its urban policies to regenerate urban spaces by leveraging cultural and natural assets.

In 2008, low-carbon, green growth was proposed as a new national development paradigm, in addition to new green engines on energy and environment, the framework promoted urban policies to reorganize city structure responding to climate change: compact city, mixed land use, and public transport-oriented system.

SEOUL METROPOLITAN DEVELOPMENT

With the development of digital solutions using ICT and an increase in citizens' demand for improved quality of life, Seoul's urban management policy took a shift towards creating a sustainable smart city by merging ICT as part of the solutions delivery.

The transport policy paradigm shifted to human/public transport-oriented from car-oriented leading to the deconstruction of 20 overpasses (2003-2015) including Cheonggyecheon Overpass (2003-2005) or turned into pedestrian-friendly places like 7017 Seoullo (2017).

In 2004, Seoul Metropolitan Government (SMG) reformed public transport to improve bus services, to promote low carbon transition to green growth.

Transit Oriented Development (TOD) promoting high density development around subway is planned to be applied to most major rail station development including Susaek station to increase convenience for public transport.

Urban & Land

- **2000** Announcement of Comprehensive Measures to Prevent Urban Sprawl
- Unification of Urban Planning System National Territory, Provincial, City Plan
- Lift of Parts of Green Belt
- **2002** Establishment of Comprehensive National Territory Plan System
- **2003** Announcement of 2nd New town development plan (0.7million units)
- **2004** Special Act on Balanced National Development
- **2008** Deregulation on real estate taxes, Announcement of new housing development (1.5million units)
- **2010** Framework Act on Low Carbon, Green Growth
- **2013** Special Act on Promotion of and Support for Urban Regeneration
- Announcement of Happiness Housing
- **2017** Act on the Promotion of Smart City Development and Industry

Transport

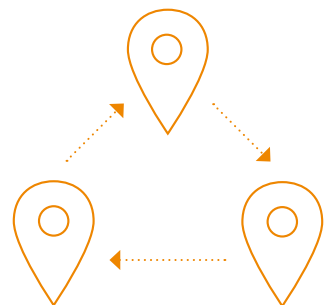
- **2002** Establishment of National ITS Standardization Plan
- **2004** Completion of Gyeongbu (Seoul-Busan) High-Speed Railway
- Act on the Promotion of Development and Distribution of Environment-friendly Automobiles
- **2005** Act on the Support and Promotion of Utilization of Mass Transit System Act
- **2009** Sustainable Transport and Logistics Development Act
- National Integrated Transport System Efficiency Act
- **2011** Establishment of Sustainable Transport Master Plan for Climate Change
- **2012** Introduction of Energy and GHG Emission Target Cap management
- **2013** GHG Mitigation Strategy Assessment Framework Act on Logistics Policies

Key Success Factors

01

Development of hub cities for industrial growth connected to comprehensive transportation networks

The government strategically identified regions across the country to establish key industries. They anticipated growth by building transportation networks in advance, connecting all hub cities together to support export-oriented economic development.



02

Building high-quality housing leveraging private capital and land through land readjustment

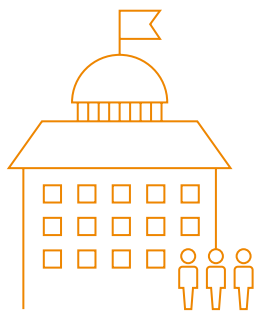
High quality housing was continuously developed by leveraging private property and capital.



03

Timely response to urban issues and people-oriented policies

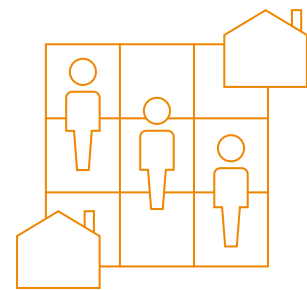
The government prioritized people-centered policies and stakeholder engagement. Issues were quickly addressed before problems escalated and caused social or political opposition.



04

Constant efforts to achieve balanced development through job and population distribution

Balanced development was one of the most important goals in Korea's land development policy. There was a steady effort to ensure jobs and housing across the country; distributed industrial base development, Gangnam development in Seoul, industrial decentralization in the metropolitan area, and development of innovation cities and new administrative capital for example.



05

Efficient and transparent management of the land and real estate market

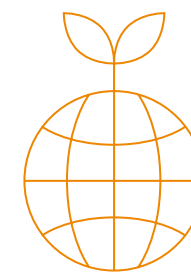
While Korea has experienced continual land and real estate speculation, the government established transparent land transaction systems, such as transaction permit management and actual transaction price reporting system, and actively intervened in the market to manage the housing supply through planning and price management policies, which contribute to creating a relatively stable real estate market.



06

Early introduction of green growth concept

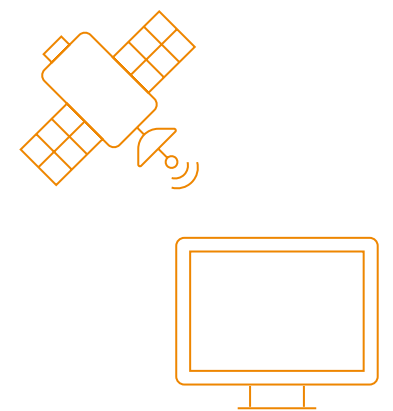
Korea's rapid growth till late 1990s resulted in environmental and social externalities. In response they developed the urban policies to promote sustainable development such as public transport-oriented system which expanded. When the framework for low carbon green growth law was adopted, Korean cities were given sufficient resources and policy tools to implement low carbon green growth solutions.



07

Efficient innovation in city, land, and traffic management using ICT

Using information and communication technology (ICT), efficient city and traffic management measures were introduced such as land/spatial information system, intelligent transportation system, and big data-based transportation service. Moreover, these systems were continuously upgraded through monitoring and evaluation to improve the adoption of more innovative technologies.



Foundations for Green Growth

Korea experienced rapid economic and social change throughout the 1960s-1980's. The focus on economic development and citizens aspirations to escape poverty was propelled by strong industrialization and urbanization which brought meaningful changes to society.



Illustration of Land Readjustment of Korea¹²

Land Readjustment: Birth of Gangnam

Following the Korean War (1950-1953), the government lacked economic resources for comprehensive development. With the population booming and businesses growing, small-scale unstructured plots or paddy fields presented a challenge for economic expansion. A land readjustment mechanism was introduced in the 1960s to secure land for public development and create regions dedicated to supporting Korea's economic expansion.

Initially, land readjustment was the only instrumental tool used to reassemble and develop land for public (common) purposes. Despite the increasing demand for land development, some parcels of land were unsuitable or unattractive because of their shape, limited access to roads, regulated land use, etc. The government (or landowners' collective union) pooled these parcels of land together and

rearranged them to help address these issues and then returned them to the owners. However, a percentage of the parcels were reserved for public purposes such as roads, schools, parks, etc. Some of the parcels were reserved for the development of infrastructure, while some were reserved for fund raising to cover the construction costs for the infrastructure. Landowners agreed to the land reduction that came with readjustment because they recognized that the economic benefits of having their land value increase would offset their losses.

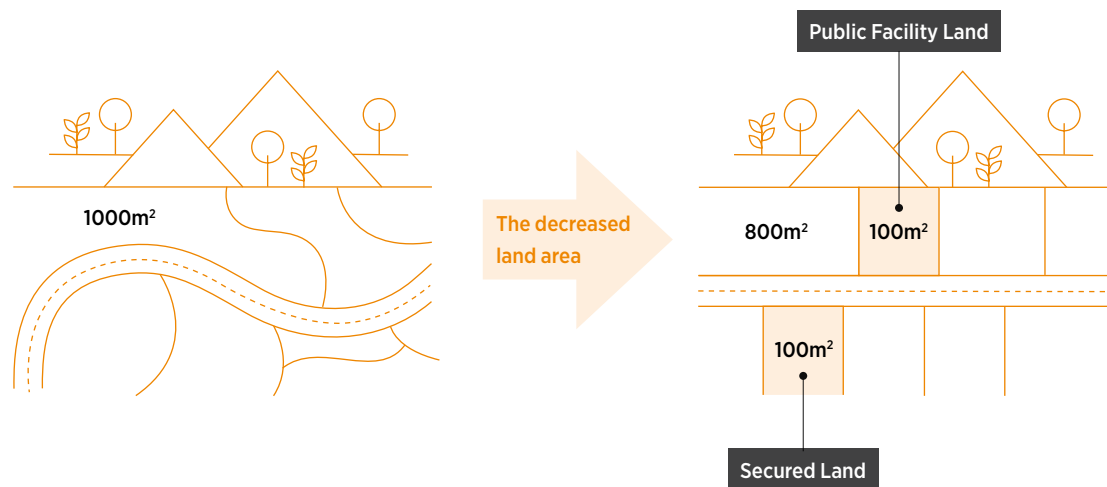
This scheme has helped establish a decent living environment for citizens by expanding public spaces and supplying essential infrastructure. It was an effective cooperative model that all stakeholders contributed to developing and have shared the benefits together.

LAND READJUSTMENT PROJECT PROCESS

- The government designates target areas for the land readjustment project.
- The project is implemented by the collective union of landowners or the government/public corporation.
- Land is divided and readjusted by receiving land donations from landowners.
- The landowners get replotted land after land reduction. The reduction rate was different depending on the situation in target districts.

The reduced land, secured by the authorities in recompense of development outlay, is sold to raise financial resources for public infrastructure development such as roads, schools, parks, etc.

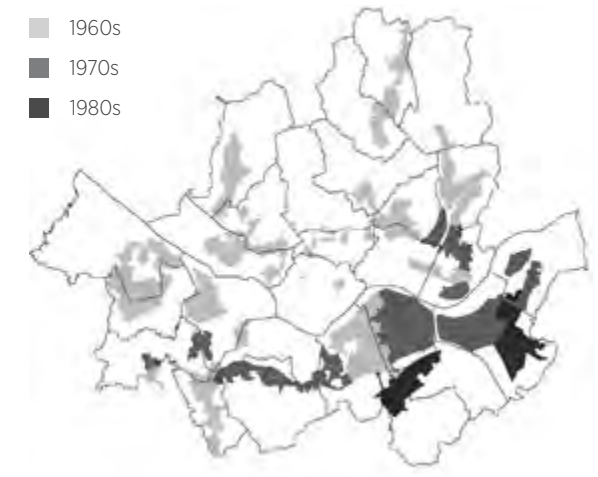
In Seoul, the land readjustment method was adopted as the main source of modern land development and reached its peak in the 1960s and 1970s. For two decades, 34 districts (113,324,000m²) were developed through the land readjustment to accommodate the increased population that migrated to Seoul due to rapid industrialization and urbanization, successfully dispersing the population to the south of Han River.



$$\text{Land Reduction Rate} = \frac{\text{The decreased land area}}{\text{All (Former) land area}} \times 100 (\%)$$

Land Readjustment Program¹³

- 1960s
- 1970s
- 1980s



GANGNAM DEVELOPMENT WITH LAND READJUSTMENT IN SEOUL¹⁴

The Gangnam development was proposed in the Seoul Urban Master Plan, and the land readjustment project plan of Gangnam was coupled with the construction of the Gyeongbu Expressway which began in 1968.

The 'New Town Plan in Yeongdong District' was proposed to create a new built-up area with a population of 600,000 in the Yeongdong 1-2 district (59km²) in Gangnam.

Due to limited budget and land resources, Seoul Metropolitan Government created a large-scale new built-up area through land readjustment mechanism. 90% of the Yeongdong District 1 development cost was financed by the sale of secured land while the government subsidies were 9.5%. In the District 2, 99.9% of the project cost was financed by secured land.

- Landowners in Gangnam area provided 40% to 50% of their lands for the public use by applying a higher land reduction rate compared to other regions. The reduction rate of lands adjacent to major roads reached 70%.

- Landowners got compensated by the highly increased land since paddy fields have been transformed into residential and commercial areas with high-quality transportation, infrastructure, and various public services.

- After land readjustment, landowners benefited economically even after contributing 50% of land for public use.

Currently, Gangnam has become the center of Seoul, south of the Han River, which is more developed than the old city center in the north. This case shows how land readjustment can leverage private resources and contribute to developing new towns to accommodate increasing population as well as business activities.



Securing public lands for various public services was very hard in the built-up area, but the land readjustment projects enabled the systematic securement of the lands for public facilities, played a decisive role in shaping Seoul as it stands now.

New Town Development: Response to Housing Shortage Crisis

WHY DID SOUTH KOREA BUILD NEW TOWNS?

Rapid urbanization presented major challenges in securing clean water, providing sufficient housing & mitigating traffic congestion. Only 10% of Korea's land mass is suitable for urban and residential use.

Between 1960 and 1990

270,000 people moved into Seoul per year and the Seoul Metropolitan Area (a.k.a. Capital Region) accounts for over half of South Korea's population to this date. The city's infrastructure was ill-equipped to cope with this pressure, and a severe housing shortage drove land and house prices up at an alarming rate creating many social problems in the city and surrounding areas. Government had imposed a development restriction area (a.k.a. Green Belt) to prevent unplanned growth in the Capital Region and major metropolitan areas.

To counter this dire social problem stemming from housing crisis the government set a goal to provide 2 million housing units in the late 1980s. In order to achieve this ambitious goal, the Korean Government announced the first new town development plan to respond to the housing shortage and calm real estate speculation.

NEW TOWNS FOR HOUSING

In the late 1980s, as the housing shortage became worse and the existing available land for large-scale urban development was nearly exhausted, the population began to spillover beyond the green belt. Faced with limitations in land supply for urban development, the central government began to build new towns in the Capital Region including Bundang in Sungnam City, Ilsan in Goyang City, Pyeongchon in Anyang City, Sanbon in Gunpo City, and Jungdong in Bucheon City.

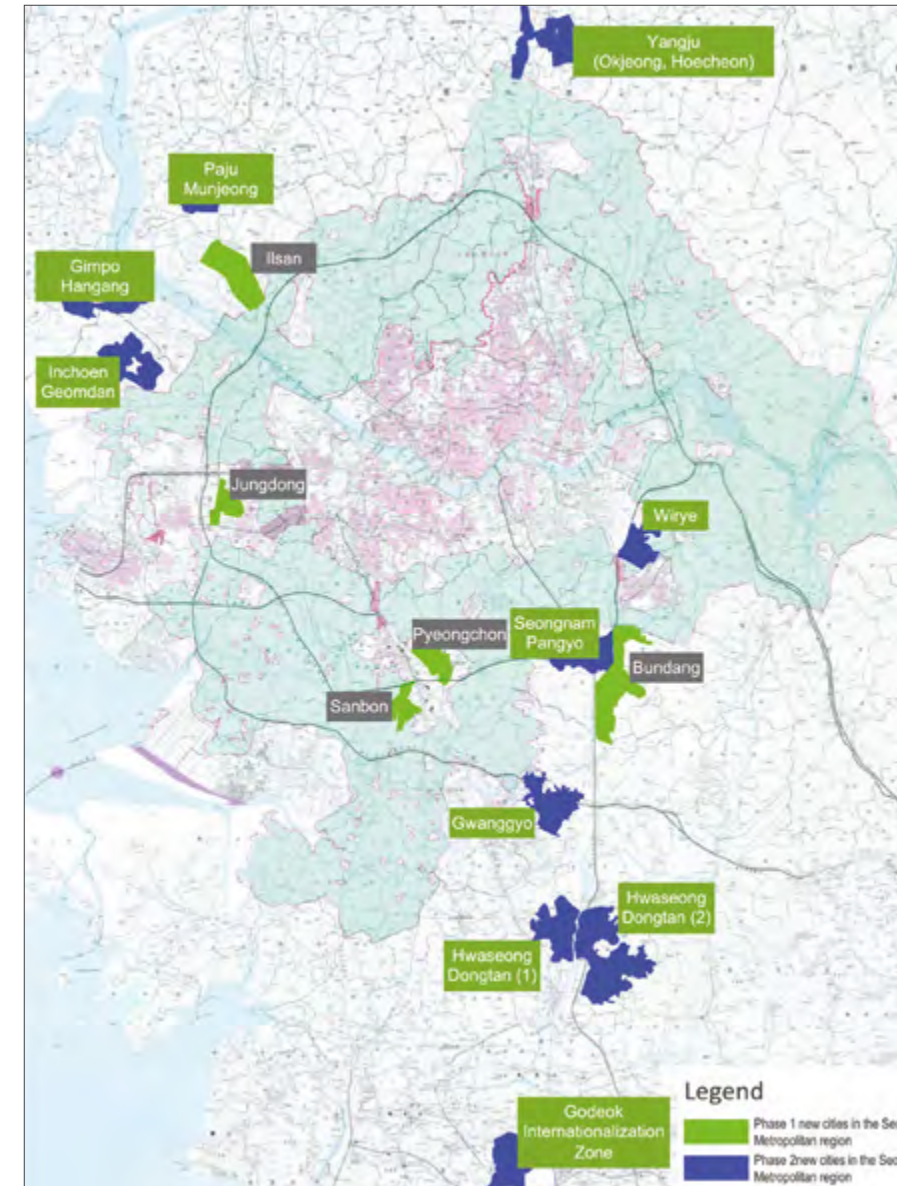
Although the main reason for these new towns were to provide housing, in order to prevent them from becoming bed towns a decision was made to move several Government agencies and State-owned Enterprises (SOEs) outside of Seoul. These were the first 5 new towns built in Phase 1. Later the government had designated to completed 10 more (Phase 2) new towns, and in present day Phase 3 is under implementation.

NEW TOWN DEVELOPMENT WAS PART OF THE NATIONAL AGENDA

Most of these projects were project managed through public state-owned enterprises such as Korea Land & Housing Corporation (LH)*. Public developers assembled the land and provided the infrastructure and sold the developed land to private developers to build housing, commercial and office spaces. Many of the development gains (profits) were used to provide public infrastructure and facilities such as building parks, library, schools and other civic facilities.

- Developed to respond to the public outcry on housing shortage
- Lead to more organized phased development
- Contributed to present day high-density development (compact cities).
- Supported the expanding middle class
- Provides affordable housing to lower income households.

Green (Environment) wasn't the main concern for the early phase of new town development in Korea, however compared to private sector led development, government led development provided a higher percentage of green spaces and started introducing environmentally friendly



Locations of Phase 1 and 2 New Cities in the Seoul Metropolitan Region

development methods. This was not only good for public health but it also made new town projects economically more feasible.

One of the key success points of Korean new town development was linking the new towns with center (core) city using public mass transit. Connection with the main urban core was considered as top priority when developing the new site and factored into the overall development cost from the beginning. Korea didn't use the term

or concept of Transit Oriented Development (TOD) at the point of development, however even the first generation new towns were all well connected via mass transit (subway and buses) which made the project more economically viable and environmentally friendly.

Experiences and lessons learned from the phase 1 new town development helped inform later stage new town developments.

* Before 2008 LH was two separate SOE Korea Land Corporation and Korea Housing Corporation which merged as government policy to integrate urban development and housing supply

Gyeongbu Expressway (Highway)



Transportation - integral to export led development plan

The Gyeongbu Expressway is widely regarded as one of the most critical infrastructure projects undertaken since the rapid industrialization and urbanization period from late 1960s. Gyeongbu Expressway was built as part of a strategic national economic development plan to facilitate export-led development. In the late 60s and 70s light industrial complexes were clustered around Seoul metropolitan area, and creating a logistical link by building a highway with Busan which had the largest exporting seaport, was a strategic decision made by then President Park, Chung Hee.

During this period international experts suggested the newly independent republic that road-based transportation network development would only lead to environmental degradation compare to upgrading rail networks built during the colonial period. However, the Korean government made an economic choice between building a rail network, which was much was far more costly compared to a road network. Moreover, the project was also met with strong opposition internally and externally when first planned as the country did not have immediate demand for an expressway connecting the two largest cities in Korea.

Back in 1967 before groundbreaking of Gyeongbu Expressway, there were only 60,000 registered vehicles (both personal and commercial) and until 1969 overall road pavement rate was barely reaching 8%. Moreover, Korea back then did not possess the necessary civil engineering capacity to embark on such construction and engineering challenge.

Despite these challenges, construction began on February 1, 1968 and took two years and five months to be completed. Travel time from Seoul to Busan was cut by a third from 15 hours to 5 hours. Total length of the expressway was 416 km and it now connects the 5 of the top 7 largest cities in Korea. At the time of construction total project cost was 43 billion KRW (\$8.5 million USD), 41.6 billion KRW for construction cost and only 1.4 billion KRW for land acquisition.

For the struggling nation, this amounted to nearly 24% of the annual national budget back in 1970. Yet, by international standards it was a very inexpensive investment. In part this was because land acquisition costs were so cheap compared to the market value at that time. Korea Expressway Corporation (KEC), a public corporation was established to oversee the construction and later maintain the expressway. Today, KEC continues maintenance of Gyeongbu Expressway and many other expressway networks in Korea.

Development experience of Gyeongbu Expressway contributed to building an additional 6,000 + km of expressway. Nowadays throughout most of Korea a major expressway can be accessed within 30 mins of driving.*

In summary, Gyeongbu Expressway established linkages of industrial complexes and cities which are now part of the national and international manufacturing value chain. Gyeongbu Expressway is an example of infrastructure development case which spurred development throughout the nation.

World Bank declined lending to Korea for the expressway as it seemed too large and unnecessary for low levels of traffic.

- **1967** only 60,000 registered vehicles in the entire country.
- **1969** Only 8% of the roads were paved.



* Expressways in are managed by KEC or a private concession operator and require a toll to access

Integrated Green Growth is Economical, Environment-Friendly & Sustainable

Green growth is not about just planting trees and riding bikes, achieving sustainable growth takes a multi-sectoral approach, for example green growth in an urban context prioritizes smart growth by further integrating innovative technologies that promote quality of life, jobs and shared economic prosperity.

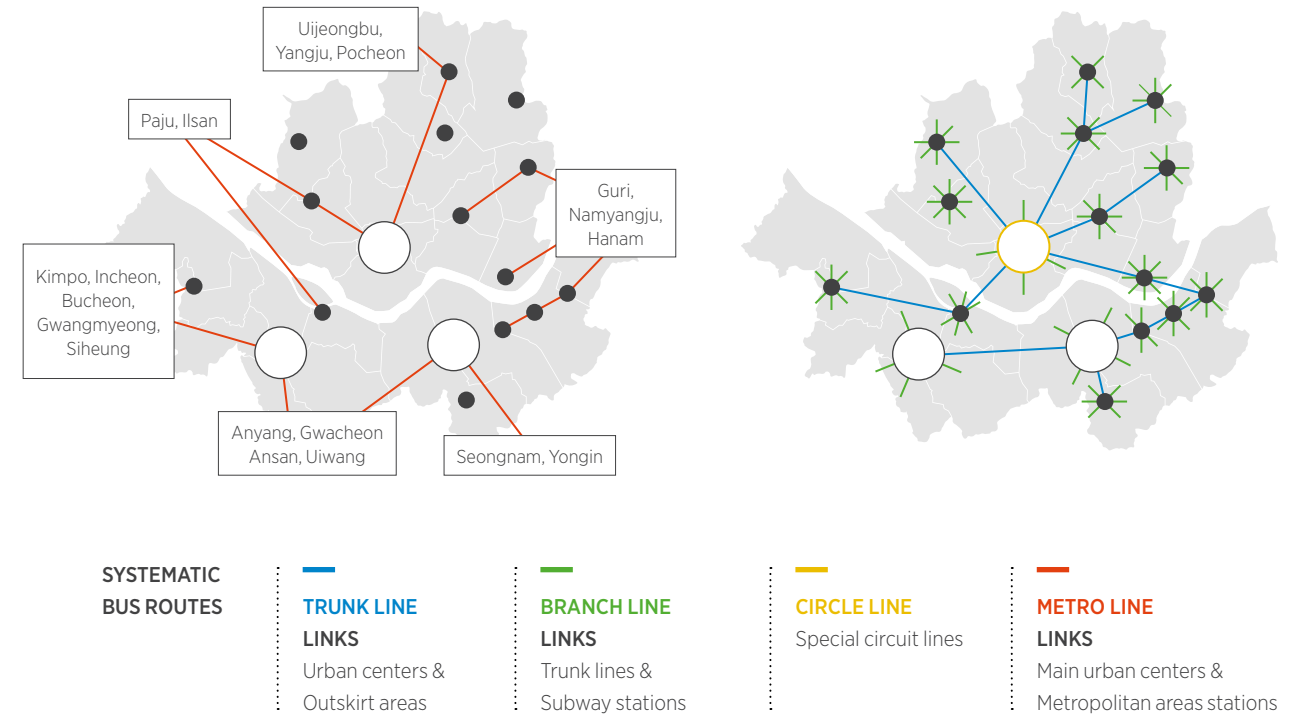
Public Transportation Reform in Seoul ¹⁵

By the early 2000s, Seoul's congestions soared due to the growing number of cars on the road. Following national strategy for economic growth they switched from a non-integrated transportation system towards a transport-centered one to create smart density, particularly using innovative partnerships and new technology.

In 2004 the Seoul Metropolitan Government (SMG) implemented the public transportation reform to reduce traffic congestion by

promoting the use of public transportation, mainly discouraging people from driving their own cars. The public transportation reform was implemented through public private partnership. SMG provided a strategic plan and comprehensive measures to transform buses into transportation as fast and accurate as subways, and these collective efforts have been instrumental in transforming Seoul into a sustainable city with green transport. There are five major policies implemented as follows.

SEOUL'S SHIFT TO GREEN TRANSPORT


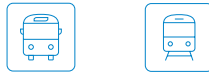



Median Bus Lane

01

Bus-oriented Reform: Dedicated Bus Lanes and Systematic Bus Routes

- Efficient hub-and-spoke model was established connecting metro and trunk lines that linked urban centers with surrounding metropolitan areas.
- Branch and circular lines operated within districts connecting subway stations.
- To increase travel speed and maintain intervals, median bus lanes were created with a dedicated lane for buses.
- Over 126.6 km of median bus lanes were established with 829 median bus platforms

Year	Before	After
 5km (by bus) + 4km (by bus)	900 + 900 = 1,800 won (approx. USD 1.6)	900 won (Basic rate within 10km)
 5km (by bus) + 7km (by bus)	900 + 900 = 1,800 won	Basic rate + 100 won (additional fares for 10km to 15km) 1,000 won
 64km (by bus) + 8km (by subway) + 4km (by bus)	900 + 900 + 900 = 2,700 won	Basic rate + 200 won (additional fares for 10km to 20km) 1,100 won

02

Seamless Integration

Integrated Fare and Multi Modalism

- A new fare system replaced per-ride flat rates with an integrated fee based on combined distance traveled for up to five transfers in any public transport modes.
- Riders can take multiple modes of transport to their destination, able to transfer up to 5 times within 10km with no transfer charge.
- Major transport nodes were upgraded as transfer centers and brought together scattered bus stops.
- Transfer centers facilitated quick and easy transfer between bus lines to different modes such as subway and taxi. For example, at Seoul Station, transfer time between bus and subway was drastically reduced from 12 minutes to 3 minutes.

03

Innovation through ICT

Integrated Payment Card and Real-time Information

- ICT innovation was essential to enable the distance-based fare system which required digital means to recognize travel distance and transfer time.
- SMG and investors created the T-money card. The T-money card system was developed and deployed through PPP scheme leveraging private capital and technology.
- Seoul's electronic fare payment system allowed the collection of fares based on travel distance by collecting passenger's boarding/getting off information through GPS.
- TOPIS, Seoul's Transport Operation & Information Center, facilitates multi modalism by providing real-time bus location, arrival time, interval, and traffic condition.
- Passengers can access information TOPIS provides through mobile apps, websites, and Bus Information Terminal (BIT) in bus stops.

04

Quasi-public bus system

Private operation and Public management

- SMG created a quasi-public bus system, in which private companies are responsible for bus service operation and SMG oversees management such as routes management and service monitoring.
- SMG led the redesign and allocation of bus routes, and the private bus companies operate the routes allocated to them.
- The revenue from all routes is collected and redistributed to operators, based on the standardized operation cost per distance, so that surplus revenue from busier routes subsidizes less popular but essential lines.
- SMG provides subsidies to bus operators to compensate the transportation deficit caused by free transfers of the distance-based fare system.

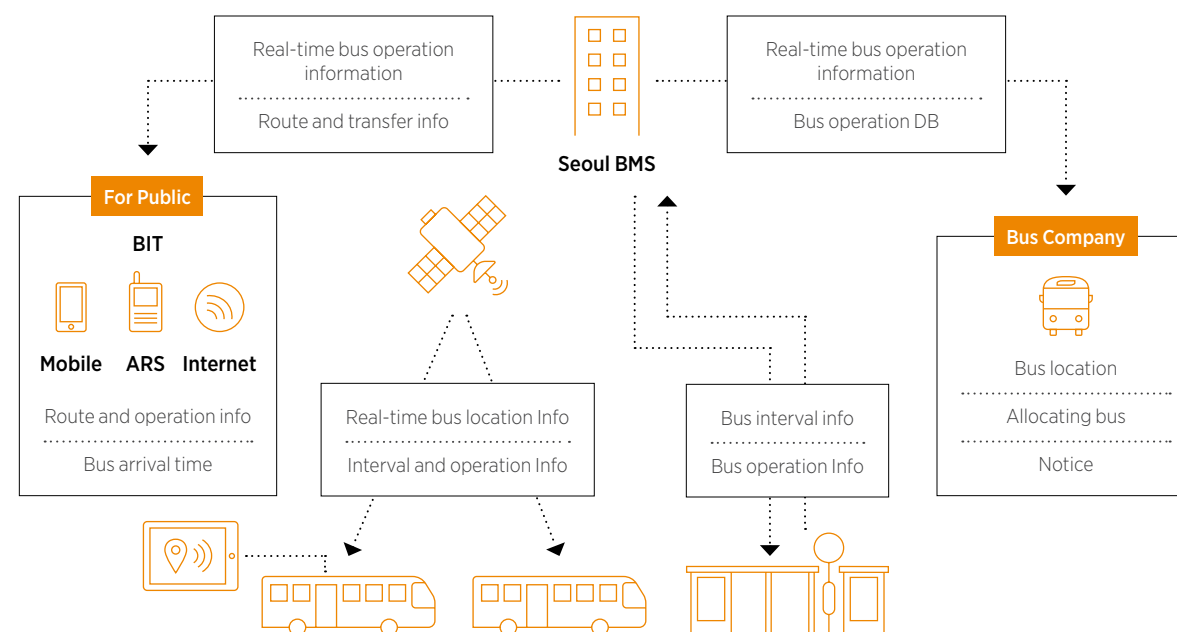
Before the 2004 Reform, bus service was operated by private companies. SMG provided road facilities for buses but had no authority to manage bus services or intervene in bus business.

Uncontrolled bus routes, prolonged bus intervals, lack of driver incentives, all contributed to deteriorating public bus service quality, and ultimately resulted in falling ridership.

In 2004, the entire bus routes were reorganized by SMG to avoiding overlapping services. The new system ensures all citizens have access to high quality transportation and are no longer disadvantaged by living in isolated or remote areas.

How Intelligent Transport Works

Seoul Bus Management System¹⁶



05

Experimentation leading to Vision and political will

- SMG initially started a pilot project in northeastern part of Seoul but encountered strong oppositions from stakeholders.
- After the failure of a pilot project, SMG decided to implement comprehensive measures simultaneously including the distance-based fare system, changes in bus routes, and a transparent reimbursement system.
- To reach a social agreement on the reform, SMG established 'Bus Reform Civic Committee' composed of civil organizations, bus companies, experts, city council and others.
- The committee made persistent efforts along with countless hearings and meetings, and official letters were written to 16,000 bus drivers to ask for their supports, which assuaged the fears of the bus companies and the bus drivers' union.

IMPACTS OF PUBLIC TRANSPORT REFORM

SMG successfully implemented the reform of public transportation by Improving the Bus System.

RIDERSHIP INCREASED	ON-TIME ARRIVAL INCREASED
9.4%	4.6%
AVERAGE BUS SPEED WENT UP	OVERALL SATISFACTION
30%	Up 32% as of 2017

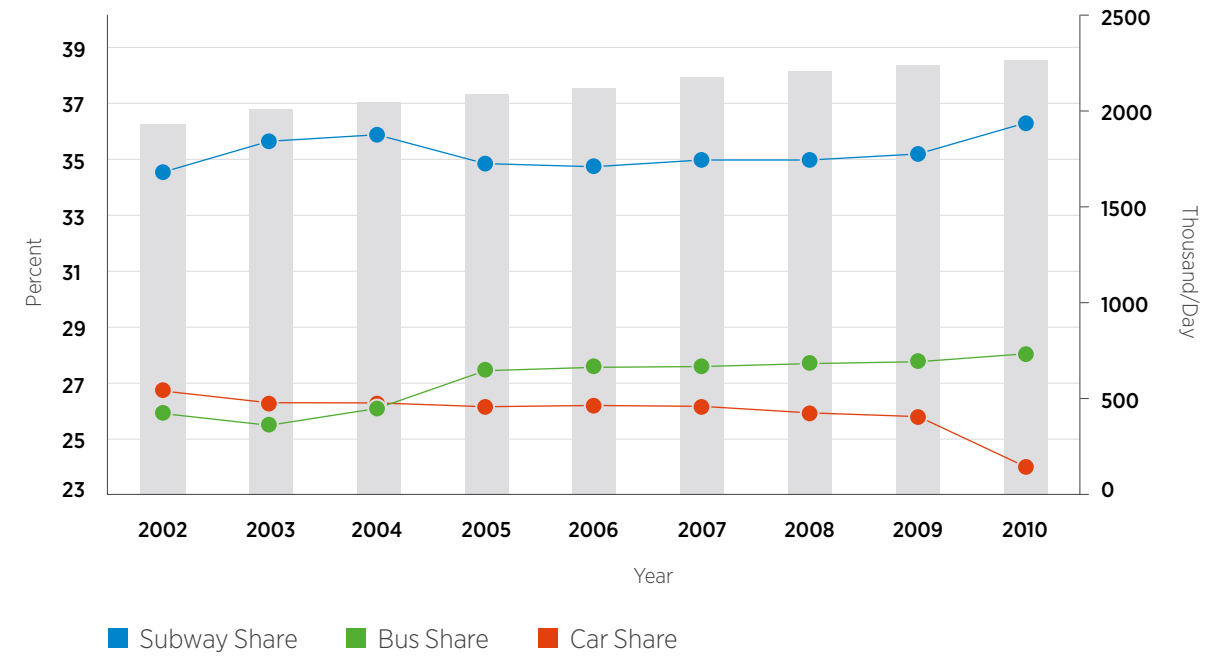
The public transportation share has increased, and the Travel speed of all transport modes has improved.

Financial Investment

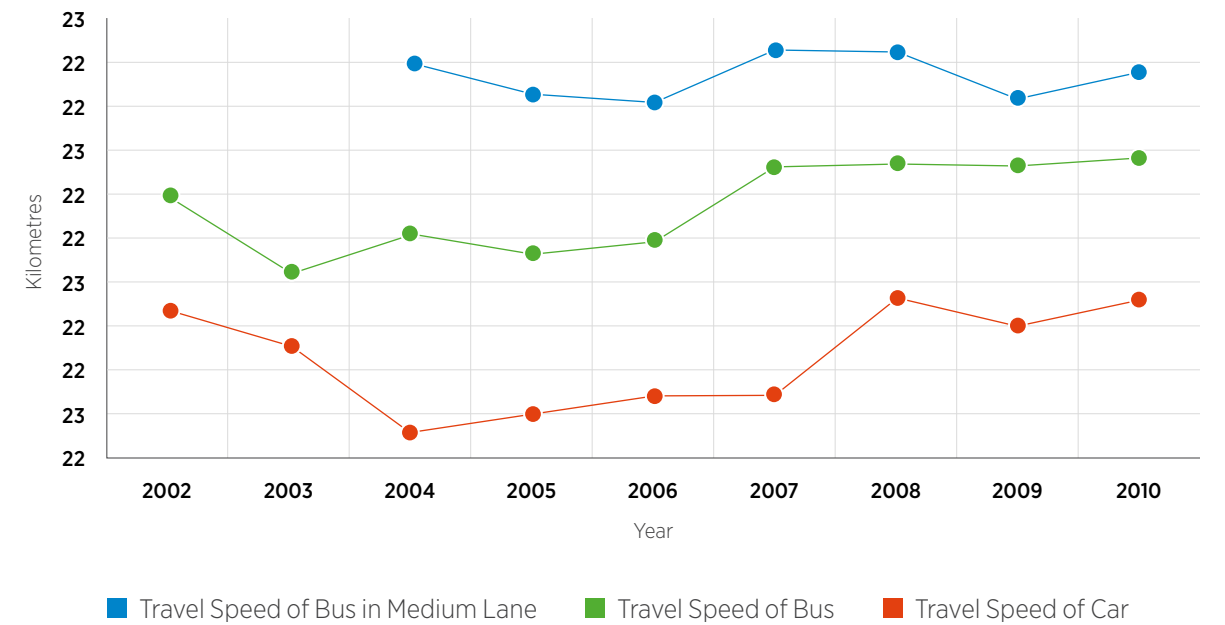
Due to the incremental and iterative process that included pilots, it is hard to provide a comprehensive estimate of the total cost of Seoul's bus reform. In short, the funding came mainly from Metropolitan Government expenditure, with private investment and spread over diverse budget items and mixed with other projects and overhead costs.

In 2014, SMG allocated \$25 billion to build 59.5 km of BRT lanes (about 47% of current length) and \$13 billion to establish TOPIS. SMG paid the bus companies \$3.4 billion to defray the cost of repainting their buses for the new color code required by the reform. Overall, initial construction and preparation costs for the revamped bus system was roughly \$100 billion, not including subsidies for transport operation.

Yearly Change of Mode Share and Number of Cars



Yearly Change of Travel Speed



Balanced Territorial Development: Sejong & 10 Innovation Cities

NEW TOWNS FOR BALANCED NATIONAL DEVELOPMENT

From mid-2000s Korean government started developing a new administration town, named Sejong Administrative City in the center of South Korea and relocated most of the national ministries offices from Seoul. This was in response to continual complaints over concentration of power and people in the Capital Region of Seoul. This investment was a shift from previous policy directions to promoting geographically equitable economic growth by redistributing development nationwide.

KEY GREEN FEATURES OF THE NEW SEJONG CITY

1. Eco-friendly transport planning

Sejong Administrative City was established with a transportation system that connects major cities. Within the city, city planners implemented an efficient public transportation system with a ring-shaped BRT lane and applying TOD concept. In addition to these features, they included other green measures such as distribution of eco-friendly vehicles and improvement of pedestrian environment along with designated bike lanes contributing to the green growth of Sejong city.

2. Green space

Sejong Administrative City has the highest green area ratio with an allocation of 50% of the urban area (approximately 38 million m²) to green areas such as parks and water-friendly spaces. Compared to Bundang (27.4%) and Pangyo (34.2%)*, Sejong Administrative City has a higher portion of land designated for green spaces.

3. Green technologies and Efficient Resource Use

Sejong Administrative City introduced eco-friendly energy independent villages, and promoted the use of renewable energy by granting incentives. Rooftop greening of public institutions and installation of solar panels on parking lots, tunnels, and waste facilities contributes to reducing greenhouse gas emissions.



Sejong Administrative City Land Use Plan

Low Density	Park	Kindergarten
Middle-Low Density	Green area	School
Middle Density	River	University
High Density	Public Open Space	Welfare Facilities
Commercial Area	Reservation Area	Cultural Facilities
High-tech Industry	Central Administrative Org.	Folk Village
Industrial Site	Public Government Office	Medical Facilities
Public Institution	Research Institute	Sports Facilities

INNOVATION CITIES

Similar to Sejong Administrative city, ten innovation cities were spread across the country and the government relocated major SOEs to the newly developed towns adjacent to existing regional hub cities to anchor the new towns. This was intended to promote development throughout the nation and to encourage innovation by establishing the basis for thriving ecosystems. SOEs were clustered according to strategic economic growth themes and are co-located into 10 cities according to each city's themes.

CITY & THEME

Gangwon: Tourism, Resource development, Health & Life

Chungbuk: ICT, Development of Human Resources, Science and Technology

Jeonbuk: Agriculture, Land Development

Gwangju & Jeonnam: Electricity Industry, ICT, Agriculture

Jeju: International Exchange, Educational Training, National tax management

Gyeongbuk: Transport, Agriculture, Electricity Technology

Daegu: Industrial Support, Educational & Academic Industry, Gas Industry

Ulsan: Energy, Labor Welfare, Industrial Safety

Busan: Maritime Fishery, Finance, Movie/Film

Gyeongnam: Housing Construction, Industrial Support

The new Sejong Administrative City and the ten innovation cities applied the latest green technologies from the planning and design stages through development with a focus on quality of life.

The following planning schemes were applied and implemented:

- Low Impact Development (LID) method
- Street widths were restricted to limit private vehicles
- Protected bike lanes were integrated into the initial development
- 30-40% of the land was reserved for parks and green space
- More than 50% of land designated to green space

Prior extensive investments in public transportation network throughout the nation, made the interconnections fiscally possible. Korea also added highway connections and high-speed rail train to enhance the transport interconnections. Effectively, Korea has transformed the entire country into a city scale (daily living zone). While the new towns' effectiveness is under review, it did accomplish the aim of spurring new development outside the capital region, creating desirable and liveable urban environments.

Gangwon

Area: 3,612,000m²
Population: 30,887

Chungbuk

Area: 6,925,000m²
Population: 41,834

Jeonbuk

Area: 9,909,000m²
Population: 30,288

Gwangju & Jeonnam

Area: 7,327,000m²
Population: 50,000

Jeju

Area: 1,151,000m²
Population: 5,100

Gyeongbuk

Area: 3,815,000m²
Population: 26,169

Daegu

Area: 4,216,000m²
Population: 23,298

Ulsan

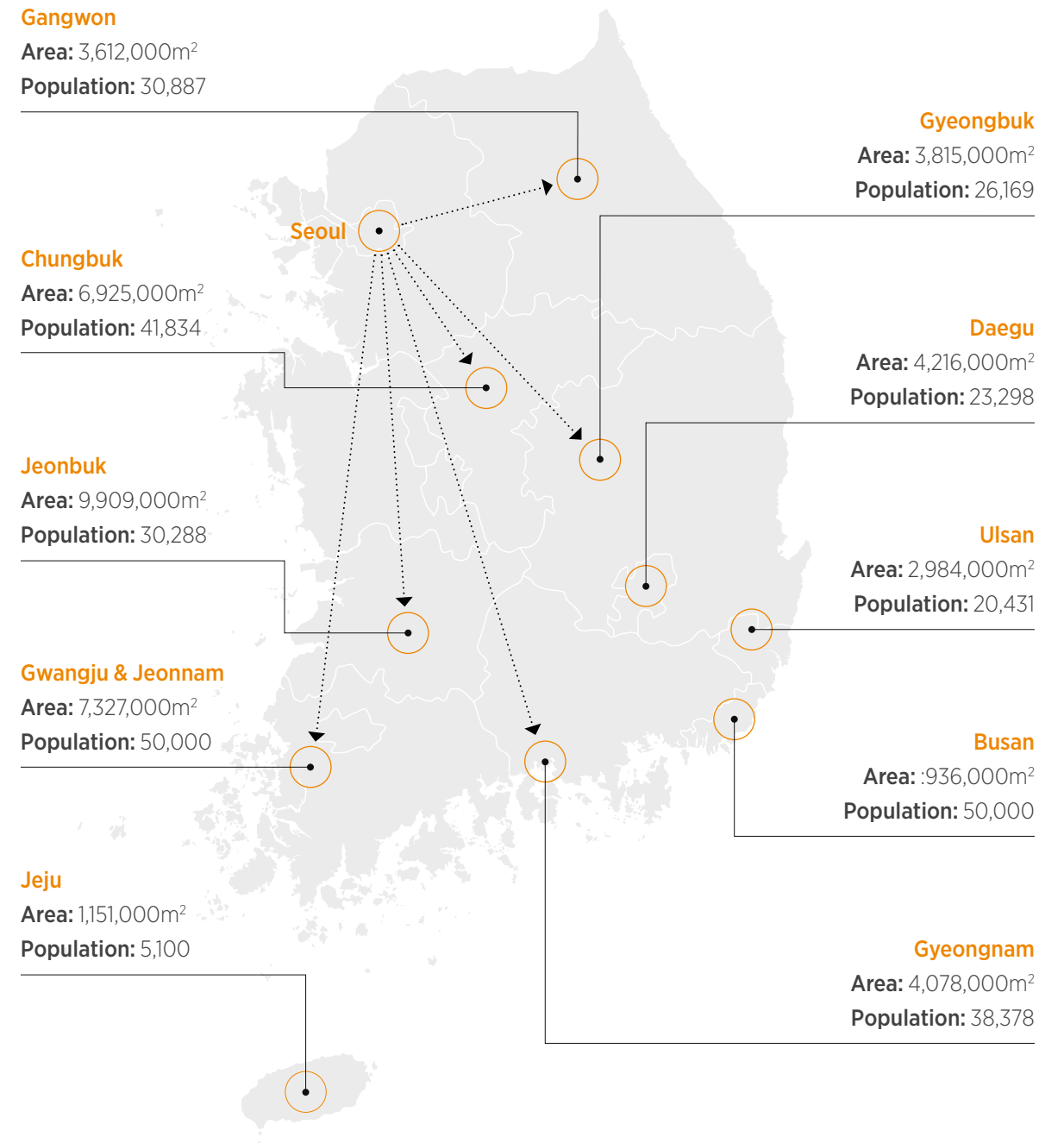
Area: 2,984,000m²
Population: 20,431

Busan

Area: 936,000m²
Population: 50,000

Gyeongnam

Area: 4,078,000m²
Population: 38,378



Green and Inclusive Growth: Happiness Housing

Anchor of green urban regeneration

Happiness Housing is Korea's new public rental housing, planned and developed as part of the green growth policy, introduced in 2013. The initiative aimed to reduce the housing cost for the younger generation who previously did not qualify for residential welfare policies. The initiative was in response to expensive housing costs which was a huge burden for young people who needed housing in the cities for jobs or schools. Happiness Housing provided lower-priced rental housings in downtown areas targeting the younger generation.

Unlike previous public housing projects which provided rental housing in the outskirts of cities, Happiness Housing complexes were built on small-scale sites, government owned land or idle sites in downtown locations. This reduced commuting times, helped to reduce the social costs of traffic congestion and inefficient energy consumption. To date, 140,000 units were approved including 4,702 units across seven pilot projects in the metropolitan area.

COMPARISON OF PUBLIC RENTAL HOUSING TYPE IN KOREA

	Happiness Housing	Rental Housing with a Purchase Option	Permanent Rental Housing
Purpose	Improving housing stability and welfare for younger generations	Supporting people who want to get their own house	Improving housing stability for low-income group
Target	University students, Newly married, Newly employed	First time homeowner, Newly married, Multi-child parents, Elderly parents care giver	Low-income group
Size	Less than 45m ²	Less than 85m ²	Less than 40m ²
Main Location	Downtown area with job-housing proximity	Newly built residential districts	Newly built residential districts

BENEFICIARY GROUP

Previously, the target groups for rental housing were vulnerable social groups and newly married couples, in particular those with low-income. Happiness Housing includes young generation such as university students and newly employed people regardless of their marital status.

- 80% of happiness housings are for newlyweds, industrial complex employees, and university students.
- 20% are for vulnerable group such as low-income as well as seniors.



University students



Newly employed



Vulnerable social group



Senior citizens



Newlyweds



Industrial complex worker

Rental Period

The rental period is different for each group.

- University students, newly employed people, and industrial complex employees can stay 6 years.
- Newly married couple (married under 7 years) can stay 6 to 10 years.
- Vulnerable social group and senior citizens can live up to 20 years.

Implementation

- The Ministry of Land, Infrastructure and Transport establishes the development plan through the consultation with the local government.
- The construction and operation are implemented by public corporation such as Korea Land and Housing Corporation (LH) or municipal corporations, etc.

Public Transport-Oriented Location in Downtown

Happiness Housing aims to build on regions where land costs are low, rental demand is high, and public transportation is convenient in downtown areas, thus mostly idle spaces near rail stations were chosen.

Urban Regeneration with Mixed Land Use

The aged and neglected urban spaces were reorganized through the Happiness Housing initiative which aids urban regeneration. Happiness Housing was planned to contribute to revitalizing the local economy not only by accommodating young residents but also by attracting social enterprises and start-ups, thus mixed land use plan is encouraged.

Oryu-dong Happiness Housing Project



Images: LH's Website <https://apply.lh.or.kr>

The Oryu-dong pilot project completed in 2018 is considered a best practice of Happiness Housing complexes. 890 units of Happiness Housing were developed in Oryu-dong, composed of 16m² - 45 m² units. The Oryu-dong Happiness Housing was built adjacent to the Oryu station, where the south area is blocked by the railway. The two divided neighborhoods are now connected through an elevated park crossing over the railroad. The multi-purpose center includes shared public facilities, a concert hall, a library, social economic spaces for youth and social enterprises, etc. In addition, green technologies were applied to individual units such as renewable energy and eco-friendly recycling.

The Oryu-dong pilot project initially faced strong opposition from existing residents. Their major concern was the potential to lower their housing price. Contrary to their concerns, Happiness Housing contributed to regenerating the surrounding area and changed residents' perception of the rental housing.

Electric Vehicles to Achieve Carbon Neutral Island¹⁷



Photo: Earth Observatory, NASA

Jeju Island located in the southern sea of the Korean Peninsula has a mild climate and can be traversed by car in less than two hours. Island residents are set to become a global leader of large-scale EV adoption as the island is home to the world's fastest growing number of EVs; the number of EVs registered in the Jeju area reached 10,006 on March 2 of 2018, from only 302 at the end of 2013. The number of EVs increased since then, with 18,128 EVs in operation at the end of 2019. Across Jeju Island, EVs are an integral part of daily life. Currently EV's account for about 2.7% of all registered vehicles.

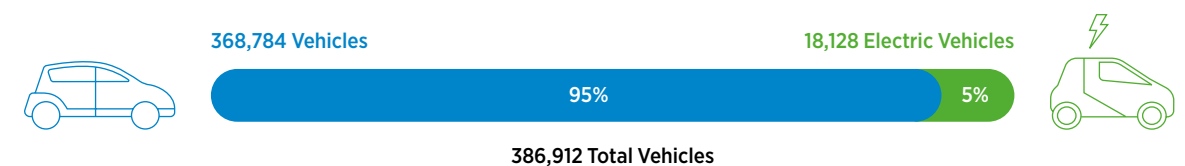
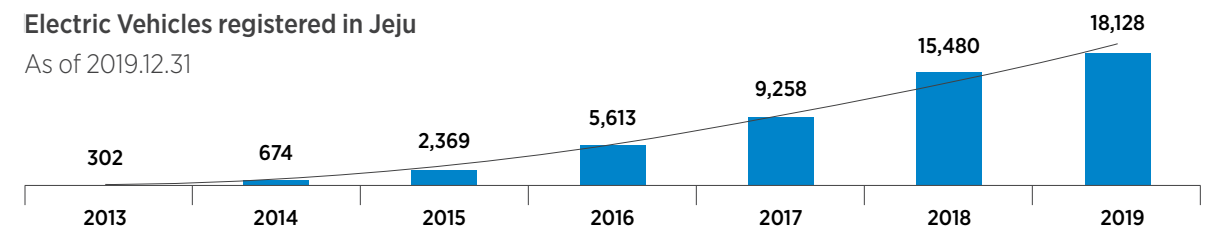
EV IN THE ISLAND AT A GLANCE

- About 71% of EVs in Jeju are private, 25% are commercial vehicles, and 4% are public vehicles.
- Commercial EVs can be categorized into different types, including rental cars (2,193), taxis (224), buses (63) and freight vehicles (2).
- There were only 4 types of EVs in 2013, but in the second half of 2018, there were 25 types of EVs (21 types of high-speed EVs, 3 types of Micro EVs and 1 type of freight EV) and electric taxis and electric buses are no longer unfamiliar.
- More than 2,000 rental EVs provide opportunities for Jeju visitors to experience.

These changes are being promoted by the strong driving force for EV by Jeju Special Self-Governing Province through participation of Jeju residents in EV policy. As countries look to deploy new technologies key factors in Jeju's EV adoption provide an example of how to implement ambitious change.

Electric Vehicles registered in Jeju

As of 2019.12.31



BEV purchase subsidy + Tax exemption (max. 400 USD)

Max. BEV subsidy (USD/unit)

	2013	2014	2015	2016	2017	2018	2019
National	15,000	15,000	15,000	14,000	14,000	12,000	9,000
Local	8,000	8,000	7,000	7,000	6,000	6,000	5,000
Total	23,000	23,000	22,000	21,000	20,000	18,000	14,000

HIGH EV SUBSIDY AND TAX BREAKS

Despite a lack of awareness on EVs, the limited EV models available for purchase, and the short driving distance on a single charge, the high subsidies for EVs made it possible to buy EVs at the same price level as internal combustion engine (ICE) vehicles and generated initial demand for EVs. In addition, financial incentives and tax benefits such as the exemption of special consumption taxes, educational taxes, and acquisition taxes made the cost of EV's comparable to traditional ICE vehicles.

REINFORCED DISSEMINATION OF EVS FOR THE PUBLIC SECTOR AND BUSINESSES

The expansion of EV distribution in the Jeju area is the result of focusing on the distribution of EVs to the public, businesses, and the private sectors. The Ordinance on the Promotion and Revitalization of EV Dissemination stipulates that Jeju Island's public institutions should make efforts to purchase EVs as business vehicles. Through these efforts, official vehicles are being replaced by EVs. In addition, EV bus fleet, taxi and rental cars increased adoption and dissemination across the island.

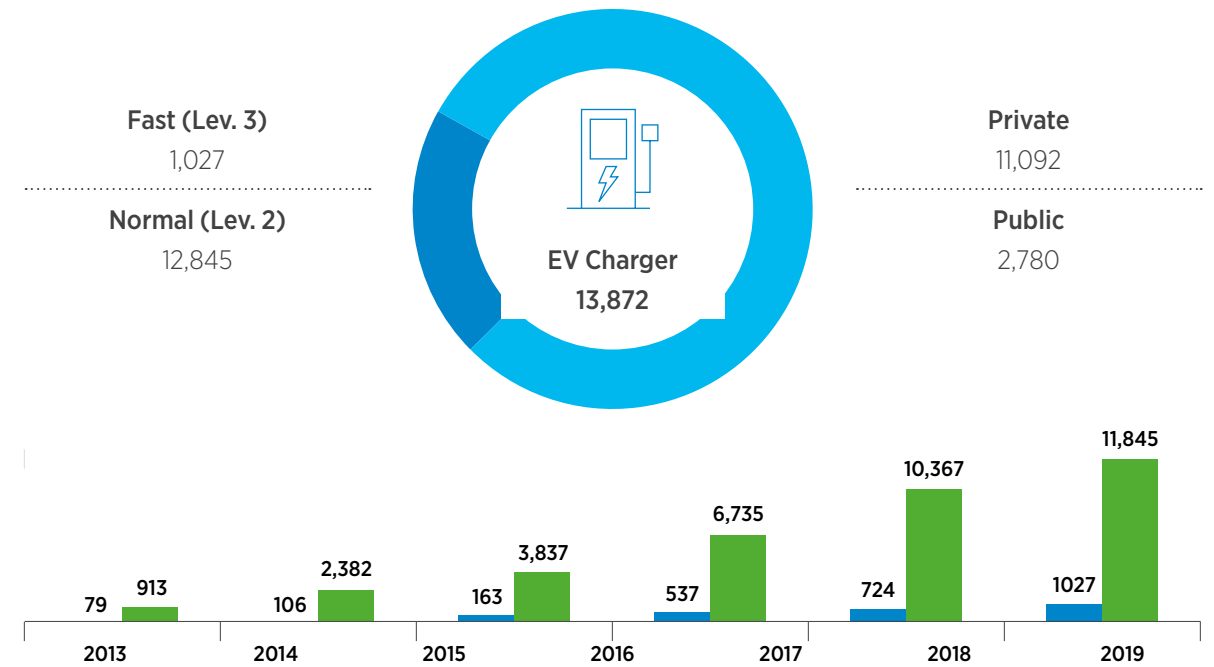
CONTINUOUSLY EXPANDING CHARGING INFRASTRUCTURE

With the continuous increase in the number of EVs, Jeju Special Self-Governing Province is continuously expanding the number of its charging infrastructure. There are 0.7 charging units per EV and 1 fast charging unit per 25 EVs. The installation cost of the charging device is supported by the central government, and low-speed charging facilities can be installed in the residential area after purchasing the EV.

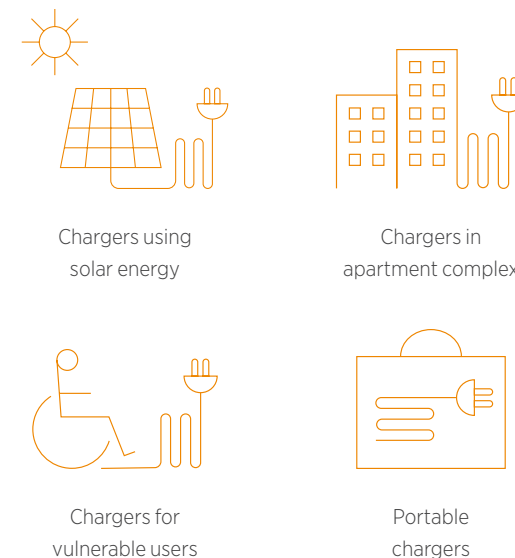
2014	2018
REGULAR CHARGING STATIONS	REGULAR CHARGING UNITS
992	10,082
HIGH-SPEED CHARGING STATIONS	HIGH-SPEED CHARGING STATIONS
79	667

EV Chargers in operation in Jeju

As of 2019.12.31



Various charging systems in Jeju



SUCCESS FACTORS OF EV DISSEMINATION IN JEJU

The success of EV deployment in Jeju Island was achieved through a number of efforts:

- Programs established by the Ministry of the Environment to increase charging stations including establishing high-speed charging units at multi-unit dwellings
- Public corporations and inducing private charging companies to expand locations
- Jeju Special Self-Governing Province's strong efforts for EV dissemination
- The cooperation between the central and local governments
- The environment and geographical conditions of the Jeju Island
- The participation of residents in EV policies

Enabling Environment for Public Good and Innovation



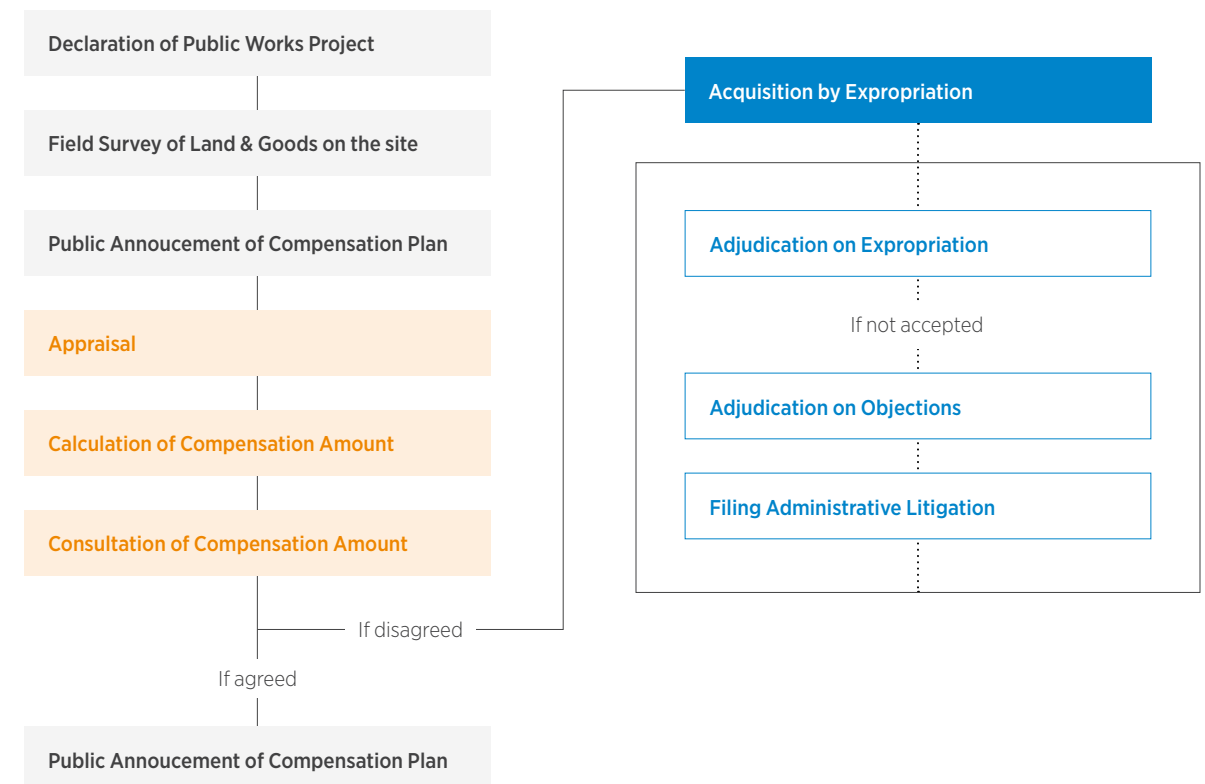
An important step in economic development starts from securing land for infrastructure, houses, and factories with appropriate price and timely manner. However, most public development can cause sharp increase in land price and speculations resulting in enormous financial burden for the public. Korea's land policies have supported economic development by securing land for public infrastructure and responding effectively to urban problems such as land speculation, price hike, and urban sprawl.

PUBLIC LAND DEVELOPMENT PROCESS

Korea developed a majority of its of urban land by using public driven redevelopment methods. Predictability of project development cycle is crucial to making development projects economically viable. Korea's urban and land laws detail procedures which allow the acquisition of private land for public purpose and provide a fair process for handling land compensation disputes.

The diagram below lays out the steps of compulsory land purchase from the public sector. Government first designates an area to be developed for public purpose. Once the plan is revealed to the public, appraisal of the land takes place and land owner can get up to three different appraisals conducted by independent appraisers. Based on the appraised value, the public developer (often LH for national development projects) will seek agreement from the land owner, if agreed the two parties will transact. If the land owner disagrees with the price offered by the public developer they can go to court to contest, and settle the price of compensation. However regardless of disagreement with land price, land owners will eventually have to sell their land as this is part of the Land Expropriation Act.

Procedure of Compulsory Purchase in Korea



Development of Hanam Misa Newtown



Before development circa 2009



After development circa 2018

In June 2009, Hanam area was identified as a location for new city development. The site was chosen because of its small population, making the compensation process easier. The Central Government approved the reduction of the green belt to accommodate the necessary city development.

Before the start of the project the population of Hanam City was 150,000. The expected population after full development will likely double to 280,000+ following completion of the Misa and Gamil Newtown developments.

Satellite image comparison of Hanam Misa newtown pre-development in 2009 and 90% developed stage at 2018.

- 30% of land was designated for housing
- 25% of land for green and park spaces
- 17% for road infrastructure.

A significant portion of cost was used towards land compensation which account approximately 50% of total cost. Construction cost accounted for 1.7 Billion USD and the single largest item was on building intra-city transportation connections such as subway line extension and road infrastructure. Korea Land and Housing Corporation (LH), a SOE, was the project developer and through this project generated modest profit which was used as cross subsidy to provide:

- Affordable housing units
- Build new public facilities such as schools, city utility and civic buildings

Area	5,463,000 m²
Household Population	37,535 94,091
Project cost	9.5 trillion Won (=7.9 billion USD)
Construction Period	2009.6 - 2020.6
Population of Hanam City Before Development	150,000
Population of Hanam City After Misa & Famil Completed	280,000+

Type	Area (m ²)	%
Total	5,462,689	100
Housing	Single Detached	183,639 3.4
	Apartment	1,539,511 28.2
	Neighbourhood Commercial	11,600 0.2
Public	Commercial	374,238 6.9
	Office	54,453 1.0
	Self-sufficiency Facilities	432,249 7.9
	Public Facilities	38,259 0.7
	Park/Green Space	1,375,683 25.2
	Roads	934,548 17.1
	Schools	210,270 3.8
	Others	298,288 5.4

During development, LH consulted with a range of stakeholders including, the national & local government, public utility, SOEs and worked with the private sector to manage the development of Hanam Misa Newtown.

LH constructed residential buildings, educational institutions, recreational facilities as well as new towns, multi-functional administrative cities, and innovation cities around across the world. LH also offers city development services.

Korea Land and Housing Corporation (LH) is one of the largest public land and housing developers in Korea. Two separate corporations, the Land Corporation, established in 1975, and the Housing Corporation, established in 1962, were merged in 2009 and became LH.

The Housing Corporation built Korea's first apartment complex in Mapo in 1962. The Land Corporation started constructing Anseong industrial complex in 1978 and developed 1-3 phases of New Towns in Korea. LH's focus has been to develop and construct affordable and stable housing as well as promote the efficient utilization of national land.

	Million USD	%
Total Construction Cost	1,791	100
Civil Engineering	210	21.1
Water Supply	55	3.1
Sewage Supply	208	11.6
Electrical Engineering	25	1.4
Landscaping	108	6
Garbage Treatment Charge	78	4.4
Pylon Relocation Charge and others	216	12
Demolition and others	250	14.1
Intra-Regional Traffic Improvement	600	33
Survey	41	2.3

Construction cost of housing or any private building is not included in the total development cost, as private developers purchase developed land from LH and build buildings which their own funding

Land Information Management

Securing land is essential for any development, however, maintaining and utilizing the land appropriately is equally as important to plan and maximize the utility and minimize transaction costs associated to land uses. Korea has developed comprehensive land information system to manage national land for the past 45 years.

Korea Land Information System (KLIS) dates back to 1976 with the revised cadastral act, which mandated to reform land ledgers for digitization. The land ledgers for 38 million parcels were converted into a digital form in the 1980s, but cadastral maps remained undigitized.

In April 1995, construction workers in Daegu unknowingly bore holes through underground gas pipes and disrupted the lines. Hundreds of casualties and significant economic loss were followed by the massive explosion. These events raised the need for NGIS. The initial plan for NGIS (thereafter re-titled NSDI) was immediately prepared and this five-year phased project has continued since. Subsequently, the national land information system was jointly developed by multiple organizations, which include LX - the cadastral surveying agency. LX also fully digitized the cadastral maps of 750 thousand sheets between 1997 and 2003.

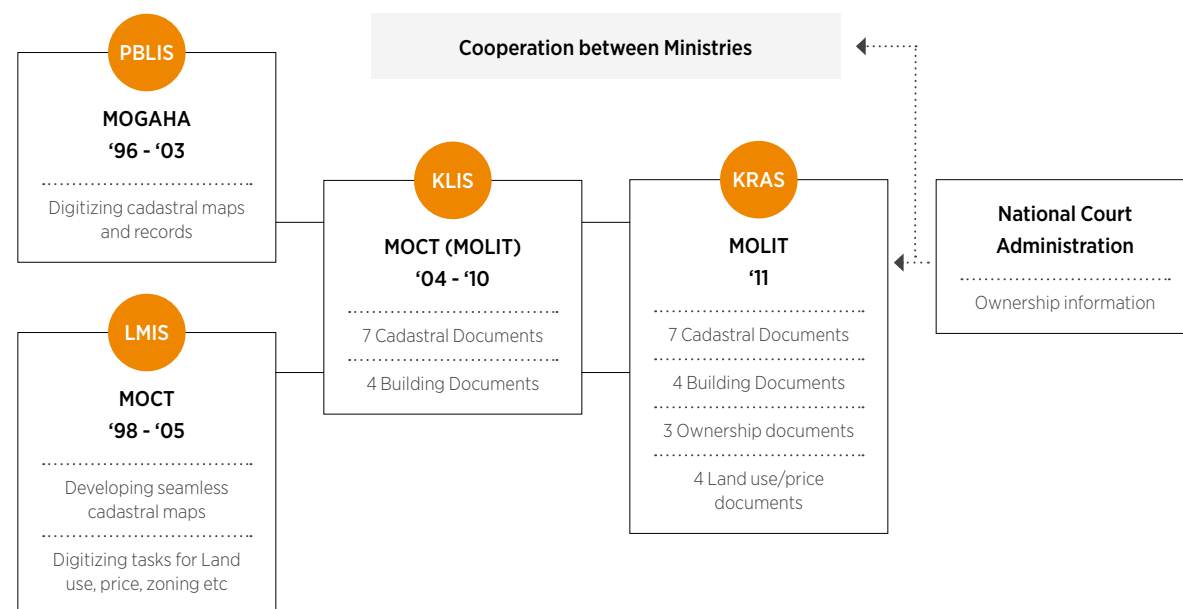
KLIS is a comprehensive land administration and management tool, which enables access to cadaster, ownership registry, land use, property taxation, building information, etc. KLIS improves data management, civil services, work productivity, and enables timely and scientific land policies via an

integrated database through the utilization of GIS and a high-speed national network.

KLIS manages around 200 administrative information, and connects to diverse systems: Land Administration Support System, Land Use Restriction Information System, Urban Planning Information System, National Defense Facility System, etc. Local government officials are the main KLIS users, while citizens benefit from more convenient and expedited civil services.

From development perspective, KLIS reduced the use of papers and ultimately increased productivity. The system is regarded as one of the rapid economic development enablers through saving time and costs in approval processes and resolving complex cadaster issues. Before KLIS, developers struggled with interpreting numbers of cadastral maps by manually linking these, as each paper map sheet has limited storage capacity. This manual operation often caused topological issues. However, the current system overcomes these challenges through seamless cadastral map; the multiple map sheets are digitally linked in the system. As a nation-wide database with trusted update and parcel boundaries, this seamless cadastral map is an important framework dataset to NSDI.

Development of KLIS by different organizations in different period



MOCT
Ministry of Construction and Transport

MOGAHA
Ministry of Government Administration and Home Affairs

MOLIT
Ministry of Land, Infrastructure and Transport

PBLIS
Parcel Based Land Information System

LMIS
Land Management Information System

KLIS
Korea Land Information System

KRAS
Korea Real Estate Administration Intelligence System

KLIS CREATION HIGHLIGHTS THE IMPORTANCE OF INSTITUTIONAL COOPERATION

Diverse land datasets were controlled by multiple government bodies and cooperation among these three government bodies was essential. Institutional cooperation facilitated data share, which in turn enabled more convenient civil services. 18 land documents are combined into a single document, which saved time and cost in requesting and interpreting multiple land document types.

KLIS brought a significant economic benefit, as the expense to benefit ratio exceeds 3. The tangible effects of the KLIS are cost reductions

and time savings by the public accessing relevant data. The expense was approximately 380 billion Won (appx. \$320 million) while the benefits were estimated 1,300 billion Won (appx. \$1.1 billion). The intangible effects were improvements to civil services from local governments, increased efficiencies of administrative duties, and contributions to scientific land policies. KLIS also significantly reduced civil service processing time. For example, those who request land transaction permit via KLIS may obtain the permit the next day, while the previous system took ten days to process a request.

Cost savings on accessing and issuing land use planning and publicly noticed individual land value through KLIS¹⁸

Accessing & Issuing	Before 2007	2008	2009	2010	2011	2012	Total
Total number (million)	78.0	129.6	75.3	69.3	97.6	73.8	523.6
Cost saving per transaction (KRW)	2,296	2,067	2,468	2,767	2,685	2,999	-
Total cost savings (Billion, KRW)	179.07	267.88	185.84	191.75	262.06	221.33	1,307.93

Examples of improved civil services as a result of KLIS development¹⁹

Types of civil service	Processing time before KLIS	Processing time via KLIS
Issue an official copy of land ledger	20 minutes	Instant
Issue an official copy of land use plan	20 minutes	Instant
Access to publicly noticed individual land value	10 minutes	Instant
Obtain land transaction permit	10 days	1 day
Submit objection to land value	10 days	3 minutes
Register a real estate agency	5 days	1 day

Green Growth: Technology and R&D Investments

Technology can help reduce inefficiencies. The world is entering the era of 5G, and data is the new engine for growth which doesn't cause much environmental pollutions. Use of ICT can improve existing services by better forecasting demand, minimizing overlapping investments and overall help make smarter decisions based on data. Investing in innovation can lead to improved public services, from which society can benefit.



Data Led Urban Management

TOPIS PLATFORM

Seoul Transportation Operation & Information Center & its Data Analysis Platform

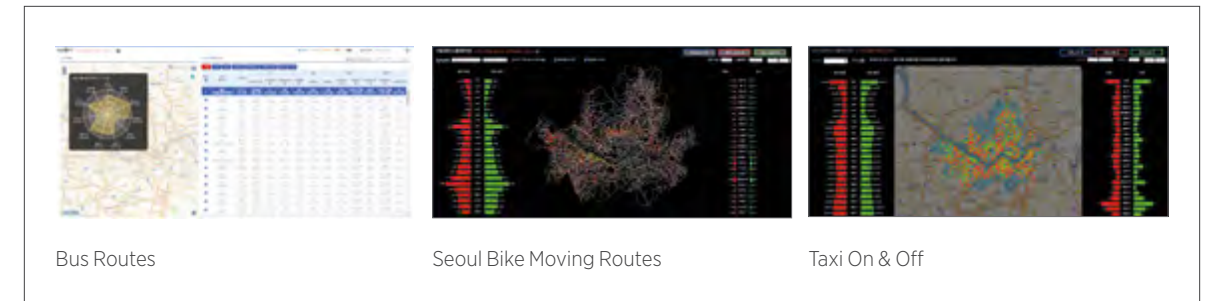
Seoul TOPIS (TTransportation Operation and Information Service) is the intelligent transportation system (ITS) brand of the Seoul Metropolitan Government (SMG). ITS in Seoul, developed in 1988, was the first of its kind in South Korea, to address transportation issues. The system has steadily improved and expanded as Seoul city expanded through the years.

In 2015, SMG decided to create an integrated system, city management transformed TOPIS into a platform, and integrated ITS solution that can be used by other cities and transportation departments. Over the past 20 years, Seoul TOPIS, further leveraged advanced ICT technology innovations for data collection & analysis. The value-added data and findings allowed for iterative improvements to enhance ITS functions.

The Seoul TOPIS platform consists of six-unit platforms

- Transportation Center Platform
- Bus Platform (BIS/BMS)
- Unmanned Regulation Platform
- Freeway Traffic Management System (FTMS) Platform
- Arterial Traffic Management System (ATMS) Platform
- Big Data Analysis Platform.

Traffic Forecasting provides operators with information they need to prevent delays



Integrating information from such a wide range of transit systems provides the information needed to make successful policy decisions. The operation of all the platforms in an integrated platform supports the analysis of big data and the host of opportunities to anticipate and solve problems.

Real time traffic information is a valuable tool for transit operators and valued by commuters. Thanks to the robust and sophisticated data analysis, TOPIS provides real-time traffic monitoring and more over able to provide traffic forecasting to anticipate and prevent delays across the system.

TOPIS Data Analysis Platform 'Transport Analysis and Information Management System (TAIMS)' is a comprehensive traffic analysis system that incorporates big data technology, and quantitatively evaluates transportation policy indicators by type of transport mode. This information and analysis system supports government officials to develop and implement new types of policies.

The system sequentially works across three steps of data collection, data analysis, and information provision. Every step is operated through the big data analysis platform in Seoul TOPIS Platform. Combining and analyzing a broad range of data, provides government leaders with clear and concrete information to make informed decisions.

Large amount of transportation data is collected through the platform:

- Transportation card information
- Bus operation records
- Taxi operation records
- Public bike operation records
- Geographic information
- Population

TAIMS presents the vast amount of data in a clear and user-friendly evaluation tool that focuses on the following:

- **Public Transportation:** travel time, travel distance, demand for public transportation, etc.
- **Public Bike:** status of rental/return, number of bikes by roads, moving routes, etc.
- **Taxi:** information on vacant/occupied, information on taxi stops, information on boarding/getting off, moving routes, etc.

In 2020, SMG started planning to develop new applications, such as a road safety map and traffic information services by making the most of innovative analytical techniques. These applications are expected to contribute to the improvement of universal transportation welfare for safe and convenient mobility for all in Seoul.



Data Based Metro Facilities Maintenance System

Smart Automatic Mechanical Bigdata Analysis System (SAMBA) is an ICT-based maintenance system for railway facilities, especially HVAC, water pump, fire equipment, and lift. Seoul Metro developed the system over the last three years and applied to three of the nine lines.

Four Elements:

- IoT sensor
- Network
- Database server
- Analysis server

Holding public safety as the number one goal, because a minor defect can result in major accidents with the railway, it is important to strictly manage all facilities. Seoul Metro had managed railway facilities based on Time-Based Maintenance (TBM), but found it was inefficient in terms of time, and field technicians were unable to deal with the failures that occurred between inspection intervals. Seoul Metro realized the need of Condition-Based Maintenance (CBM), predictive maintenance technique that analyzes the condition of each facility and determines which facilities need to be inspected. After three years of diligent work, the idea was embodied in a practical system, called SAMBA.

SAMBA KEY FUNCTIONS

Developed by fully using Information and Communications Technology, including IoT sensor, big data, and machine learning.

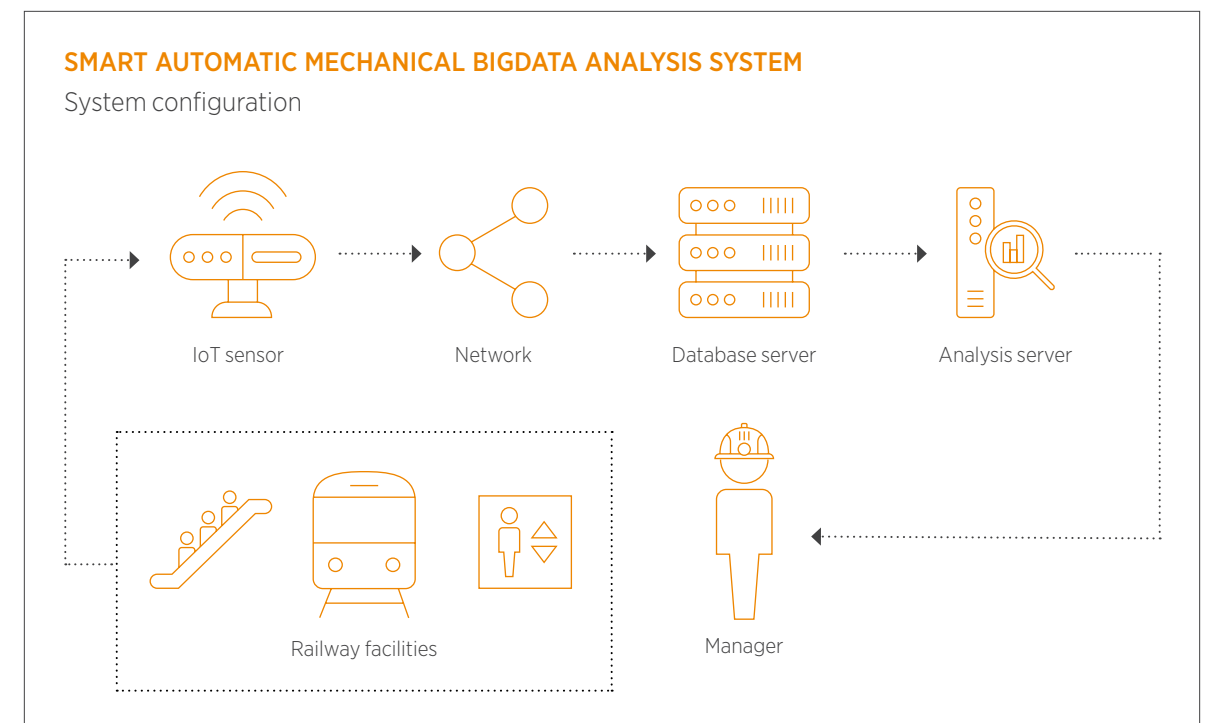
- **Failure Monitor:** SAMBA monitors the current status of facility and sends an alarm to Control Center when a failure is detected.
- **Failure Prediction:** SAMBA analyses data acquired from facility and predicts a failure on the algorithm developed by Seoul Metro.

KEY CHANGES TO MAINTENANCE

The first change was made to the maintenance systems. Once incorporated, SAMBA periodically monitors registered facilities. When a certain failure is detected, the alarm for the failure is sent to Control Center. Field technicians need to inspect only reported abnormal symptoms, not all the facilities.

MAINTENANCE METHOD

Previously field technicians inspected facilities with measuring instruments, and under certain circumstances with intuition and knowhow by watching, smelling, hearing, and touching. Such ad hoc methods frequently resulted in inaccurate results and resulted in further malfunction. Now, with SAMBA, the system acquires and analyzes data from all facilities and can accurately anticipate maintenance. The result is increased accuracy of inspections, and decreased time to complete those inspections. For example, a pilot test of Seoul Metro on 100 escalators found the MTRR (Mean Time To Repair) decreased by 34%.



Testbed City for Self-Driving Cars

In June 2019, the world's first 5G self-driving testing site was established in Sangam-dong (district), Seoul. The 2 km urban setting is both a technology and policy sandbox, allowing for experimentation. Located in the middle of the test-bed-city area, is a control center that monitors and evaluates all driving demonstrations. The test-bed city is equipped with technology and infrastructure needed to operate and monitor the vehicles including the following:

- 5G & C-V2X network
- Cooperative-ITS infrastructure
- High density map
- Signs & road markings
- Electric vehicle charging station
- Parking & maintenance space

The test bed is open to all domestic private companies interested in testing their technologies and demonstrating solutions using the available infrastructures.

Current plans include expanding the site to nearly 20 km.



Conceptual Diagram of 5G-V2X Self-Driving



Location Map of Sangam Self-Driving Test Bed

The Seoul Metropolitan Government has been carrying out self-driving demonstrations with 25 institutions from universities, research institutes and private companies under the following scenarios:

- **Shared Mobility:** On-demand car sharing services. The autonomous car is called via smartphone and picks up and deposits passengers at their destination.
- **Shuttle Bus:** Self-driving shuttle bus service. Autonomous bus circulates a route of 33km that links main bases and one subway station. Passengers receive bus information, including current number of passengers traveling on the bus and can summon the bus via their smartphone.
- **Smart Parking:** Smart parking service. Once a passenger exits the autonomous car, the passenger logs onto the service platform which can identify a parking space in a lot some distance from the car. The car then drives itself to the parking lot.
- **Robot Delivery:** Robot logistic service delivers goods in front of houses or shops in areas where vehicles are difficult to operate. Goods are loaded onto the robot, and the robot maneuvers to the appointed destination to deliver the goods. When an obstacle arises on route, the robot stops until the path is clear and then continues on its way.

The test-bed city and supporting infrastructure creates an ecosystem for R&D that stimulates innovation and commercialization of the developing autonomous industry. This environment supports domestic companies and startups, laying the groundwork to compete globally.



Shared Mobility



Shuttle Bus



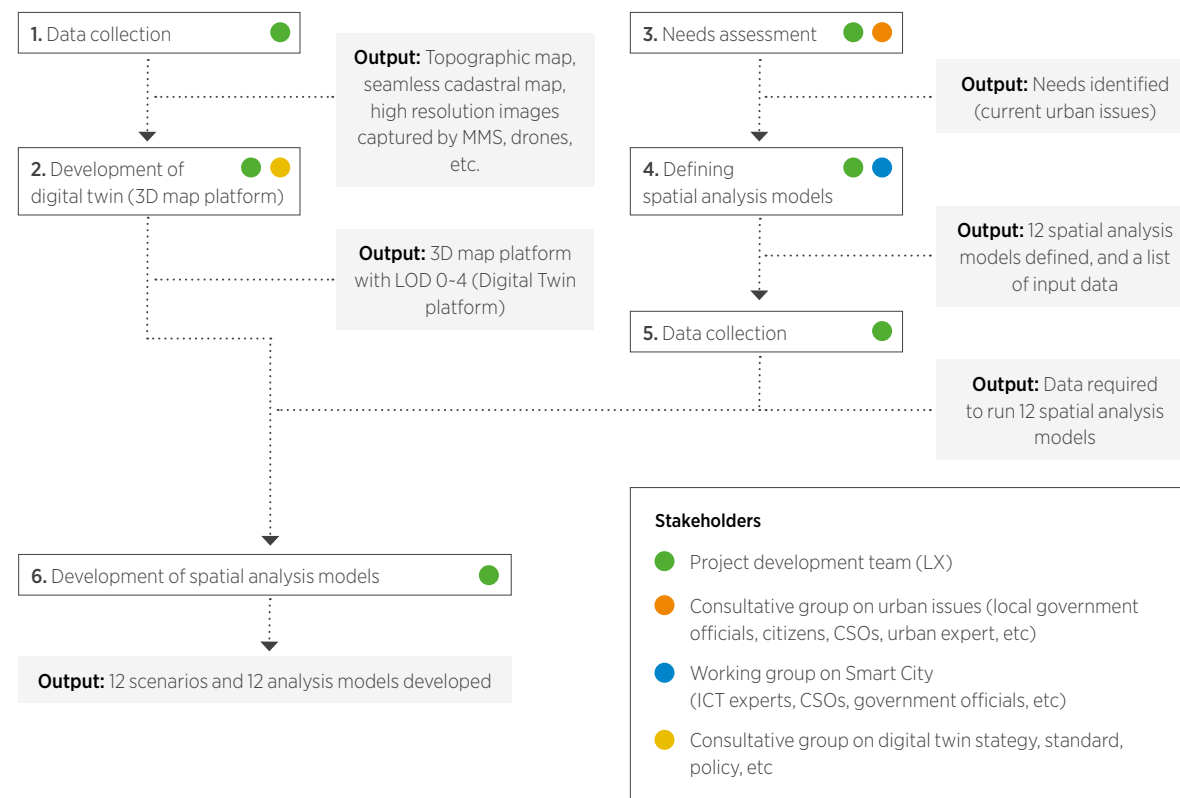
Robot Delivery



Smart Parking

Innovative Technology: Use Cases

Steps to Building and Using and Digital Twin

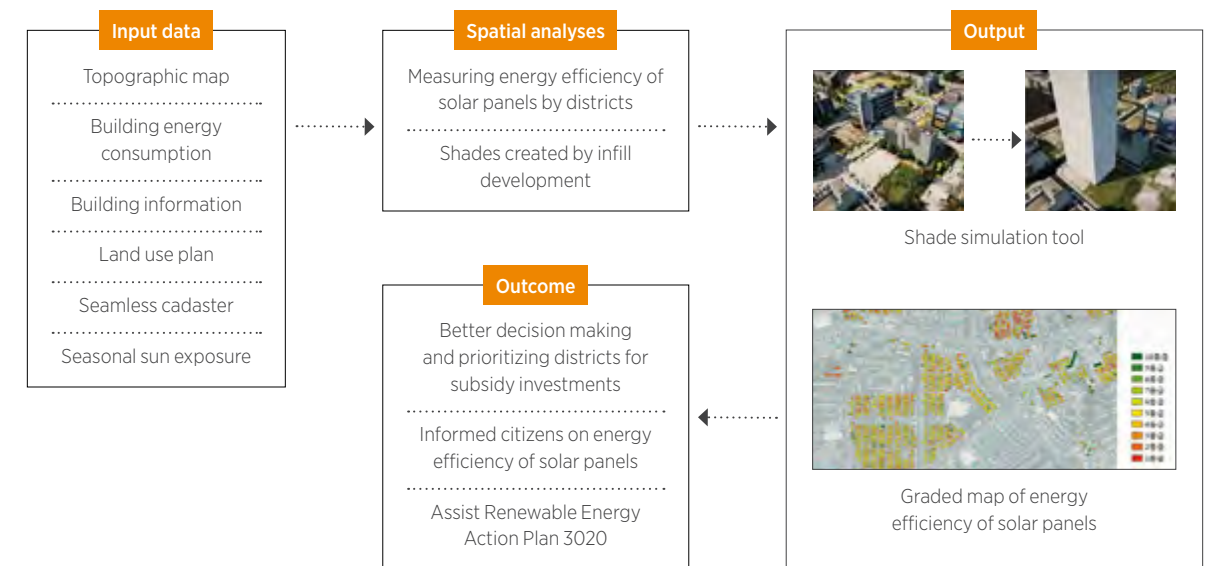


DIGITAL TWIN

Digital Twin is a comprehensive data analysis tool for urban planning. The platform creates comprehensive 3D models of the built urban environment and various scenario planning tools to help with the decision-making process. Issues such as urban blight, traffic, energy consumption, pollution, crime, among other things can be experimented with before putting into practice. The scenario planning reduces time and costs. Based on the success thus far for reducing costs of poor urban planning, and the ability to improve the quality of life, Digital Twin became one of the *Digital New Deal* technologies the Moon administration proposed spending approximately 58 trillion Won (appx. \$48 billion) over the next five years. The data analysis tool is also central to implementing Smart City.

As a public sector entity specialized in spatial data, LX, Korea Land and Geospatial Information Corporation, undertook a Digital Twin pilot project in Jeonju, one of the oldest cities in Korea in 2019. The aim of the project is to address current urban issues identified by focus group meetings by bringing together stakeholders such as: local government officials, citizens, civil society organizations and experts in urban design. Data was collected from diverse sources, which includes administrative data from the municipality along with the existing base maps, seamless cadastral maps, and imageries obtained from UAVs and MMS. The initial 3D model covers 4 square kilometers with four Levels of Details (LOD) developed by the OGC standard CityGML 2.0. The project simulated 12 scenarios with spatial analyses.

Overview of identifying energy efficiency of residential solar panels



LOCATION OF RESIDENTIAL SOLAR PANELS

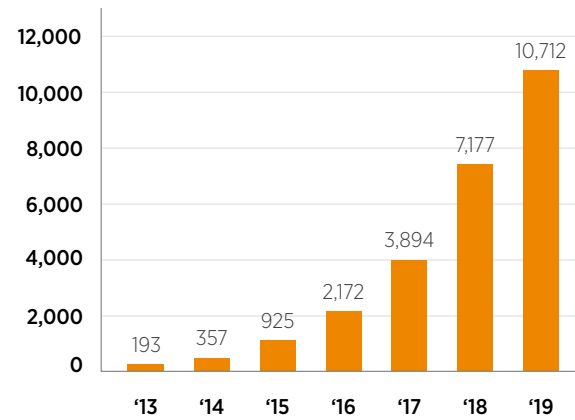
The project tested a scenario to establish the optimal location for residential solar panels to maximize energy efficiency. The use of renewable energy is highly recommended by the government's Renewable Energy Action Plan 3020, which subsidizes residential solar panels. Despite the subsidies and increased environmental concerns, voluntary installation has not yet taken off. Current speculation is the public still lacks information on energy efficiency. Efficiency of residential solar panels is impacted by a number of factors including geographical location, and the surrounding building environment (for examples, an adjacent building blocking the sun for part of the day). Thus, this project simulated a scenario to estimate individual energy efficiency through the analysis of seamless cadastral map,

topographic map, building information, building energy consumption, and land use plan. The land use plan provides useful data to visualize infill developments in a 3D model. Such visualization creates virtual shades of new constructions, and the shades limit sun exposure in the adjacent buildings. Without dynamic 3D model simulation, estimating energy efficiency of solar panels is less accurate.

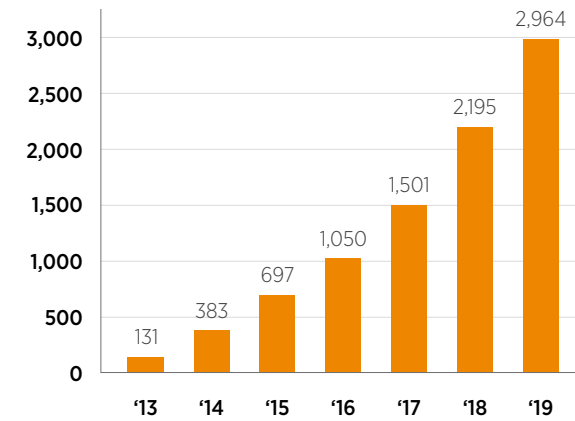
This pilot project included additional scenarios, such as predicting vacant and abandoned properties, fire-prone areas, optimized route for collecting garbage and food wastes, among other things. Policy makers and stakeholders will be informed on new potential ways of addressing such urban issues derived from the scenarios.

INCREASE OF DRONE MARKET IN KOREA

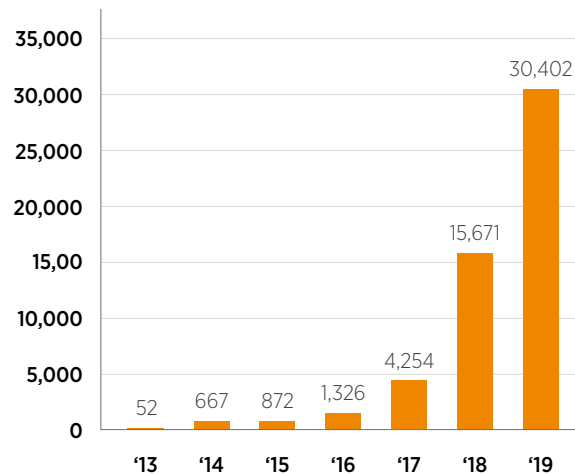
Equipment Report



Registered Company



Certificated Pilot



DRONE TECHNOLOGIES IN INNOVATION & TECHNOLOGY ²⁰

Drones, which are legally defined as “a flight vehicle that can navigate without a pilot on board,” is one of Korea’s eight core leading businesses and is a convergence industry at the nexus of ICT, aviation, software, sensor, 3D printing, etc. Due to the continual advancement in technology and the continual drop in equipment prices, drone usage is continuing to increase. The drone industry in Korea is changing from a low-cost and small-sized tool for filming use, into to a high-cost and medium-sized for a range of areas including agriculture, disaster management, monitoring, surveying, and delivery.

The establishment of the drone market in Korea is led by the public sector, with the cooperation and development of private sector. Drones are introduced and operated in various tasks of the national and public institutions, creating additional public demand.

Drones can perform many things more effectively and efficiently including:

- Land occupation survey
- Observing the maintenance of construction sites
- Fire prevention
- Land slide research (in cooperation with LX, Korea Forest Service, KEPCO, and other public institutions)

Public Sector

LX Corp. State-owned and public land occupation survey <hr/> Annual KRW 5 billion worth of market creation	LX Corp. Design, construction, maintenance, etc in the public construction site <hr/> Annual KRW 25 billion worth of market creation	Korea Forest Service Forest fire prevention, landslide research, etc <hr/> Time reduction by 1/10	KEPCO Electric equipment check <hr/> Around 83% of cost saving per steel tower
-------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------

Private Sector



Aerial pesticide spraying and farmland monitoring



Remote area transport (Photo: UPS)



Public surveying

On-site utilization of drone in Korea

EFFECTIVE TOOL IN GEOSPATIAL TECHNOLOGY ²¹

Drones have dramatically improved the field of geospatial technology. Land registration and the administrative system have been improved by the real-time cadastral data generation and acquisition, and the use of effective public

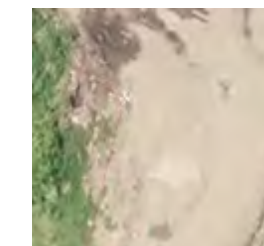
surveying with drones. The reduction in time, manpower, resources, cost, and increase in accuracy has positioned drone technology as one of the most powerful surveying tools in the land management sector.



Data points extracted from images: 425 points
Manpower deployed: 1
Time utilized: 3 hours



Data points extracted from Total Survey System: 15 points
Manpower deployed: 2
Time utilized: 2 hours



Pre-marking: 13 points
Manpower deployed: 2
Time utilized: 1 hours



Total number of parcels: 216
Total borderline points: 453 points
Manpower deployed: 5
Total time utilized: 6 hours

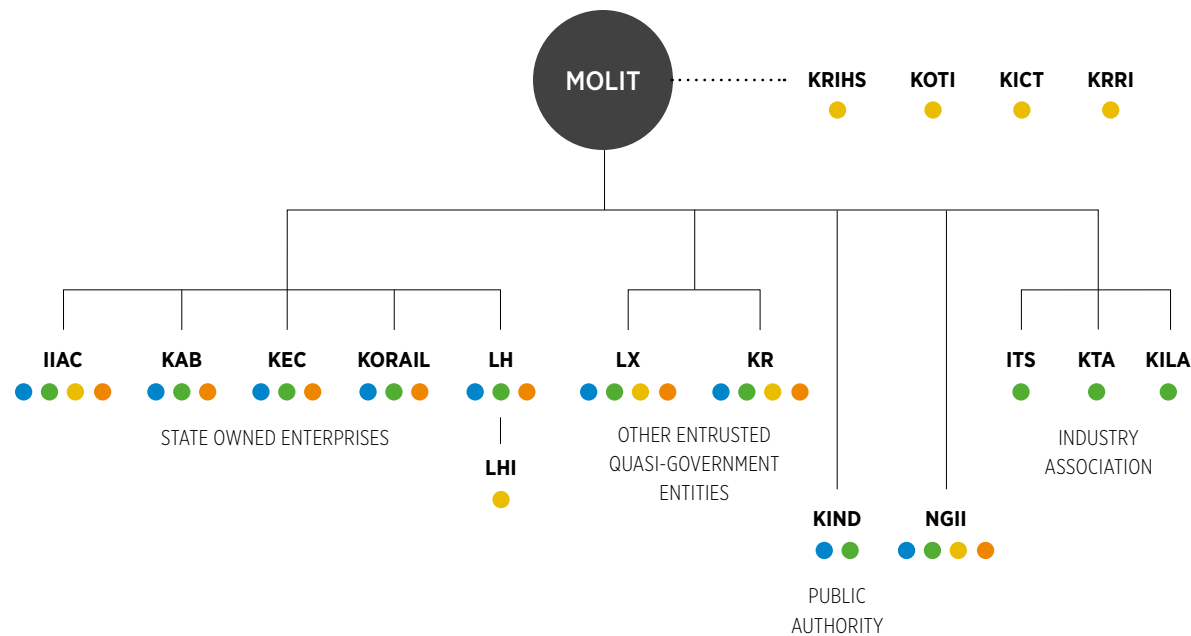
Use of ortho image from Drone to extract demarcation of parcel/missing points from images obtained from ground surveying using Total Survey System by Hojung Solution, Korea.



PART 5

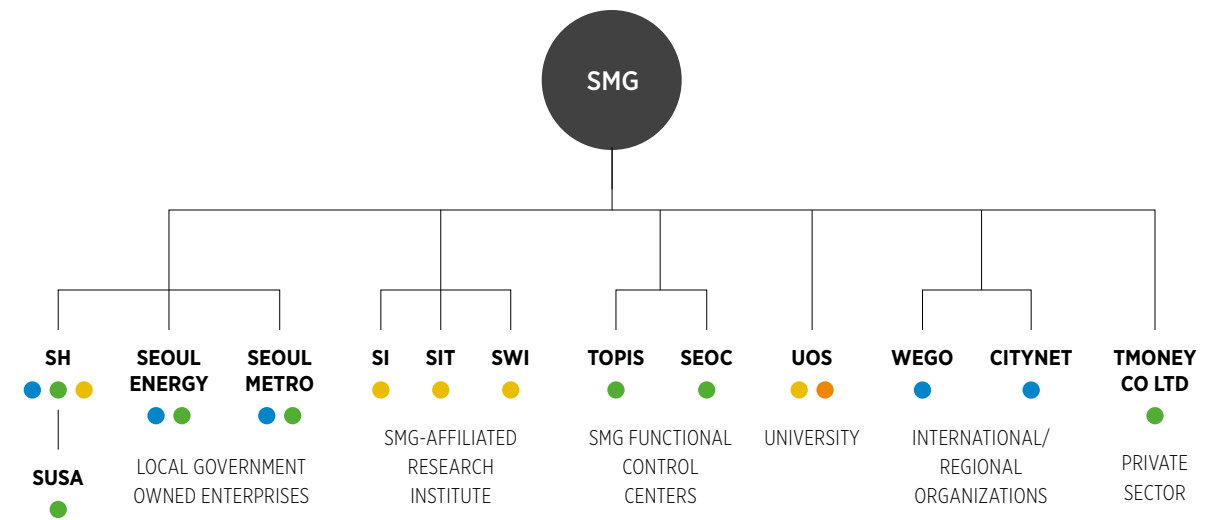
Key Institutions in Korea's Urban, Land, and Transport Sector

(Organizational structure/role in May 2020)



- | | | | |
|----------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------|
| IIAC
Incheon International Airport Corporation | LHI
Land & Housing Institute (LH-affiliated Research Institute) | NGII
National Geographic Information Institute | KRRI
Korea Railroad Research Institute |
| KAB
Korea Appraisal Board | LX
Korea Land and Geospatial InformatiX Corporation | KRIHS
Korea Research Institute for Human Settlements | ITS
Korea Intelligent Transport Society of Korea |
| KEC
Korea Expressway Corporation | KR
Korea Rail Network Authority | KOTI
The Korea Transport Institute | KTA
Korea Trucking Association |
| KORAIL
Korea Railroad Corporation | KIND
Korea Overseas Infrastructure and Urban Development Corporation | KICT
Korea Institute of Civil Engineering and Building Technology | KILA
Korea Integrated Logistics Association |

- | | |
|-------------------------------------------------|---------------------------------------------------------|
| ● DOMESTIC AND OVERSEAS DEVELOPMENT IMPLEMENTOR | ● IMPLEMENTING AGENCY/INSTITUTE |
| ● RESEARCH + POLICY INSTITUTE | ● CONDUCTING INSTITUTIONAL TRAINING & CAPACITY BUILDING |



- | | | | |
|--------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| SH
Seoul Housing & Communities Corporation | SI
The Seoul Institute | SEOC
Seoul Emergency Operations Center | CityNet
The regional network of local authorities for the management of human settlements |
| SUSA
Seoul Urban Solutions Agency (SH-affiliated organization) | SIT
Seoul Institute of Technology | UOS
University of Seoul | Tmoney Co. Ltd
Formerly Korea Smart Card Company. (SMG has 35% majority share) |
| Seoul Energy
Seoul Energy Corporation | SWI
Seoul Water Institute | WeGo
World Smart Sustainable Cities Organization | |
| Seoul Metro | TOPIS
Seoul Transport Operation and Information Service | | |

- | | |
|-------------------------------------------------|---------------------------------------------------------|
| ● DOMESTIC AND OVERSEAS DEVELOPMENT IMPLEMENTOR | ● IMPLEMENTING AGENCY/INSTITUTE |
| ● RESEARCH + POLICY INSTITUTE | ● CONDUCTING INSTITUTIONAL TRAINING & CAPACITY BUILDING |

Ministry



The Ministry of Land, Infrastructure and Transport (MOLIT) is the central authority of the Republic of Korea responsible for the affairs concerning land, infrastructure, and transport. To realize its vision of 'Livable Territory, Convenient Transport,' MOLIT has set out four missions: (i) Balanced Territorial Development & Environmental-friendly National Land Management; (ii) Housing Stability for Low-income Households through Universal Housing Welfare; (iii) Safe & Convenient Transport Services and (iv) Efficient Logistics System & Global Aviation Superpower. To this end, MOLIT develops a national plan on land use and development while introducing and enforcing laws and policy measures on land. MOLIT also oversees matters on land resources (e.g. use and preservation of water and land), infrastructure (e.g. construction of cities, roads and houses), reclamation of offshore and riverside areas, and matters on land, air and rail transport.

Public Authority



Korea Overseas Infrastructure and Urban Development Corporation (KIND) is an organization established in June 2018 in accordance with the Overseas Construction Promotion Act (April 2018) to proactively support global Public-Private Partnership (PPP) business. It has the mandate to promote the development of new infrastructure projects globally, using Korea's well-recognized expertise in constructing and operating infrastructure assets. It supports Korean contractors in each stage of their business, ranging from developing infrastructure projects to fundraising and direct investment across all phases of construction projects.

State-owned Enterprise (SOE)



Korea Appraisal Board (KAB) is a quasi-market public corporation under the Ministry of Land Infrastructure and Transport. It specializes in the evaluation of real estate and management of the real estate market. It runs and develops an advanced appraisal and assessment system to ensure real-time assessment, and it contributes to the stability and maintenance of the real estate market through providing transparency by the disclosure of real estate prices, statistics and information management, and real estate market policy support.



Korea Land and Housing Corporation (LH) is one of the largest public land and housing developers in Korea. Two separate corporations, the Land Corporation, established in 1975, and the Housing Corporation, established in 1962, were merged in 2009 and became LH. The Housing Corporation built Korea's first apartment complex in Mapo in 1962. The Land Corporation started constructing Anseong industrial complex in 1978 and developed 1-3 phases of New Towns in Korea. LH's focus has been to develop and construct affordable and stable housing as well as promote the efficient utilization of national land. LH has constructed residential buildings, educational institutions, recreational facilities as well as new towns, multi-functional administrative cities, and innovation cities around across the nation. LH also offers city development services.



Korea Expressway Corporation (KEC), a public corporation, was established in 1969 to promote the installation and management of roads, maintenance of roads, and development of road traffic. It is responsible for the establishment, expansion, and maintenance of highways including convenience facilities, and the research and development of related service. KEC has played a decisive role in the modernization and expansion of the domestic road network since the late-1960s and the rapid development of road traffic. As of 2020, 6,160km of expressways are managed by Korea Highway Corporation.

Land and Housing Institute (LHI), the affiliated institute, provides practical knowledge and expertise in the fields of urban development, land, housing, and construction through specialized and field-based research activities. With planning expertise and technical development services, LHI contributes to the implementation of housing welfare programs and the execution of national projects. It also offers a path-finding role for the government to set up and implement the land and housing policies.

Other Entrusted Quasi-Government Entities (QGEs)



Incheon International Airport Corporation (IIAC) is a public corporation responsible for the construction, operation, and management of Incheon International Airport. Established in 1999, its focus is to operate and manage Incheon International Airport and includes securing the airports, developing and contracting projects, selecting contractors to operate commercial facilities, and renting and managing offices and business facilities. They additionally develop infrastructure around the airport.



Korea Railroad Corporation (KORAIL), established in 1963, is the national railroad operator in Korea. It operates commuter, intercity, and freight trains as well as subways through the country. It is known for the development of its two high-speed trains: the KTX and the KTX-Sancheon. The trains are designed to reach speeds of 330km/hr in 5 minutes and 16 seconds.



Korea Rail Network Authority (KR) is a quasi-government organization established in 2004 for the construction of the national rail network and management of rail infrastructures and assets since KORAIL is in charge of operation and management of rolling stocks. KR's core businesses are the construction of railways for expansion of the national rail network, rail technology development, and overseas projects to strengthen national competitiveness, innovation of rail structures for enhanced safety and convenience, and development of railway assets.



Korea Land and Geospatial Information Corporation (LX Corporation) is the national agency representing Korea in handling spatial information. LX Corporation oversees the development of the spatial information sector. Its roles include the consolidation of the sector with the other industries and the popularization of information and communication technology services based on location and geospatial information. It extends its services and expertise at the international level as well by providing professional and technical services on land administration, registration, geo-information, and management.

Research Institute



National Geographic Information Institute (NGII) was established in 1974 under the Ministry of Land, Infrastructure and Transport as the mapping agency of Korea. It provides spatial information and is divided into seven divisions: planning & policy, general services, geodesy, geospatial imagery and photogrammetry, geographic information, national geographic data monitoring, and Korea land satellite center. NGII contributes to the national development by setting up the national geodetic datum and sharing system of geospatial information by establishing a national base map and conducting the national land survey.



Korea Research Institute for Human Settlements (KRIHS) founded in 1978 has played a pivotal role in national territorial policy development with researches in balanced national development, housing stability, infrastructure development and geospatial information system. The policies KRIHS developed and suggested has contributed to enhancing the quality of life of the people.



The Korea Transport Institute (KOTI) is a leading national think tank in Korea's transport and logistics sector since 1986. KOTI's mission is to provide recommendations and alternatives for the nation's transport policy and to create the best transport system through specialized research and technical innovations. The organization has gained a global reputation for developing human-centered highly convenient transport systems. KOTI now helps countries and organizations around the world establish and implement effective and efficient transportation systems.

Other



Korea Railroad Research Institute (KRI) was established in 1996. Its main tasks are to develop new railcar and infrastructure technology such as high-speed trains (HEMU-430X), CNG-hybrid bimodal trains, wireless trams, etc. KRI promotes the Korean railway industries through R&D on railway technology, operation, and applications. It has also developed environmental technologies to decrease air pollution, noise, and carbon footprint and to increase energy savings.



Korea Institute of Civil Engineering and Building Technology (KICT) is a government-sponsored research institute specializing in the development of construction technology. The research area of KICT consists of various fields covering structures, highways, underground, water resources, architecture, fire, and engineering services. With the aim of creating knowledge for the development of the construction industry, KICT now tries to strengthen its relationship with small and medium-sized businesses and to cooperate with a number of prestigious international organizations such as the International Federation of Consulting Engineers (FIDIC).



Intelligent Transport Society of Korea (ITS Korea) is a non-profit private company that was established in 1999. Its main aims are to promote mutual cooperation among the public and private sectors for efficient implementation of ITS and to contribute to the development of the ITS field through various research, policy consultation, technology promotion, and business activities related to ITS. Its main activities are comprised of ITS standardization, standards observance verification & certification, and performance evaluation, ITS overseas business assistance and consulting, ITS R&D including study on latest ITS technology trends, ITS-related national and local government consignment business, ITS education, revision and management for standards of estimate in ITS, and collection, verification, dissemination of ITS traffic information.



Korea Integrated Logistics Association (KILA) is a special corporation established in accordance with Article 55 of the Framework Act on Logistics Policy approved by the Ministry of Land, Infrastructure and Transport. The association is dedicated to contributing to the logistics industry's competitiveness enhancement, logistical status investigation, research, diagnosis, policy and contributes to the training and dissemination of professional manpower, and innovation activities in logistics.



The Seoul Metropolitan Government (SMG) is the administrative organization of Seoul, the capital city of the Republic of Korea. In just five decades, it has experienced explosive demographic and economic growth, which was accompanied by the rapid expansion of public infrastructure, the advancement of technology and its use in policymaking. Behind this speedy and tremendous transformation of Seoul, SMG took strenuous efforts to tackle urban challenges that followed. A series of initiatives to promote low carbon transition such as public transportation reform and green urban regeneration reflected its strong will for a greener and more sustainable city. Thus, Seoul is now a model of human/public transport-oriented city.



Seoul Housing & Communities Corporation (SH) is a local public enterprise, founded by Seoul Metropolitan Government (SMG) in 1989, to contribute to stable residential conditions and improved public welfare of the citizen of Seoul through the development and supply of residential land, construction, improvement, supply, and management of housing. It offers land development, redevelopment, reconstruction, remodeling, and maintenance services.



Seoul Metro is a local government-owned enterprise of Seoul Metropolitan Government (SMG). It operates one of the world's largest urban railway networks, comprised of Subway Lines 1 to 8 and the second and third sections of Subway Line 9 (293 stations, 319.3 kilometers). Two separate operators, the Seoul Metro established in 1981 (operator of line 1 to 4), and the Seoul Metropolitan Rapid Transit Corporation established in 1994 (operator of line 5 to 8) were merged in 2017, and became Seoul Metro, SMG's transport corporation. More than 7 million people use urban railway services provided by Seoul Metro every day.

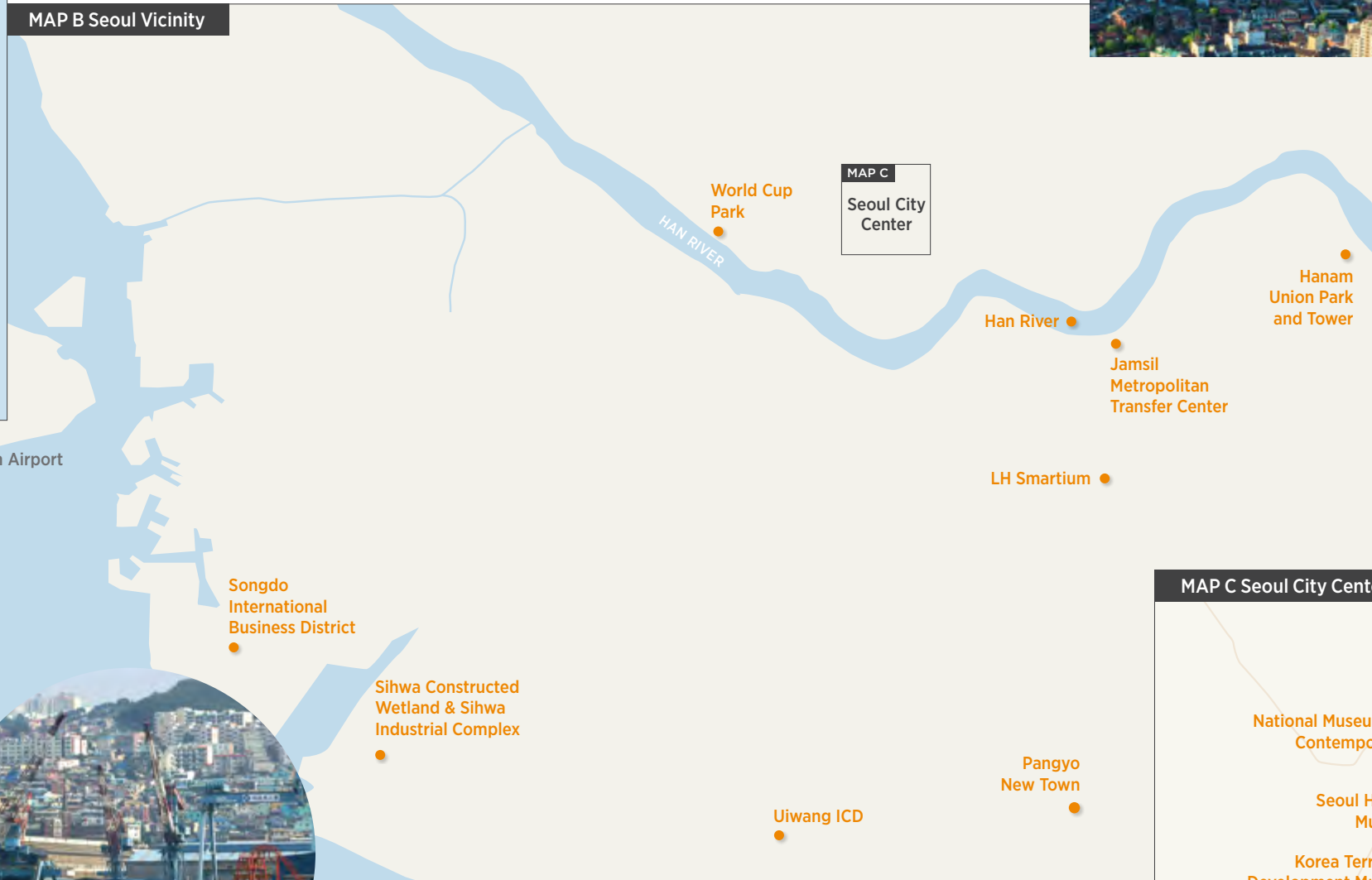


Seoul Institute (SI), established in 1992, is the official think tank for the Seoul Metropolitan Government (SMG). It was created to establish a medium and long-term vision for Seoul, continuously work on ways to improve SMG's policies, and to improve the quality of life for citizens through research by utilizing their expertise in municipal administration, deep understanding of policy, and their vast knowledge of overseas cases. Key research departments include: urban society, urban management, safety and environment research, data and information, public investment, civil economy, transportation, urban planning and design, and the future of the global.

Site Visits and Locations

Han River

The dividing line of Seoul, the Han River or 'Hangang' separates North Seoul from the Gangnam district, which means 'South of the River'. The river has witnessed the history of the Korean people for over five thousand years, through good and bad times.



Seoul Museum of History by Jong Sung Kimm is licensed under [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)



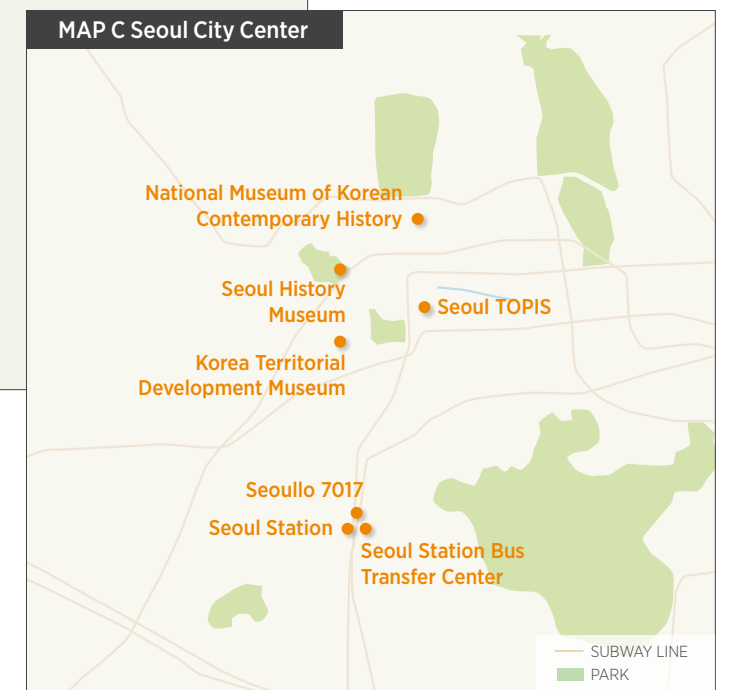
Gwangang Bridge

A 7,420m long suspension bridge in Busan, the second longest bridge in the country.



Busan Port 1st Pier

by KOREA.NET - Official page of the Republic of Korea is licensed under [CC BY-NC-SA 2.0](https://creativecommons.org/licenses/by-nc-sa/2.0/)



Seoul

MAP C

NATIONAL MUSEUM OF KOREAN CONTEMPORARY HISTORY

National Museum of Korean Contemporary History is the first museum in Korea to record the nation's history. From the late nineteenth century to date, it provides a clear overview of the history of Korea. The museum was established to share the nation's history and is comprised of four exhibition halls: Prelude, Foundation, Development, and Modernization of Korea.

MAP C

KOREA TERRITORIAL DEVELOPMENT MUSEUM

Korea Territorial Development Museum is located in Jeongdong, the central district of Seoul surrounded by sites from Korea's modern history. The museum will help foreigners, as well as Koreans, broaden and deepen their understanding of Korea. The Republic of Korea achieved economic development that surprised the world, overcoming the ruins and poverty of the Korean War. The Museum shows how Korea rebuilt its economy and infrastructure from the ravages of the war.

MAP C

SEOUL MUSEUM OF HISTORY

Seoul Museum of History captures the traditional culture of Seoul. Vestiges from the prehistoric era to modern Seoul are on display. Many of the Joseon Dynasty relics were donated during a Relic Donation Campaign. Features of the museum include: the recreation of Seoul landscape when it was the capital of the Joseon Dynasty, and the daily life of Seoulites along with items viewed through an online cyber museum, and the display of modern history of urban development of Seoul after the Korean War.

MAP C

SEOUL STATION

Seoul Station serves as the main hub for Seoul's many transportation lines. Each day over 100,000 guests pass through the station to access the local, express, and high-speed trains, which depart from the station. The station additionally serves, as the primary terminus for local and express bus lines. In 2015 a complex bus transfer center, **Seoul Station Bus Transfer Center**, was built at the Seoul station's main entrance. While nine-bus platforms operate in the highly trafficked pedestrian way, the innovative design separating the main roads with a barrier around the platforms is a sophisticated design solution instead of building an entirely separate terminal building.

MAP C

SEOULLO 7017

Seoullo 7017 is one of the representative regeneration cases in downtown Seoul. In the 1970s, an elevated highway was built to alleviate traffic congestion around Seoul Station. 47 years later, the overpass was closed to road traffic due to safety issues, and transformed into a pedestrian park, called Seoullo 7017 or Seoul Sky garden. The path is about one kilometer in length and lined with 24,000 plants. This change contributed to regenerating the local economy attracting over 20million visitors.

MAP C

SEOUL TOPIS (TRANSPORT OPERATIONS & INFORMATION SERVICE)

Seoul TOPIS (Transport Operations & Information Service) is the transport control center for operating and managing Seoul's traffic condition. TOPIS collects information not only from SMG's various transport system such as the road traffic management system, the bus management



Seoul Station

system, the transport card system, but also from the external institutions such as the Seoul Metropolitan Police Agency, the Korea Expressway Corporation, and Korea Meteorological Administration, then provides consolidated data useful for public transport passengers and drivers.

MAP B

JAMSIL METROPOLITAN TRANSFER CENTER

Jamsil Metropolitan Transfer Center is the first underground bus terminal in the country, connected to the Jamsil Station, where 2 subway lines (2, 8) and 77 metro bus routes are being

operated. It is 19,979m², approximately 2.7 times of a soccer field. At the center, 31 buses can be parked and stopped at the same time. It was built to enhance traffic flow around Jamsil station with the contributions from Lotte Group totaling 130 billion won (approx. 110 million USD) to compensate and mitigate increased traffic caused due to construction of Lotte World Tower. For passengers' convenience, screen doors and air curtains are installed between the bus stop and the platform to block the inflow of smoke and carbon dioxide into the platform.



World Cup Park

MAP B

THE HAN RIVER

The Han River (Hangang) is a major river in South Korea and the fourth longest river on the Korean peninsula. The river begins as two smaller rivers in the eastern mountains, which then converge near Seoul, the capital of the country. The Han River and its surrounding area have played an important role in Korean history for over five thousand years. The river serves as a water source for over 12 million Koreans. Currently, the lower stretches of the Han River running through Seoul are lined with pedestrian walkways, bicycle paths, public parks, and restaurants.

MAP B

WORLD CUP PARK

World Cup Park is an ecological park consisting of five parks that include Nanijdo Eco-Park and Haneul Park, opened in 2002. Originally

a landfill for metropolitan Seoul, it has been converted into a beautiful camping site for visitors. In order to prevent waste runoff and contamination of the surrounding environment, the city undertook a process to stabilize the landfill with precautionary measures, while simultaneously converting the garbage under the park into a source of energy for local residents.

MAP B

LH SMARTIUM

LH Smartium was opened in 2010 by the Ministry of Land, Infrastructure, and Transport (MOLIT) and LH is a publicity center dedicated to Smart City that allows visitors to see and experience urban development history and major smart technologies at a glance. It is a platform to experience the smart city in the 4th Industrial Revolution era.

Gyeonggi Province

MAP B

HANAM UNION PARK AND TOWER

Hanam Union Park and Tower (Hanam Newtown Urban Service Complex) is located in the center of Hanam City, just east of Seoul. The site is approximate 117,115m² and is a popular shopping, recreational, and entertainment area. The city of Hanam took an innovative approach to redesign the area and introduced new forms of governing and investment structures. The project was designed to maintain equality of living service facilities and educational conditions across the regions with a particular emphasis on alleviating the financial gap between previously autonomous regions. The result is now several neighborhood districts previously discrete are combined into the same living zone and share desirable amenities, cultural sites, and efficient transportation.

MAP B

PANGYO NEW TOWN

Pangyo New Town is located in the central part of Gyeonggi province, near the Bundang Newtown. It was built to solve the housing demand in the Gangnam area of Seoul and share some functions. Compared to other newtowns near Seoul, it has achieved economic self-efficiency by hosting the IT cluster called Techno Valley. It is also conveniently connected with Seoul and Gyeonggi Province by opening a new subway line. As the city expanded and developed, residential areas have been established through the second stages of the new town construction, and there are about 90,000 residents currently.

MAP B

SIHWA NATIONAL INDUSTRIAL COMPLEX

Sihwa National Industrial Complex (Siheung Smart Hub) is an industrial complex developed exclusively for small and middle-sized companies. It was built to accommodate factories located in Seoul and to promote the West Coast Industrial Belt. The establishment of this industrial complex led to the realignment of the population and industries of the Seoul metropolitan area.

MAP B

UIWANG ICD (INLAND CONTAINER DEPOT)

Uiwang ICD (Inland Container Depot)- South Korea's export-oriented economy has established extensive transport and logistic operations throughout the country. In order to support importers and exporters, containers need to be brought inland and made available to key manufacturing hubs. Korea's main deep-sea port is located in Busan, about 350 km southeast of Seoul. In 1992, a cluster of two inland container yards was established at Uiwang, about 25 km south of Seoul, forming an inland port that serves as a loading center for the metropolitan area and handles about 45% of its container traffic. Each yard has intermodal rail terminals, enabling a connection to the port of Busan. Uiwang can functionally be considered as a satellite terminal where containers are trucked in or out and where custom clearance is realized. The facilities utilize the latest technology and provide a remarkable example of logistics and transport in action.



Incheon

MAP B

SONGDO INTERNATIONAL BUSINESS DISTRICT

Songdo International Business District is located in the southwestern coastal part of Incheon, Songdo International City. It provides a foreigner-friendly business environment and settlement condition for the development of Northeastern Asia International Business Hub City. The district is 5.771 million m² and part of the Incheon Free Economic Zone (IFEZ) which was designated in 2002, and Incheon International Airport is connected with a highway bridge. Features of the district include the Northeast Asia Trade Center, central park, residential, industrial, business facilities, international schools, convention center, culture center, and infrastructure.

MAP B

KOREAN AIR CARGO TERMINAL

Korean Air Cargo Terminal is operated by Korean Airline and there are two cargo terminals. Capable of handling up to 1,430,000 tons a year, Korean Air's Cargo Terminal 1 at Incheon Airport serves as a key logistics hub of the Northeast Asian region to handle the region's continuously increasing cargo handling demand. Cargo Terminal 2 at Incheon opened in 2007 next to Incheon Cargo Terminal 1 and can process 260,000 tons of cargo annually. Being the latest addition to Korean Air Cargo's own terminals, Incheon Cargo Terminal 2 features a wide variety of modern cargo handling equipment.

Sejong City

MAP A

SEJONG CITY

Sejong is a multifunctional administrative city. In 2002, then President Roh, Moo-hyun proposed to move the capital out of Seoul to promote economic developed outside the capital region. However, it was met with resistance and through political compromise only the executive branch of the government has relocated to Sejong. The site of Sejong, a former peach-farming area 120km outside of Seoul, was chosen due to its location between the three cities of Daejeon, Cheonan, and Cheongju. Opened in 2012, it is now home to 36 government ministries and agencies and can be reached from Seoul in just under 40 minutes by high-speed train. The city holds one of the largest buildings and roof-top gardens in the world and is on track to house 500,000 residents by 2030.

LH ADMINISTRATIVE CITY (AC) SEJONG HALL

LH Administrative City (AC) Sejong Hall showcases the history and vision of the development of Sejong City. It shows the ideology of construction and the larger philosophy behind creating integrated and sustainable urban environments that support shared economic prosperity for all citizens.

Busan

MAP A

BUSAN PORT

Busan Port is the largest port in South Korea, the fifth busiest container port in the world and the tenth busiest port in North-east Asia. It is developed, managed, and operated by the Busan Port Authority (BPA), which was established in 2004. Today the Port of Busan consists of an International Passenger Terminal, the Gamman container terminal, and four ports- North Port, South Port, Gamcheon Port, and Dadaepo Port. The North Port provides passenger handling facilities and cargo, and with the support of Gamcheon Port, more cargo volumes can be handled. The South Port is home to the Busan Cooperative Fish Market which is the largest fishing base in Korea, and it handles 30% of the total marine volume. The Dadaepo Port located west of the Busan Port, mainly handles coastal catches.

MAP A

GAMCHEON CULTURE VILLAGE

Gamcheon Culture Village, called Korea's Machu Picchu or Lego Village, is a representative case of Busan's hillside regeneration. After the Korean War, refugees from all over the country rushed to Busan and settled to the top of the hills, creating several hillside villages. Gamcheon village was one of them, where 4,000 religious people lived together. It was alienated and deteriorated for several decades, then in 2009 the Ministry of Culture, Sports, and Tourism carried out a public art-themed renovation to convert the village into a cultural hub. Art students and professional artists were invited and worked with residents to repair and decorate the village with art. It has become the most colorful and artistic spot in Busan and had approximately 3.1 million visitors in 2019.

MAP A

GWANGAN BRIDGE

Gwangan Bridge (or Diamond Bridge) is a suspension bridge located in Busan. With the bridge as a whole spanning 7,420m, it is the second-longest bridge in the country after the Incheon Bridge. With the opening of the Gwangan Bridge, chronic traffic congestion in the nearby Busan area has been dramatically improved, and the port traffic volume is quickly connected to the Gyeongbu Expressway, contributing to reducing logistics costs and enhancing export competitiveness. For the first time in Korea, a state-of-the-art lighting system with artistic formative beauty was established, and it is being used as a tourist attraction.



Gamcheon culture village
by Andrey Grushnikov is licensed under [CC BY-SA 2.0](https://creativecommons.org/licenses/by-sa/2.0/)

Annex: Sources and Links

1. The Korean Economy from the Liberation to the 1950s
Lee Dae-keun, SERI, 2002
2. Economic Statistics System
Bank of Korea
3. World Development Indicators database
World Bank, 23 December 2019
4. Seoul Solution, The History of Seoul
<https://www.seoulsolution.kr/en/content/3323>
5. Federal Reserve Economic Data
<https://fred.stlouisfed.org/series/AEXKOUS>
6. Republic of Korea's Green Growth Policy Transformation Story, *Yujin Lee, Committee on Green Growth*
7. Republic of Korea's Green Growth Policy Transformation Story by Yujin Lee, Committee on Green Growth; Green Growth in Korea by Hoguen Song May 2017; Understanding Korean Green Growth Policy Myungkyoo Kim May 2017; Climate Action and Public Expenditure SD June 2015; Why do we need Green Growth (Green Growth Phase 3) Hyungsoo Kim, Budget and Policy Priorities – Fiscal Management Green Growth Kinam Oh May 2018
8. Statistics Korea, 2020
7 & Seoul Metropolitan Government
9. Seoul Metropolitan Government website
<https://news.seoul.go.kr/traffic/archives/285>
10. MOLIT Presentation, Land Management through Establishment of Land Information System
11. World Bank Data Bank & OECD calculations based on MOLIT (1998), Land planning factsheet 1998; MOLIT (2008), Land planning factsheet 2008; MOLIT (2018a) Land planning factsheet 2018; Statistics from MOLIT and TS website
12. Evolution of Housing Policies Korea
Hee -Nam Jung, LH's PPT of Urban KE in June 2020
13. <https://www.seoul.go.kr>
14. Smart and Sustainable Seoul Metro Area Urbanization Planning, Land Readjustment, and Public Transportation
Myounggu Kang, SMG's PPT in Aug 2014
15. Seoul Solution website (<https://www.seoulsolution.kr/en/node/1803>); the Seoul Urban Solutions Agency website (<http://www.susa.or.kr/en/content/transportation>)
16. Jun ho Ko, 2014, Seoul Metropolitan Government
17. Electric Vehicle Policy in Jeju and Key Factors for its Success
Sanghoon Son, JRI, PPT of Energy KE in May 2020
18. The Ministry of Land, Infrastructure and Transport (MOLIT), 2013
19. The Ministry of Land, Infrastructure and Transport (MOLIT), 2013
20. Korean Drone Policy and Challenges
Ilsan Hong, MOLIT, PPT of ADF2020 in Feb 2020
21. Drone-Based Geomatics Land Data Acquisition
Sukhee Andrew Cho, Hojung Solution, PPT of ADF2020 in Feb 2020

With sincere thanks to all of our knowledge partners for their collaboration, technical expertise and valuable contributions to the creation and production of this rich green growth resource:



KGGTF is committed to sharing technical knowledge and first-hand experience of implementing integrated green growth solutions that contribute to sustainable development and shared economic prosperity.

To learn more about us visit www.wbgkgtf.org and for enquiries about grant applications please contact the Country Management Unit at your local World Bank office www.worldbank.org.



Korea
Green Growth
Trust Fund

www.wbgkgtf.org