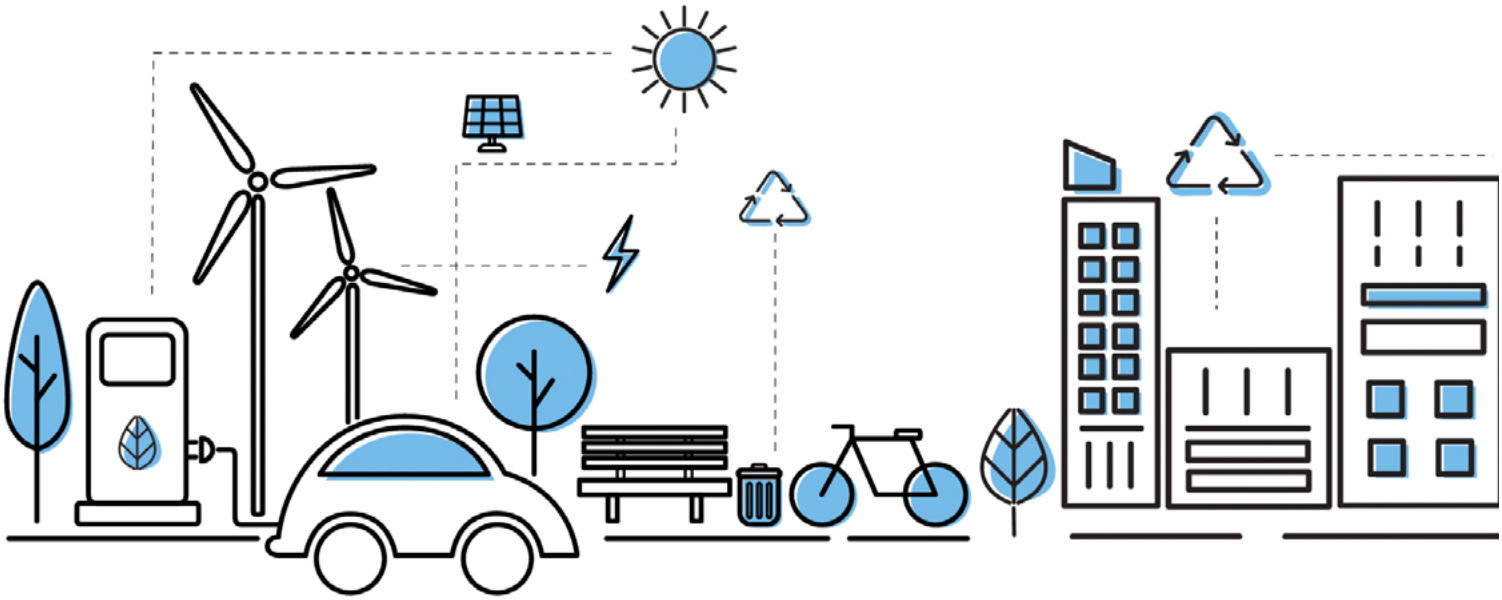
Knowledge Series No. 11



Making Cities More Livable: The Korean Model

Workshop on Smart City in Environment, Equity, and Economy (3Es)

28-31 October 2019
Seoul, Republic of South Korea

Knowledge Series No. 11

Making Cities More Livable
Seoul, Republic of South Korea
28-31 October 2019

Co-Organized by the Digital Technology for Development Unit, Sustainable Development and Climate Change Department, Asian Development Bank; and Seoul Housing & Communities Corporation

Contents

Workshop Overview

Cities in Asia and the Pacific have unprecedented opportunities to transform human well-being and catalyze economic development by 2030. At the same time, these cities face several mega trends, including high rates of urbanization, growing infrastructure deficits, increasing risks of climate change impacts and disasters, environmental stress, aging societies, and rapid technological advancement.

All these challenges are often most visible and difficult to address in urban settings, characterized by complexity, uncertainty, concentrations of people and compounding risks.

Seoul is no exception. As the capital city of the Republic of Korea, Seoul has made remarkable progress for about 60 years since the Korean War. Rapid economic growth during the industrialization in the 1960s–1970s has raised living standards considerably; it also saw the beginning of the city's urban problems. A huge number of rural people have migrated to Seoul looking for economic opportunities, turning Seoul into one of the most crowded cities in the world. This massive population influx caused housing shortage, increase in slums, lack of infrastructure and services, such as water supply and sewerage system, environment degradation including river and air pollution, and traffic problems.

Asian Development Bank's (ADB) Strategy 2030 identified "Making Cities More Livable" as one of its seven operational priorities and will support cities in developing member countries (DMCs) for developing the right institutions, policies, and enabling environment to become more livable.

To help its DMCs build livable cities, ADB is developing the operational plan focusing on three priorities: (i) improved access, quality and reliability of services in urban areas, (ii) strengthened urban planning and financing sustainability of cities, and (iii) improved urban environment, climate-resilient and disaster management of cities.

In this context, ADB and Seoul Housing & Communities Corporation (SH Corp), a leading public enterprise responsible for housing welfare under the Seoul Metropolitan Government (SMG), co-organized a workshop on "Making Cities More Livable: Smart City in Environment, Equity and Economy (3Es)" on 28–31 October 2019 in Seoul, Republic of South Korea.

SH Corp coordinated the program with relevant national and local government agencies, bringing together distinguished scholars, key policy makers, practitioners and technology experts.

Highlights

Participants

57 participants from national government agencies and local governments from ADB's developing member countries, in addition to ADB staff directly related to ADB's operations in the urban sector

Speakers

More than 20 international speakers from the public and private sectors in the Republic of South Korea

Objectives

Learn from the Republic of South Korea's experiences in Smart City development, including key policy actions and initiatives from some case studies in addressing key urban issues through site visits as well as interactive discussion sessions.

Programme

DAY 1 (28 October 2019) I Venue: Seoul Business City	
09:00-09:30 a.m.	**OPENING SESSION** **Welcome Remarks** **Kim Seiyong**, president, Seoul Housing & Communities Corporation (SH Corp) **Opening Address** **Thomas E. Abell**, advisor and chief of Digital Technology for Development, Sustainable Development and Climate Change Department (SDCC), ADB
PART 1: INTEGRATED URBAN PLANNING AND DEVELOPMENT	
09:30 - 10:30 a.m.	**SESSION 1: MANAGING CITY GROWTH** Moderator: **Thomas E. Abell** • Urban Strategy and Planning for Managing City Growth **Bum Hyun Lee**, research fellow, Urban Research Division, Korea Research Institute for Human Settlements • New Town and Urban Renewal Projects **Keonwoo Kim,** deputy director, Global Urban Development Office, Affordable Housing Project, SH Corp
10:30 - 10:45 a.m.	Coffee Break
10:45 a.m. - Noon	**SESSION 1: MANAGING CITY GROWTH** Moderator: **Thomas E. Abell** • Compact City in Seoul: Utilizing Underused Infrastructure **Chil-Mun Choi,** director, Compact City Development Office, SH Corp • Digital Technology (DT) Use Case: Urban Planning Information System **Doi Kim,** officer, Urban Planning Division, SMG
Noon - 01:00 p.m.	Lunch
SITE VISITS	
02:00-04:00 p.m.	**SITE VISIT 1: Anyang Wastewater Treatment Plant**
04:00-05:30 p.m.	**SITE VISIT 2: The Compact and Smart City – Magok District (Botanic Park)**
06:30-08:30 p.m.	Welcome Dinner Hosted by SH Corp at Natural Byeol Gok Gwanghwamun

DAY 2 (29 October 2019) I Venue: Seoul Business City	
PART 2: ENVIRONMENTALLY SUSTAINABLE CITY	
09:00 - 10:30 a.m.	**SESSION 2: CITY DEVELOPMENT AND RIVER** Moderator: **Alexandra Conroy**, urban development specialist, Pacific Department, ADB • River Comprehensive Development **Woowon Kang**, tourism and culture specialist, Han River Headquarters, SMG • Resilience to Water-Related Disaster Risk and Safety System in Seoul **Suk-Min Lee**, research fellow, Seoul Institute • DT Use Case: Flood Forecasting System **Man-Shin Han**, senior officer, Forecast and Control Division, Han River Flood Control Office, Ministry of Environment

10:30 - 10:45 a.m.	Coffee Break
10:45 a.m. - Noon	**SESSION 3: ENVIRONMENT AND WASTE MANAGEMENT** Moderator: **Antonio Ressano Garcia**, principal urban development specialist, Southeast Asia Department, ADB • Smart Wastewater Management **Byung Kook Lee**, chief research fellow, Korea Environment Institute • Municipal Solid Waste Management **Kunwoo Oh**, team leader, Urban Environment Division, SH Corp • DT Use Case: Thermal hydrolysis technology for the conversion of sludge to renewable energy and high-quality bio solids **SangKyu Hwang**, director, Green Energy Center, Cambi Korea
12:15 - 01:00 p.m.	Lunch
SITE VISITS	
01:45-03:00 p.m.	**SITE VISIT 3: Mapo Resource Recovery Facility**
03:30-04:30 p.m.	**SITE VISIT 4: Seoul Housing Lab**
05:00-06:00 p.m.	**SITE VISIT 5: Han River Ferry Cruise**

DAY 3 (30 October 2019) I Venue: Seoul Business City	
PART 3: URBAN TRANSPORTATION FOR INCLUSIVE CITY	
09:30 - 10:30 a.m.	**SESSION 4: URBAN DEVELOPMENT AND TRANSPORTATION (I)** Moderator: **Andri Heriawan**, transport specialist, South Asia Department, ADB • Seoul's Policy Sharing Initiative **Dong Hoon Shin**, Seoul Urban Solutions Agency • Public Transportation System Reform in Seoul **Wonho Kim**, Director, City Diplomacy Research Center, The Seoul Institute • DT Use Case: T-Money — New Public Transport Paradigm Using Smartcard **Byungsang Lee**, chief consultant, T-Money Corporation
10:30 - 10:45 a.m.	Coffee Break
10:45 a.m. - 12:15	**SESSION 5. URBAN DEVELOPMENT AND TRANSPORTATION (II)** Moderator: **Yang Lu**, transport specialist, South Asia Department, ADB • Smart City and Intelligent Transport System **Taehyung Kim**, head/research fellow, Smart City and Transport Division, The Korea Transport Institute • DT Use Case: Car Sharing Service in Republic of Korea **Sang Yeon Hong**, associate research fellow, Department of Transportation System Research, The Seoul Institute
12:15 - 13:15 p.m.	Lunch
SITE VISITS	
02:00-03:00 p.m.	**SITE VISIT 6: Transport Operation and Information Service Center**
04:00-05:00 p.m.	**SITE VISIT 7: Seoul Start Up Hub**
05:00-05:40 p.m.	**SITE VISIT 8: Ku Anam-dong Campus Town**

Programme

DAY 4 (31 October 2019) I Venue: Seoul Business City	
PART 4: COMPETITIVE CITY	
09:00 - 10:20 a.m.	**SESSION 6: SMALL AND MEDIUM-SIZED ENTERPRISES AND STARTUP SUPPORT PROGRAMS** Moderator: **Danyaal Malik**, investment specialist, Private Sector Operations Department, ADB • Start-up Ecosystem in Korea **Nari Shin**, senior manager, Start-up Alliance • Case of Yonsei Enterprise Support Foundation Incubation Programs **Sung Joo Bae**, professor of Technology Management, Yonsei University School of Business
10:20 - 10:40 a.m.	Coffee Break
10:40 a.m. - 12:00	**SESSION 7. E-GOVERNMENT AND SMART ADMINISTRATION** Moderator: **Euna Shim**, public-private partnership specialist, Office of Public-Private Partnership, ADB • Seoul Metropolitan Government's e-Government Road Maps and Projects **Kyunghee Ko**, director, Smart City Policy Division, Seoul Metropolitan Government (SMG) • National Spatial Data Infrastructure **Jongile No**, senior manager, Global Business Department, Korea Land and Geospatial Informatix Corporation (LX)
12:00 - 01:00 p.m.	Lunch
01:00 - 3:00 p.m.	**SESSION 8: GROUP DISCUSSION** Moderator: **Juan-Pablo Martinez-Molina**, investment specialist, Private Sector Operations Department, ADB Group projects and presentations
03:00 - 04:00 p.m.	**CLOSING**

Workshop participants on a site visit to the Mapo Resource Recovery Facility (Photo credit: ADB/Edsel Roman)

Opening Remarks

While the term "smart city" has received much attention of late with the use of high technologies, it is also often associated with solutions to various challenges facing many urban areas today.

Kim Seiyong, president of SH Corp, said there are two major challenges facing many developing nations today: "first is rapid urbanization and the second is the level of knowhow on current research."

While the urban population is growing, the quality of housing for the poor has been declining, and demand for basic services such as electricity and water supply, as well as for vital infrastructure and transport, is rising. "These are issues that cannot be addressed by just one nation," said Mr. Kim. "It is important to share knowledge and experiences, and this is why you are here today."

The Korean capital of Seoul has been undergoing a period of transformation for nearly 60 years, he said. As a local public enterprise founded by the Seoul Metropolitan Government (SMG) in 1989, Seoul Housing & Communities Corporation (SH Corp) has accumulated vast experiences and insights that can benefit ADB's DMCs in addressing today's urban challenges, particularly public housing.

SH Corp has been stabilizing the residential condition and improving public welfare for the citizens of Seoul by supplying over 132,000 rental houses and 81,000 houses for installment sale. *(Source: SH Corp website)*

Mr. Kim described Seoul's smart city development model as "citizen-friendly" as its salient features include the utilization of available space, jobs creation, and a place that residents need.

This model is being replicated by SH Corp in the development of new towns, such as the Eunpyeong New Town and Magok District. SH Corp is also influencing government policies to shift to a "new paradigm" of housing. "Our focus is on citizen satisfaction. All of our employees do their utmost to continuously provide the fine quality housing services and maintain close relationships with our customers under the vision of 'Happy City of Citizens with Communication and Consideration'," Mr. Kim said.

For his part, **Thomas Abell**, advisor and chief of Digital Technology for Development at ADB's SDCC, told the workshop participants: "Seoul is one of the very best examples of a megacity and a leader in the region in smart city development. There are a lot of different things happening here and SH is in the middle of that and each of you can learn from this experience."

Digital technology is a vital element in any smart city transformation. ADB recognizes this and is thus keen to assist its DMCs in their smart city journey, he added.

Through the workshop, he said DMCs can learn from Korea's experiences on urban planning, housing, environment, urban infrastructure (water, sanitation, and transportation), business environment, and startup ecosystem.

"There are two major challenges facing many developing nations today: first is rapid urbanization and the second is the level of knowhow on current research."

KIM SEIYONG
President
SH Corp

"Seoul is one of the very best examples of a megacity and a leader in the region in smart city development. There are a lot of different things happening here and SH is in the middle of that and each of you can learn from this experience."

THOMAS ABELL
Chief of Digital Technology for Development, ADB

Session 1: MANAGING CITY GROWTH

(Left to right) Keonwoo Kim of SH Corp, Bum-Hyun Lee of Korea Research Institute, and session moderator Thomas Abell of ADB (Photo credit: ADB/Edsel Roman)

Home to nearly 10 million people, Seoul ranks among the world's megacities. Its population density is about twice that of New York City and four times higher than that of Los Angeles, according to the United Nations' 2016 report.

Unlike many large cities plagued with urban woes caused by pollution, traffic congestion, overcrowding, and lack of affordable housing, among others, Seoul has become a model for every city, thanks to good urban planning and development.

In this session, moderated by **Thomas Abell**, advisor and chief of Digital Technology for Development at ADB, speakers from the academe and the government shared Seoul's experiences in its smart city journey.

Managing a Growing Seoul

Bum-Hyun Lee, research fellow at the Urban Research Division of the Korea Research Institute for Human Settlements, said Seoul's strategy on urban growth management started in the 1960s as a response to rapid urbanization and industrialization. The capital city installed vital infrastructure such as an extensive network of roads, expressways, subways, high-speed trains (Korea Train Express), harbors, and airports, among others.

As Seoul rapidly urbanized, industrialization intensified and led to higher economic growth. On the other hand, this created problems on energy consumption, waste management, transportation, housing, urban infrastructure, modes of governance, and more.

These growing challenges prompted the Republic of South Korea to experiment with the development of a 'smart city' model. In 2003, South Korea came up with the U-city (Ubiquitous city) model in which various IT solutions were integrated into the urban infrastructure. By 2007, there was a paradigm shift in implementing U-Cities, with its new emphasis on integrating ICT with human and ecological aspects.

In 2017, the country renamed U-City into "Smart City," defined by law as "a communication network, intelligent infrastructure, and integrated city operation center," Mr. Lee said.

He said this gave rise to several prototype new towns such as the Pan-gyo New Town that functions as a central business and commercial district in Seoul's Gangnam area. Within Pan-gyo New Town is Venture Valley, which currently hosts 643 venture businesses with a workers population of more than 30,000, and continues to attract high-tech IT companies.

Another new town is Sejong City, which features an integrated transport system that uses ICT; and the Saemangeum project, a waterfront city in the west coast (situated close to the People's Republic of China), which is being positioned as an eco-friendly smart city that can host smart festivals, medical center, and

cultural facilities. Mr. Lee said Saemangeum will also feature a "Smart Network Street" that will showcase the use of renewable energy in public transport and an autonomous transportation system that uses ICT applications. Saemangeum will also have a smart housing system that harnesses the Internet of Things, real-time water management system through big data integration, and smart poles and smart lighting that can collect various data.

Armed with these vast knowhow in smart city planning and management, South Korea "now plans to make a foray in the global market," Mr. Lee said. The government has already signed memoranda of understanding with the governments of Malaysia, Indonesia, and Peru, and is in the forefront of the ASEAN Smart City Network.

New Town and Urban Renewal Projects

Keonwoo Kim, deputy director, Office of Urban Development, Affordable Housing Project at SH Corp, presented the role of SH Corp as a public entity.

Established in 1989 by SMG, SH Corp has provided nearly 300,000 affordable housing for Seoul citizens and operates with an annual budget of $5 billion, 400 professional experts and over 1,000 employees handling the full management cycle of housing development.

Mr. Kim presented the current portfolio of urban housing projects that SH Corp handles. Among these is the Jungreung Affordable Housing that offers 20-year lease to single, newly married, and senior citizens of Seoul.

Built in 2009, Jungreung was already up for demolition but some residents refused to evacuate as they cannot afford to relocate. SMG tapped SH Corp to develop the site in 2016 to the tune of $7 million.

Another SH Corp project is Eunpyeong New Town, dubbed as a "first-generation Smart City" as it features smart infrastructure such as public wifi, a flood monitoring system, and smart lighting, among others.

Developed by SH Corp for eight years, Mr. Kim said low-rise buildings were demolished to give way to 17,000 newly constructed units. "We applied the European concept where residences are constructed above commercial areas. More than a third of the area is green so residents feel like living in a forest," he said.

Another new town that SH Corp developed is the Magok Smart City and Housing, which is currently 80% complete since construction started in 2010. Magok is not just home to 12,000 residents, it also welcomes four million people who visit the newly opened Seoul Botanic Park, the largest greenhouse in Korea that combines a forest, a garden, a lake, and marsh. "Before Magok, most of SH Corp projects were residential developments," said Mr. Kim.

Magok is now being positioned as a gateway city of Northeast Asia, a knowledge industry innovation city, as well as a futuristic green city. As a smart city showcase, it is expected to create 1,000 jobs and attract US$25 million in annual investments.

SMART CITY CASES IN KOREA *(Images courtesy of Bum-Hyun Lee and SH Corp)*

Venture Valley in Pan-gyo New Town: Venture businesses destination

Sejong City: Integrated transport system

Saemangeum: Eco-friendly smart city with waterfront feature

Magok: Futuristic green city

Session 1: MANAGING CITY GROWTH

Today, 55% of the world's population resides in cities. By 2050, this is set to increase to 68%, which means 2.5 billion more people living in cities, the vast majority in Asia and Africa, according to the United Nations. All these urbanites will need to find a place to live and work.

In this session, moderated by **Thomas Abell**, advisor and chief of Digital Technology for Development at ADB, speakers from the SMG and SH Corp presented the urban planning and development strategies of the capital city to tackle today's urban challenges.

Smart Urban Planning

As with many megacities, Seoul had to cope with rapid urbanization and the increase in population density. **Doi Kim**, Urban Planning Division officer of SMG, said urban planning projects started to spike in the 1980s, prompting actions to effectively manage the risks that come with growing concentrations of people and economic activities in many cities.

Seoul turned to new innovations in information technology in creating “smart” approaches and solutions to many of these issues that will continue to pose great challenges to its sustainable growth. One of these is creating an Urban Planning Information System (UPIS) to help the SMG better plan and manage the complexity of the urban environment.

Ms. Kim said SMG embarked on the digitization of urban planning documents and built the UPIS in 1999-2004. Prior to its formal launch in 2005, SMG relied heavily on paper-based documents and floor plans and small bulletin boards, and urban planning information are scattered in different city websites. She said this caused a lag in decision making, and delays in the development of land and housing.

Not content with the UPIS, SMG started an Informatization Strategic Plan (ISP) in 2017 and further enhanced the UPIS in 2018. An upgraded system launched in 2019 now offers citizens real-time access to UPIS database which contains 164,922 materials collected since 1936. "The new system also made it easier for citizens to access materials through email and SMS," Ms. Kim said.

The UPIS is being accessed for administrative work by close to 2,000 city planners per month. "Currently, UPIS focuses on the history of projects so in the future we want to forecast trends by adding smart technologies. We will add a dashboard in the third phase for design and scientifically support urban planning projects," she said.

In addition, the Seoul Urban Planning Portal makes accessible all public announcements and decision notices on urban planning of SMG, map viewing, glossary of terms, 3D decision making support system, and public announcements, and has 33,493 users monthly.

"Not only will residents feel satisfied but this also leads to regional economic development."

Chil-Mun Choi, director, Compact City Development Office, SH Corporation

"By systematically managing urban planning information, we are able to provide clear and accurate information to our citizens, support efficient and reasonable decision making, and make the information sustainable for future generations to use."

Doi Kim, Officer, Urban Planning Division officer, Seoul Metropolitan Government

"By systematically managing urban planning information, we are able to provide clear and accurate information to our citizens, support efficient and reasonable decision making, and make the information sustainable for future generations to use," Ms. Lim said.

For a successful UPIS to work, she said it is important to exert political will among decision makers, create a task force that is vested with authority to implement, forge cooperation among various stakeholders, and ensure sustainable investment support since the project is geared for the long term. "You must also have prior research before building the system," she added.

Seoul's 'Compact City' Concept

Aside from SMG, SH Corp is also at the forefront of tackling the city's urban woes. SH Corp is the largest supplier of public housing in Seoul for 30 years now.

In 2010, the government cancelled "greenbelt zones" (areas designated for preservation where development is strictly restricted by law) which were converted into public housing districts. **Chil-Mun Choi**, head of the Compact City Development Office of SH Corp, said this was in response to the scarcity of usable lots for housing as the land supply market of the Republic of Korea dramatically shrank by 72% from 2010 to 2011.

While the policy action solved the housing shortage, Mr. Choi said there was still a "need to secure a number of public housing by 17-23% of total households to stabilize the habitation."

To meet the demand, SMG rolled out a strategy to supply 240,000 public rental housing by 2022, or 13.2% of the total number of houses in Seoul.

Mr. Choi said the changing demographic profile of Seoul is also prompting state-owned SH Corp to shift its strategy. "The population is not growing and one of the reasons is that Koreans do not want to get married because they cannot afford the housing cost," he explained. Citing a latest survey, he said 38.5% of unmarried couples responded that housing cost is the reason they are not getting married. He added that 89% are satisfied with the quality of public housing and 58% of Seoulites expressed their preference to live in public housing.

To continue making public housing affordable, however, the city must find an innovative solution to tackle the prohibitive cost of land for housing in Seoul, which is close to KRW 5.5 million per square meter (USD$5,000). "Land cost usually accounts for 75% of the cost of housing development," Mr. Choi said.

While creating artificial land is "ideal and cost competitive," he said the city turned to "under-utilized land taken by public infrastructure" such as garage, rainwater pump stations, and even expressways "where there are no land cost." Thus "Compact City" became a new concept for public housing.

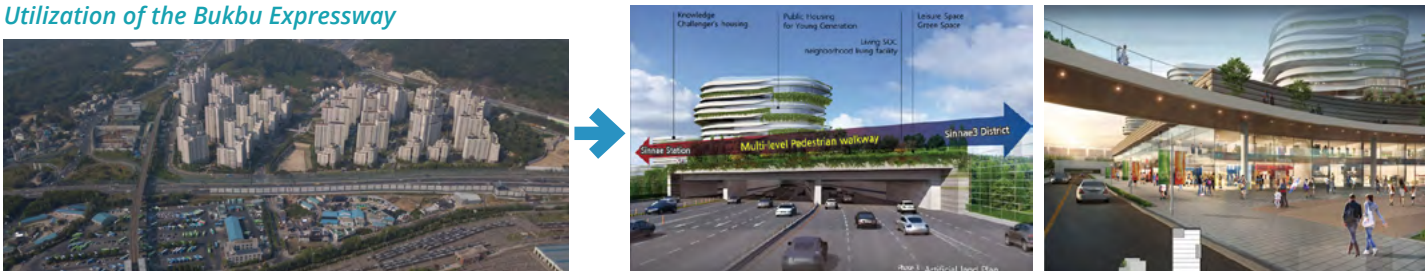
Under the compact city concept, facilities will be provided for the neighborhood to solve the urban land scarcity as well as keep public housing affordable. "Not only will residents feel satisfied but this also leads to regional economic development," Mr. Choi said.

COMPACT CITY SOLUTIONS *(Images courtesy of Chil-Mun Choi of SH Corp)*

Old Community Service Center

Bus garage

Utilization of the Bukbu Expressway



Site Visit: Magok District (Seoul Botanic Park)

Many have been dubbed as "green city" but only a few comes close to Magok District, located in Seoul's Gangseo-gu district.

Not only is Magok an environmentally friendly town, it is also being transformed into an energy-efficient zone that boasts of some of the world's best technology.

Magok is also being positioned as the "Gateway City of Northeast Asia" because of its strategic location: being just 2 kilometers away from Gimpo International Airport, 40 kilometers from Incheon International Airport, and has six subway stations that connect to downtown Seoul.

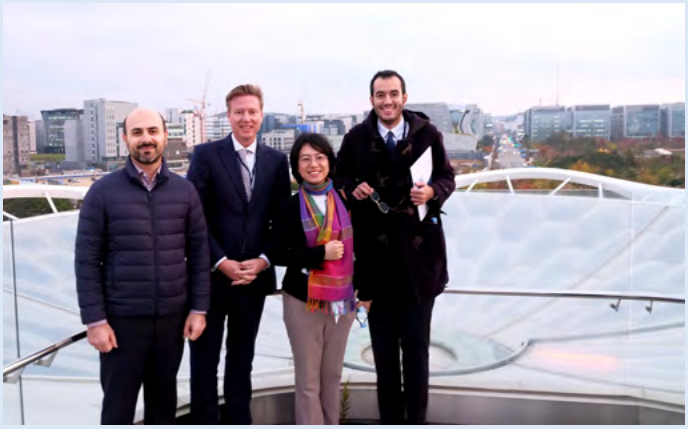
As a futuristic high-tech city, Magok is also being intensively promoted by SMG as a “knowledge industry innovation base.” SMG is by developing an R&D cluster for cutting-edge convergence technologies, as well as a business and residential complex.

Leading global companies such as LG, Lotte, Daewoo Shipbuilding & Marine Engineering, and S-oil, have started to transfer their offices to Magok Industrial Complex and around 1,300 companies are expected to move in by 2020.

The industrial complex also showcases its state-of-the-art and fuel-efficient systems, including a new heating and air conditioning system that will cut fuel and energy consumption by 50%. A solar energy-producing facility with the ability to produce 10MW of energy will also help decrease greenhouse gas production.

In addition, Magok district also offers an ecotourism destination that combines a park, where citizens can enjoy rest and leisure, with a botanic garden, where plants are exhibited and where visitors can learn. This Seoul Botanic Park occupies a total land area of 760,756 square meters — roughly the size of 70 soccer fields — and is considered as the "largest greenhouse in Korea." It is composed of an open forest, a theme garden, a lake garden, and a swamp garden.

(Right) The facade of the Seoul Botanic Park in Magokdong-ro, Gangseo-gu, Seoul (Photo credit: Seoul Metropolitan Government) (Below) Workshop participants pose on the rooftop of the Seoul Botanic Park during a site visit.



Site Visit: Seoul Housing Lab

Seoul Housing Lab in Yeongdeungpogu, Seoul (Photo credit: Sheila Samonte-Pesayco/ADB)

Seoul Housing Lab is a co-working space set up in June 2016 jointly by SMG and SH Corp.

As a platform for flexible housing, Seoul Housing Lab caters to individuals and groups looking for a "co-working space" to communicate, cooperate, and archive data. The company defines a co-working space as a flexible concept, which changes depending on its current visitors and their shared topics of interest.

In addition, the Seoul Housing Lab also serves as a venue for the public to discuss housing-related issues in Korean society. Korean citizens are engaged when planning new housing agenda and reforms, as well as a seed bed of housing-related ideas.

The Lab also exhibits films about housing, followed by an open forum on the housing issues tackled in the films.

Workshop participants and ADB staff during the site visit to the Seoul Housing Lab (Photo credit: Edsel Roman/ADB)

PART 2: ENVIRONMENTALLY SUSTAINABLE CITY

Session 2: CITY DEVELOPMENT AND RIVER

Rapid economic growth has a cost and the capital city of Seoul is a prime example. Its population is dense, its buildings and underground networks are intricately structured, and the fear of flooding and inundation always hangs like a sword.

The devastation from heavy flooding in July 2011 served as a wake-up call for Seoul. It was not only caused by heavy rainfall that exceeded the designed drainage capacity, but also by a host of other factors.

In this session, moderated by **Alexandra Conroy**, urban development specialist, Pacific Department at ADB, speakers from the public sector and the academe in Seoul shared the lessons learned from their experiences on flood and other disaster risk mitigation, as well as efforts to promote the Han River, considered the navel of South Korea's capital.

Making a Smart Safety City

Most of the annual rainfall in South Korea is typically concentrated during the wet season (June to September) usually in the form of monsoons, typhoons or torrential rains. Climate change, however, has made extreme weather conditions a common occurrence while the extent of flood damage increases in scale, said **Suk-Min Lee**, research fellow at Seoul Institute. He said precipitation levels in Seoul are predicted to rise by 17% by the 21st century and temperatures by 4 degrees Celsius.

"The 2011 flood incident that involved some casualties prompted the SMG to come up with a comprehensive plan to prevent natural disasters, especially floods," he said. "A system breakdown can have a negative impact on the city. Small challenges combine to become bigger challenges."

The city has embarked on a more integrated approach under its "Smart Safety City" that utilizes the latest technologies such as Internet of Things, cloud, and big data for an integrated response and preventive disaster risk management system. It features IoT-based monitoring, real-time information gathering, and big data analysis to improve disaster risk management efficiency and safety.

This Smart Safety City model has been successfully applied in Bukchon, home to many traditional wood houses that are fire hazards so a smart fire protection service has been installed in 2016. In Magok District New Town, smart street lighting and an underground sinkhole monitoring service have been rolled out in 2018.

To be able to respond to extreme weather changes, the city plans to combine structural measures (sewage, stream, pump station, low-flow facilities) with "non-structural" measures such as an alarm system, land use, building disaster guidance, and flood insurance, among others.

"We are restoring the Hang River's natural beauty balanced with economic development."

Suk-Min Lee, tourism and culture specialist, Han River Headquarters, SMG

"A system breakdown can have a negative impact on the city. Small challenges combine to become bigger challenges."

Woowon Kang, research fellow, Seoul Institute

Using Technology for Flood Forecasting

South Korea has experienced periods of severe flood damage due to strong typhoons and heavy rainfall since 1959, said **Man-Shin Han**, senior officer, Forecast and Control Division, Han River Flood Control Office at the Ministry of Environment.

To minimize the damage from a recurrence, the city has been repairing and improving its flood prevention facilities over the years, including installing river embankments, rainwater pumping stations, and sewage facilities. Five Flood Control Offices (FCOs) were established starting in 1974 to monitor the city's five river systems.

On July 17, 2011, however, a record amount of rainfall (300 mm of rain per day) caused severe flooding in Seoul as the existing facilities did not have sufficient capacity for a prolonged precipitation. To tackle climate change and the rapid growth of urbanization, Korea developed an integrated flood analysis system that systematized technology to quantify flood risk and flood forecasting in urban areas.

Under the new system, the FCOs now have an Integrated Water Management System that runs the operation of dams, weirs, rivers, etcetera; and uses meteorological satellite data that feeds into an Integrated Information Monitoring that makes real-time data exchange with other state agencies possible.

A real-time River Flow Management at the Han River FCO enables flood alerts and warnings to be issued when the river water discharge reaches 50% and 70%, respectively, said Mr. Han.

"We can now predict how many hours the areas can be inundated so our citizens will know when they can evacuate," he added. A Cell Broadcasting Service (CBS) is also used by the Ministry of Information to send out emergency disaster messages to anyone with a mobile phone. "In addition to CBS, every year we get applications from people who want to receive SMS on flooding, in addition to the information on our website."

Pulling Off Another Miracle

More than half a century of industrialization and rapid urban growth has also taken its toll on the Han River, a revered symbol of the country's explosive economic growth spurt in the 1960s that is more popularly known as "the Miracle on the Han River."

Woowon Kang, tourism and culture specialist, Han River Headquarters at SMG, said restoring the river's natural beauty "balanced with economic development" started in 2010. "A recently announced Renaissance Plan allows touristic activities" to serve as the capital's premier tourist attraction.

Facilities include 11 parks, expressways on north and south sides, ecological parks, fishing viewdeck for tourists, and floating islets that can be used as convention or concert hall. SMG also partnered with private companies to cultivate the Hangang forest. A Moonlight Rainbow Fountain 1,140 meters in length was recently unveiled and earned the Guinness World Record for being the longest bridge fountain.

In 2018, 70 million locals and nearly 1 million foreign tourists visited the attraction.

Session Moderator
Alexandra Conroy, urban development specialist, Pacific Department, ADB

"We can now predict how many hours the areas can be inundated so our citizens will know when they can evacuate."

Man-Shin Han, senior officer, Forecast and Control Division, Han River Flood Control Office, Ministry of Environment

Site Visit: Han River Ferry Cruise

The Hangang (Han) River is considered the most important physical landmark in the capital city of Seoul. Some call it Korea's lifeline, others call it the country's "primary vein" or even its belt.

Not only does the river divide the capital's northern and southern sides, but it also played an important role in Korean history. Han River used to be an important trade route to China.

Many Koreans hold the phrase "Miracle on the Han" close to their hearts as it refers to the rise of the Republic of South Korea from being a struggling economy in Asia to one of the major economies in the region in nearly half a century.

Several major construction projects occurred around the Han River during this period of immense growth, which ran from the 1960s to the 1990s. The city government cleaned up the area and rid it of toxic waste.

The river currently serves as one of the major water sources for over 10 million Koreans.

Now being positioned as a world-class tourist destination by the Seoul city government, Han River is lined with parks and recreational facilities on both banks.

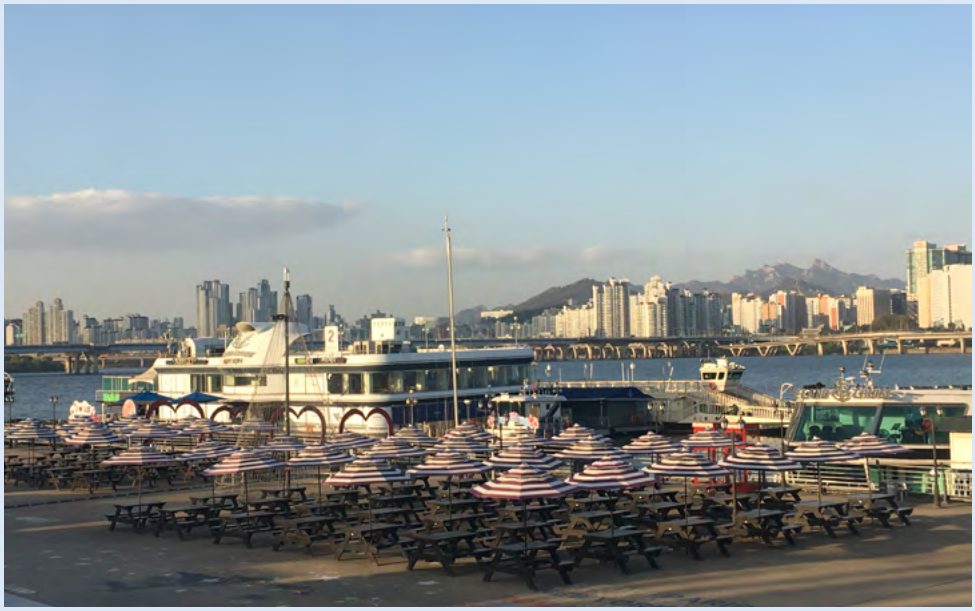
The Hangang River Ferry Cruise began operations in 1986 to allow tourists to enjoy the Han River from east to west. It also aims to promote and familiarize international tourists with the Hangang River as a world-famous attraction.

During the site visit, workshop participants were able to enjoy the fresh air and the spectacular views of the Han River during the ferry cruise. They also watched a live jazz performance as they admire the scenery.

(Right) The Han River Park greets visitors going on a ferry ride. (Photo credit: Sheila Samonte-Pesayco/ADB)

(Below, left) Workshop participants entering the ferry. (Photo credit: Edsel Roman/ADB)

(Below, right) The upper deck of the ferry (Photo credit: Sheila Samonte-Pesayco/ADB)



Workshop participants on board the ferry (Photo credit: Edsel Roman/ADB)

(Left) Workshop participants and ADB staff on the ferry ride. (Photo credit: Edsel Roman/ADB)
(Right) Sunset view from the ferry (Photo credit: Sheila Samonte Pesayco/ADB)

Session 3: ENVIRONMENT AND WASTE MANAGEMENT

"The use of smart technologies in wastewater management must also be encouraged. It's very important to find out where and when failure will happen."

Byung Kook Lee, chief research fellow, Korea Environment Institute

Session Moderator

Antonio Ressano Garcia, principal urban development specialist, Southeast Asia Department, ADB

Over half of the world's population now live in cities, with numbers expected to double by 2050. The flipside to this promise of greater prosperity, however, are the serious challenges that rapid urbanization poses, including waste generation.

In this session, moderated by **Antonio Ressano Garcia**, principal urban development specialist, Southeast Asia Department at ADB, speakers presented recent trends and examples of using the latest technologies in waste management.

Smart Water Management

Byung Kook Lee, chief research fellow at the Korea Environment Institute, said the Republic of South Korea has eclipsed most developed countries (except the United Kingdom) both in terms of population growth and rate of urbanization since the end of the Korean War in 1954.

"Before 1960, there was no problem; the economy was poor so it did not cause serious environmental pollution," Mr. Lee said. However, between 1960 to 1981, Korea experienced rapid economic growth which caused air, waste, and water pollution and these triggered serious public health concerns that were left unnoticed. "E-coli increased 150 times from 1963 to 1967, and there were several chemical accidents in industrial complexes," he added.

This prompted the Republic of South Korea to focus on the enactment of sewerage laws. As early as the 1980s, the first environmental plan was already drafted. However, what served as a greater impetus for solving environmental problems was Seoul's hosting of the Olympics in 1988. In the 1990s, the government spent 3% of its GDP to construct waste treatment plants as part of its long-term environmental plans. While the current investment in the sewerage sector exceeds US$52 billion, 60% are for publicly owned treatment works (POTW) or sewage treatment plants owned and operated by the government, while less than 40% is allocated for sewer. "We are still under-investing in sewer," Mr. Lee said.

"Historically, investment in sewer has been slow but there was a dramatic increase in sewerage service ratio since 1992," he added. These steady investments boosted water quality dramatically. "People now like to walk along the urban stream and want the recovery of aquatic ecosystem," he said.

Despite these developments, Mr. Lee said much needs to be done in terms of state management of all water infrastructure assets ("too many"), improvements in sewerage service (e.g., reduce odor complaints from sewer), and advanced sewerage management (improve water ambient quality).

"We do not have an operating and maintenance process because of lack of ownership. Most public utilities prepare an O&M budget only as a reactionary response so it's difficult to replace aging facilities," he explained. This poses a serious challenge to the sustainability of water service.

"Compared with telecom, energy, transport, and electricity, water is not being regarded as a cause for concern," he said. Low water tariffs also weaken the ecosystem. "We must decouple the price decision

"With CambiTHP™, there will be less carbon emissions as the methane (emitted) can be used as energy source and you will end up with a smaller amount of sludge."

SangKyu Hwang, Director,
Green Energy Center, Cambi Korea

"The use of smart technologies in wastewater management must also be encouraged. It's very important to find out where and when failure will happen."

Kunwoo Oh, Team Leader, Urban Environment

process from the political situation," he suggested. In addition to ensuring financial soundness, he said the use of smart technologies in wastewater management must also be encouraged. "It's very important to find out where and when failure will happen," he added.

Municipal Solid Waste Management

With its rapid pace of industrialization that started in the 1980s, construction waste also started to pose environmental problems to the capital city of Seoul. **Kunwoo Oh**, team leader, Urban Environment Division at SH Corp, said out of the 414,000 tons of total waste generated by the city, 73% is "construction waste." This is defined as at least five tons of waste generated in construction sites that are classified as either combustible, incombustible, or mixed.

"To keep construction waste from landing in landfills, Seoul relies on a technology-driven Construction Waste Management System (CWMS) that strictly enforces regulations against illegal dumping," Mr. Oh said.

The CWMS uses CCTV cameras installed in construction sites and monitors the transport of the waste using smartphones. "We have cameras that take photos of the top of the dump truck as it enters the construction site to see if it's empty, then a camera takes another photo of the truck when the waste is loaded and the weight is registered," Mr. Oh explained.

The information then enters the real-time monitoring system when the driver taps his smart card and enters the information about the waste.

The data is immediately processed and the driver gets paid for the waste collection based on the photos taken onsite and the information provided.

Using these digital technologies, only 7.8% of the city's construction waste ends up in landfills while 86.4% is recycled and the 5.8% ends up in incineration facilities, Mr. Oh said.

Sewage Sludge and Food Waste Disposal

SangKyu Hwang, director, Green Energy Center at Norwegian-based firm Cambi Korea, presented how a technology called thermal hydrolysis process (CambiTHP™) is used for the conversion of sludge to renewable energy and high-quality bio solids. Sludge comes from organic waste such as food waste and livestock.

"During a period of economic growth, Korea underwent a lot of experimentation with technology. So save yourself the cost of experimentation by using this technology," Mr. Hwang said.

The development of THP took more than 25 years and only in 2017 when it was introduced in South Korea with the treatment of all the sludge from the Anyang underground wastewater treatment plant that serves 700,000 people in the municipality.

"With CambiTHP™, there will be less carbon emissions as the methane emitted can be used as energy source and you will end up with a smaller amount of sludge," said Mr. Hwang.

Site Visit: Bakdal Wastewater Treatment Plant

The award-winning wastewater treatment plant was constructed underground. (Photo credit: International Water Association)

The Bakdal Wastewater Treatment Plant near Anyang, Gyeonggi Province located south of Seoul is not just an engineering and technological marvel, but also a showcase of how the government values public opinion.

When the facility opened in 1992, the neighborhood was deserted and the idea of living beside a filthy dumping ground for wastewater and a source of waterborne diseases was unappealing. The biggest turn off was the odor. The problem was exacerbated with rapid urbanization. As cities grew, treatment plants that were once located in remote places began being surrounded by buildings and people.

So the government built the wastewater treatment facility underground to reduce the odor in the neighborhood. During the workshop participants' tour of the plant last October 28, 2019, not a whiff of odor was detectable even from inside the plant. The facility can handle 25,000 tons of wastewater a day, mostly from Anyang's 600,000 residents.

Using innovative technologies, the treatment plant has become energy self-sufficient through the production of biogas, while simultaneously recovering water and other valuable resources. The plant has also significantly reduced its carbon footprint by reducing greenhouse gas emissions.

To make the neighborhood a welcoming and livable place, the land above the Anyang plant has been turned into a public park with sports and recreational activities. Proof that the community welcomes the existence of the facility in its neighborhood are the posh apartment buildings rising nearby.

With its "proven technology on resource recovery, applied at full or demonstrative scale," the Anyang wastewater treatment plant was given the prestigious Best Practices on Resource Recovery from Water Award in 2017 by the International Water Association.

A scale model of the Mapo Resource Recovery Facility in Mapo-gu, Seoul (Photo credit: Sheila Samonte-Pesayco/ADB)

Site Visit: Mapo Resource Recovery Facility

With greater wealth brought about by their country's rapid economic development, South Koreans consume more goods and then throw them away. As a result, more waste were generated and sent to landfills, forcing the country to explore new solutions to deal with waste.

That was two decades ago. Now, South Korea has started to rely on new technologies that transform waste into energy and other resources.

A showcase of this transformation to a low-carbon environment is situated in what used to be Seoul's landfill site for 15 years. Located between two parks in western Seoul and built on two former mountain landfill sites, the Mapo Resource Recovery Plant now stands tall as a state-of-the-art resource incineration facility that opened in 2005.

The facility handles waste from five of Seoul's 25 districts, processing an average of 650 tons of waste each day, six days a week. Waste segregation starts inside Korean households which are required by law to separate waste into two categories: those that can be burned and not burned (toxic). These waste are then collected and transported to the Mapo Resource Recovery Plant, burned at extremely high temperatures, and the heat from the waste incinerator is captured and recycled for various uses, including district heating.

This recycled thermal energy powers 20,000 homes in the Mapo area and the neighboring Korea District Heating Corporation. Though the incineration process is typically unpopular due to the risk of discharging highly toxic emissions, the facility is capable of destroying most dioxins and other harmful gases with high temperature and retention time in the incinerator. By recycling the heat generated by waste incineration, Seoul was able to reduce its greenhouse gas emissions and its reliance on crude oil imports.

PART 3: URBAN TRANSPORTATION FOR INCLUSIVE CITY

Session 4: URBAN DEVELOPMENT AND TRANSPORTATION

Demand for public transportation started to rise in Seoul in the 1980s, in step with the rapid economic growth of the Republic of South Korea.

In this session, moderated by **Andri Heriawan**, transport specialist, South Asia Department at ADB, speakers discussed how South Korea addresses the transport needs of its citizens by supplying public solutions, and easing their management through the innovative application of smart solutions.

Reforming Seoul's Bus Transport System

Nearly three decades ago, getting around Seoul meant either walking, biking, or taking a bus. Other modes of public transport were non-existent, said **Wonho Kim**, director of the City Diplomacy Research Center at The Seoul Institute.

The need for public transportation grew rapidly starting in the 1980s. At the same time, the number of private vehicles grew by more than tenfold in the three decades while roads only saw a 20% increase during the period, said the state entity Seoul Urban Solutions Agency (SUSA). This led to traffic congestion and prompted SMG to come up with innovative traffic solutions at a lower cost. Instead of constructing expensive subway lines, the city government instead turned to the only existing mode of public transport that needed reorganizing: the buses.

Before 2004, bus companies in Seoul had exclusive licenses to operate particular routes. This created overlaps and operational inefficiency. In July 2004, SMG introduced a "semi-public operation system." The bus firms remained private, but the government will have control over route and fare decisions.

Under the reform, more than 400 bus routes were integrated and redesigned. Routes were divided into feeder lines for shorter trips, and trunk lines for medium- to long-distance trips. Buses were also color-coded for easy identification. To speed up travel, bus rapid transit corridors were also developed.

The reorganization of the bus routes abolished long and circuitous paths, while making previously neglected areas accessible to bus services. Commuters were also able to transfer easily from bus to bus, and from the bus to the subway.

As for fares, the bus company was only tasked to hire the driver and did not have to worry about revenue targets and operating costs, said Mr. Kim. SMG subsidized the cost in return for having the authority to manage bus schedules and routes to provide better service to Seoulites. In addition to giving out a subsidy to the tune of $250 million a year, SMG also gave incentives to bus firms and higher salaries to drivers to lessen competitive pressures.

"SUSA's mission is to bring an integrated solution by marrying government and citizen-led policies with hard and software solutions of the private businesses."

Dong Hoon Shin, Project Advisor,
Seoul Urban Solution Agency, SH Corp

"Higher passenger satisfaction encouraged more people to take the buses, which in turn improved revenues."

Wonho Kim, Director City Diplomacy Research Center, The Seoul Institute

"Higher passenger satisfaction encouraged more people to take the buses, which in turn improved revenues," said Mr. Kim.

SMG also redesigned the fare structure to replace the previous flat fare system. With the integration of the bus and subway systems, a passenger pays according to the distance travelled. "They can also transfer five times free of charge within a 10-kilometer radius. This led to an increase in transfer demand because transfer is free," he said.

The 2004 reform also paved the way for the creation of the Seoul Bus Management System (BMS) that collected data provided by related government agencies. Each bus was equipped with an onboard unit that enables it to communicate with, and send data in real time, to the control center. The control center can then adjust the number of buses plying a particular route to manage the traffic, get the data on the bus speed, even the number of passengers. This information can be made available to passengers checking timetables online so every passenger knows when the bus will arrive using their mobile app," said Mr. Kim.

Making Payment Seamless

Aside from reforming the bus system, SMG also promoted the use of a new transportation card called "Tmoney" ("T" stands for travel, touch, traffic, and technology) for seamless ticketing and managing the shift to a distance-based fare system. The rechargeable smart card can be used to pay transport fares in and around Seoul and other areas of South Korea. Tmoney can also be used in lieu of cash or credit cards in some convenience stores and other businesses.

Byungsang Lee, chief consultant at Tmoney Corporation, said: "Seoul currently ranks among the highest in mobility card acceptance in the world, alongside Hong Kong." Around 50 million Tmoney transactions are recorded per day, generating 85 million in card data, including 26 million real-time operations data that can be used to track traffic speed, traffic volume, and location.

"Over the past 19 years, we have accumulated experiences with the use of smartcards worldwide," said Mr. Lee. He cited Tmoney services made available in Wellington, New Zealand; Bogota, Colombia; Bangkok, Thailand; and Ulaanbaatar, Mongolia.

Seoul's Policy Sharing Initiative

In addition to sharing knowledge and experiences on Tmoney with the global community, **Dong Hoon Shin**, project advisor at the Seoul Urban Solutions Agency Seoul Urban Solutions Agency (SUSA), said Seoul can also provide integrated urban solutions to those seeking to grow into smart, livable, environmentally and economically sustainable cities.

He said SUSA is a state entity established in 2015 by SMG under the umbrella of SH Corp for balanced urban development. Its mission is "to bring an integrated solution by marrying government and citizen-led policies with hard and software solutions of the private businesses." The solutions package may come in a variety of forms, including knowledge sharing, consultation, business and financial solutions.

Session Moderator
Andri Heriawan, transport specialist,
South Asia Department, ADB

"Seoul currently ranks among the highest in mobility card acceptance in the world, alongside Hong Kong."

Byungsang Lee, chief consultant,
Tmoney Corporation

Session 5: URBAN DEVELOPMENT AND TRANSPORTATION

(Left to right) Taehyung Kim of The Korea Transport Institute, Sang Yeon Hong of The Seoul Institute, and session moderator Yang Lu of ADB (Photo credit: ADB/Edsel Roman)

A threefold increase in its metropolitan area population a 16-fold growth in the volume of vehicles from 1970 to 2015 prompted the shift to an effective transport system in the South Korean capital of Seoul, according to **Taehyung Kim,** head/research fellow, Smart City and Transport Division at The Korea Transport Institute.

In this session, moderated by **Yang Lu,** transport specialist, South Asia Department at ADB, speakers discussed how Seoul addressed traffic congestion and other transport-related problems such as increasing air pollution and vehicular accidents to sustain its economic competitiveness.

Making its Transport System Smart and Intelligent

Mr. Kim said various policies and strategies have been explored to solve rapid urbanization and motorization. However, the usual solutions such as the construction of new roads "do not always serve as the optimal solution."

In the case of the Republic of South Korea, the use of intelligent transport systems (ITS) that build intelligence into existing systems served as the smart choice. Currently, Mr. Kim said there are seven primary ITS services in the country *(see diagram)*.

Since the shift to ITS, he said the country has reaped several benefits, including increased passenger use of public transport, higher public satisfaction, a 60% drop in fatal road accidents, reduction in greenhouse gas emissions, high cost-benefit ratio (1% of road construction cost is enough to reduce traffic jams by 20%), and $11.8 billion worth of annual social benefits.

Over the past 15 years, the Republic of South Korea has invested more than $3 billion for ITS deployment "but this only covered 16% of the total road length in the country, which means we still need huge ITS investment to cover all the roadways and even more for future maintenance," said Mr. Kim.

Bridging the Taxi-Ridesharing Gap

With an effective ITS in place, Seoul now faces the dilemma of what to do with its taxis. In recent years, conflict has escalated between ridesharing service and taxi companies as Koreans get on the growing bandwagon of commuters drawn to the convenience of using their mobile phones to hail a cab.

Sang Yeon Hong, associate research fellow, Department of Transportation System Research at The Seoul Institute, said taxis accounted for 10% of the passenger market in the 1990s. Since the late 1990s, however, demand for taxis has started to decline after the government built additional metro lines in Seoul. Before this, taxis augmented the limited supply of public transport but their share of the passenger market is now down to 7%.

Since the government capped the number of taxi franchises to 72,000, a taxi franchise now fetches a staggering resell price of $60,000. With demand for taxis declining while competition with ridesharing companies rises, the value of a taxi franchise is shrinking, said Mr. Hong.

The situation, however, changes by night time when demand for taxis doubles. Mr. Hong said 72,000 taxis serve Seoul's 10 million population, which translates to 136 people per taxi. Taxis also charge a base fare of 2,800 KRW, which is the lowest among major cities in Asia, he added.

The introduction of ridesharing services and rent-a-car services in Seoul has made it even harder to operate a viable taxi business. Taxi operators, however, are getting a reprieve as complex legal problems currently hound ridesharing services. The Seoul government allows ridesharing only without payment. Exception is given to 11-15 seater vans and some ridesharing companies use this to skirt the law.

In 2013, multinational ridesharing company Uber entered the Korean market only to be ordered to stop operations two years later due to stiff regulations and resistance from the local taxi industry. Grab never entered the market.

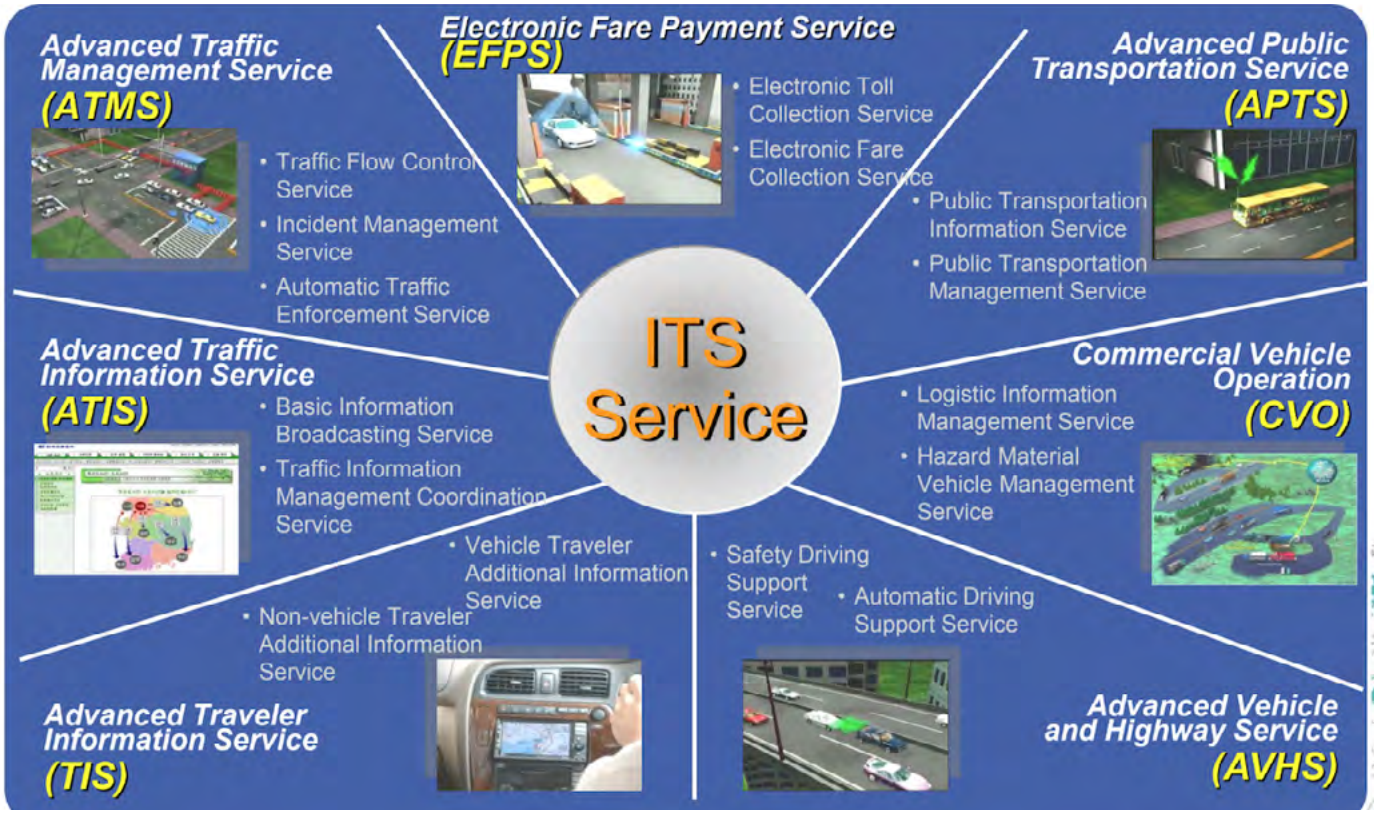
The same legal woes hounded South Korean firms that attempted to enter the ridesharing business. Local chat giant Kakao launched a ride-hailing app and started to acquire taxi fleet to get into the ridesharing business but scuttled the operation after facing lawsuits from taxi operators. The same fate befell van-hailing app operator Tada.

Aside from tough regulations, ridesharing companies also had to contend with opposition from taxi drivers who fear that ridesharing threatens their livelihood. Two taxi drivers even resorted to self-immolation in protest.

"The government thinks that ridesharing is inevitable. When autonomous vehicles are introduced in Korean society, the taxi business also cannot stand still. We need to prepare the taxi business for soft landing," Mr. Hong said.

Regulators are now toying with the idea of allowing ride sharing operators to conduct business only if they will make a social contribution to the taxi business. Another possible scheme is to deregulate the taxi franchise business so that existing taxis can be allowed to combine with ridesharing. "There must be a creative model that we can explore beyond simple intermediation," Mr. Hong said.

INTEGRATED TRANSPORT SYSTEM (ITS) IN KOREA *(Image from Sang Yeon Hong, The Seoul Institute)*



Workshop participants with Seoul Transport and Information Service Center officials (Photo credit: Edsel Roman/ADB)

Site Visit: Seoul Transport Operation and Information Service (TOPIS) Center

In Seoul, you can roam the city streets safely at night or even trek to the nearest mountaintop without fear of not getting any help if an accident happens.

YoungGye Yang, transport information officer at Seoul's Transport Operation and Information Service Center (TOPIS), said there are more than 30,000 security cameras around the megacity dedicated to keeping people safe.

Hard to believe? During a site visit to TOPIS Center on October 30, 2019, workshop participants stood in awe as Mr. Yang demonstrated how powerful and advanced the agency's security cameras are — with one click, he zoomed in on climbers on Bukhansan mountain more than a mile away and monitored their activity.

"In case there is an accident on the mountain, our surveillance cameras can pick up real-time on-site information and trigger a swift response among all of the parties concerned — the emergency responders, police stations, etcetera," Mr. Yang said.

TOPIS was set up by SMG in 2005 primarily to serve as the general transport control center responsible for operating and managing Seoul's overall traffic. It gathers and processes road traffic and subway train information in real time to enable the city to efficiently manage the intervals between buses, relieve congestion, among other things.

Traffic information is collected from the Bus Management System (BMS), the Transport Card System, the unmanned surveillance system, and traffic-related authorities and institutions such as the Seoul Traffic Broadcasting, Seoul Metropolitan Police Agency and the Korea Expressway Corporation.

Prior to introducing TOPIS, Mr. Yang said all implementing agencies operate their own systems then integrate when the need arises. The process caused undue delay in decision making, however.

Seoul's transportation system was suffering from chronic problems as the number of private vehicle owners grew, the service quality of intra-city buses started to deteriorate, and the subway system became inadequate. Despite various efforts by Seoul City, such as the opening of new subway lines and the expansion of road networks, the city's already saturated transportation facilities were showing serious cracks. Thus, the need arose for a highly advanced transport information system that would seamlessly link all the data from various implementing agencies.

(Top) Mr. YoungGye Yang of TOPIS demonstrates how the agency uses powerful CCTV cameras to monitor the traffic situation in Seoul. (Right) The motto of TOPIS displayed on the office wall. (Photos: Edsel Roman/ADB)

Mr. Yang said SMG invested 20 million KRW on advanced security cameras with varying functionalities. These are installed in public spaces to monitor people's movements, making Seoul safe.

To protect people's privacy in public places, TOPIS uses facial recognition technology on a limited basis. As for data privacy, "Data collected are stored for 17 years and are strictly utilized for smart city planning," Mr. Yang said.

In addition, the data collected is "not sold, but shared with all citizens but only to get their feedback. There is no profit motivation as we are run by SMG," a government entity, he added.

SMG discloses real-time traffic information on a 24/7 basis year round. By linking the CCTVs around the city, it can assess traffic conditions on major roads at a glance and share road control and congestion information, including the locations of any accidents, roadworks or protest rallies, with the Seoul Police Agency and the TBS.

Once a traffic situation or a road accident is flagged, Mr. Yang said the information is shared with the commuting public through social media and through a mobile app.

"You can even be anywhere in the world and still monitor the traffic situation in Seoul using your smartphone," he added.

As if the current technology were not powerful enough, Mr. Yang said TOPIS still hopes to build security capabilities with high-speed connectivity in the near future. "Currently, we're still not able to see fish swimming in the stream but with 5G, we can," he added.

Session 6: SMALL AND MEDIUM ENTERPRISES AND START-UP SUPPORT PROGRAMS

(Left to right) Session moderator Danyaal Malik of ADB (standing), Nari Shin of Start-up Alliance and Sung Joo Bae of Yonsei University School of Business (Photo credit: ADB/Edsel Roman)

SMG plans to turn the capital city of Seoul into one of the world's top five hubs for start-up companies. This is why Seoul is fast gaining a reputation for being the birthplace of many Korean unicorns. The city enjoys the highest government backing per capita for start-ups.

In this session, moderated by **Danyaal Malik,** investment specialist, Private Sector Operations Department at ADB, speakers discussed the emerging opportunities and challenges for DMCs in building a startup ecosystem.

Thriving Start-up Ecosystem

"The start-up ecosystem in South Korea is thriving," said **Nari Shin**, senior manager at Startup Alliance, a non-profit organization that derives funding from Naver Corporation, the parent firm of Line and one of the successful Korean start-ups that evolved into a multibillion-dollar global tech firm.

In the last five years, she said venture capital (VC) investment in start-ups has doubled to more than US$3 billion while the number of start-ups that received investments of US$1 million or more has grown fast: from 76 firms as of 2015 to now over 530.

She cited five reasons why the Korean start-up ecosystem is booming:

1. **Strong support from the government.**
Under the current administration of President Moon Jae-in, "growth on innovation" gets top priority. Among its new policies were: the creation of a Cabinet-level Ministry of SMEs and Startups, the Presidential Committee on the Fourth Industrial Revolution, two funding agencies that gave birth to hundreds of new VC funds in Korea, an education program through the Young Entrepreneurship Academy, and agencies that match investment funds by the government, among others.

2. **Emergence of start-up communities.**
A vibrant start-up community has been emerging. Gangnam became the "Center of Startup Fever" as big names such as the Lotte group and Naver provide funds and office space to promising start-ups. Naver and the Ministry of Science, ICT, and Future Planning also set up the Startup Alliance to create a positive start-up ecosystem in the Republic of Korea.

3. **Influx of capable entrepreneurial talents into the start-up world.**
Entrepreneurs who have studied abroad or in prestigious research universities in Korea, or who have worked in global consulting firms or big corporations, started their own businesses in Korea and became successful role models. There has also been an increasing number of female and "serial entrepreneurs.

4. **Growing number of aggressive venture investors.** There are almost 200 local VCs in Korea, with prominent entrepreneurs as well as foreign VCs providing money to many start-ups.

5. **Korean millennials love to use start-up services.** Korea is an ideal test bed for start-ups to pilot their program since its population is very open to change. Young Koreans are also very adept with technology.

While these present opportunities and inspiration for potential ventures, Ms. Shin there are also challenges that confront Korean start-ups. Among these are: strict regulations, lack of diversity, fear of failure among young Koreans, lack of entrepreneurship drive, lack of an exit strategy (should the start-up fail), too much government funding, and lack of B2B and tech start-ups.

Supporting Incubation Programs

Sung Joo Bae, professor of Technology Management at Yonsei University's School of Business and dean of Sangnam Institute of Management, said the Republic of South Korea is considered a "latecomer" when it comes to technology evolution. For the past 30 years, Korea went through a period of technological experimentation as a developing country. Unlike countries like the United States, Korea followed the Japan model in which the government first selected a few industries first for R&D. As such, many industries were developed successfully following the pattern of reverse technological evolution.

"Now, we are competing on the global stage but all institutional mechanisms are still the same," Prof. Sung Joo said. As the leading university that supports start-ups, Yonsei University created YES Foundation (YESF) in 1998 "to change the institutional mechanism to nurture technology evolution in a new era," he said.

In 2018, YESF was tasked by the Ministry of Small and Medium Enterprises and Startups (MSS) , to be the "best incubator of enterprises in Asia." A combined office community and business incubator based at Yonsei University, YESF was created to encourage students to turn their innovative ideas into reality.

YESF now runs 26 start-up classes, from entrepreneurship to business planning and technology, Since it started in 1998, 152 start-ups have been successfully launched, of which six companies have become publicly listed or M&A ventures. YESF has also forged an alliance with global institutions in Denmark, the United Kingdom, Israel, India, Singapore, Japan, and China to replicate its model. "Our challenge is to support all stages of start-up development beyond their campus life," added Prof. Sung Joo.

KOREAN UNICORNS

8 Korean start-ups among the 300+ global unicorns (private firms valued at over $1 billion)

VENTURE CAPITAL IN KOREA

VC INVESTMENTS

US$3B+

in 2018 vs. $1.4 billion in 2014

NUMBER OF VCS

200

KOREAN START-UPS

530

have received venture capital investment of at least US$1 million

Source: Startup Alliance

Some of the workshop participants at the Seoul Startup Hub in Mapo-gu, Seoul (Photo credit: Edsel Roman/ADB)

Site Visit: Seoul Start Up Hub

Besides being the birthplace of K Pop and K Drama, Seoul has also become renowned for being one of the top startup hubs in Asia. Once fledgling companies turn into billion-dollar unicorns like tech startup giants Kakao and Coupang, to name a few.

These startups needed help with networking and industrial backup and Seoul has plenty of startup community organizations to offer a venue to exchange ideas, get assistance, and tap into a support system to get through their birthing pains.

One such place is the Seoul Startup Hub (SSH), Korea's largest startup incubator. Established by SMG in June 2017, SSH plays a huge role in transforming the capital city into a regional startup hub.

The hub currently has around 150 startups in the incubation stage, and 1,000 startups that have grown into corporations, said Tae-Hoon Lee, Director of the Seoul Startup Hub Team at Seoul Business Agency.

The hub is a critical component of Korea's tech start-up ecosystem as it helps foster collaboration with private professional partners, including global incubators, investors, law and accounting service providers, and patent advisories.

Located in Gongdeok-dong, a neighborhood of the Mapo district, SSH consists of a 10-floor main building and a four-floor annex building. The hub provides a diverse range of support services for foreign and local innovators through its all-in-one platform.

During the site visit on October 30, 2019, workshop participants were given a tour of the business space and support facilities for startups, as well as the public areas for citizens to share.

In a bid to sustain its economic growth, the SMG has vowed to support technologies that create jobs and invest in ideas that will change the world. It will increase the number of startup spaces from a mere 40 to around 100. Mr. Lee said the Seoul Future Growth Fund worth 1.2 trillion KRW (US$1 billion) has also been set up to invest in more than 2,000 Seoul-style innovative startups based on the core technologies of the 4th Industrial Revolution.

He said Seoul also recently unveiled its "Vision 2020" that will reposition itself as home to a startup ecosystem under the motto of being a “Global Open Platform Startup City.” The new ecosystem will be made up of foreign entrepreneurs, test beds for innovative products and information- and resource-sharing platforms.

Site Visit: KU Anam-dong Campus Town

The KU-Anam Dong Campus Town, also known as "π-Ville99" (Photo credit: Edsel Roman/ADB)

The city of Seoul is considered an academic haven. Having 25 universities in one city is a rare phenomenon in the world. Yet economic recession has made it a challenge for the youth to find employment in the city.

So SMG thought of a creative solution by creating an urban regeneration project called "Campus Town." The project aims to transform university towns into youth development hubs. SMG plans to inject about 152 billon KRW into the project until 2025.

In addition to youth development, the project also seeks to promote a startup culture among young Korean students to "future-proof" the economy.

Surrounded by startup culture, Korea University (KU) and Anam-dong, Seongbuk-gu district joined forces in 2016 to serve as the testbed for the Campus Town project.

To nurture the youth who want to found their own enterprises, KU, SMG, and Seongbuk-gu erected the "π-Ville99" ('π' or 'pi' for 'pioneer') by turning 36 used container vans into a dynamic place for students and local communities to nurture their startup dreams.

Workshop participants sit comfortably on multi-colored textiles while listening to the briefing on Ku-Anam Dong Campus Town.

Session 7: E-GOVERNMENT AND SMART ADMINISTRATION

(Left to right) Jongile No of Korea Land and Geospatial Informatix Corporation of The Seoul Institute, Kyeonghee Ko of Seoul Metropolitan Government, and session moderator Euna Shim of ADB (Photo credit: ADB/Edsel Roman)

To tackle rapidly evolving urban challenges more proactively, the Republic of South Korea has been investing heavily in smart city technologies such as e-government, big data and the Internet of Things (IoT).

In this session, moderated by **Euna Shim**, public-private partnership specialist at the Office of Public-Private Partnership at ADB, speakers shared how the city of Seoul was able to carve a global reputation for being a pioneer in the field of e-government and how it continues to perfect its smart city solution over the years.

Towards e-Government Excellence

Kyeonghee Ko, director of the Smart City Policy Division at SMG, said the city has been investing in and applying digital technologies in its public office efforts for the past 30 years to become the top e-government of the world. As a result of these efforts, Seoul has been ranked 1st in the United Nations' eGovernance survey since 2003.

For its Smart City Policy Division, the city government has allocated a budget of $121 million or just 0.3% of Seoul's annual budget of 38.8 billion for 2020. The Division only has a staff complement of 209 out of the total city government workforce of 43,500.

Despite this, the Division has come a long way since 1999 when the SMG appointed its first chief information officer. "Back then, the office had only one PC and one staff who knew how to work on a computer," said Ms. Ko. The office was initially tasked to digitize the Citizens' Registration Card, "which took us a decade to complete," she added.

After this, a series of e-government projects were implemented, most notably the creation of a single online portal for citizens, which brought together government web pages that had previously only existed in silos. "We launched our online services using only Cobalt and Pascal (software). The first to go online were government workers. We used e-payment to give them their salaries and an online time record keeping. For citizens, we first offered tax-related services online," Ms. Ko said.

The third phase involved networking. "Using ubiquitous technology, we implemented networks. Our largest project was a network of services within one apartment complex," she said. Also launched was the Oasis, an online public proposal system that collects citizens' ideas on issues affecting the city. Every month, a handful of suggestions were submitted to the board and the best ones are interpreted to form policies.

Since Oasis was launched, 565 ideas from citizens have been reflected in state policies: from having designated 'no-smoking' zones around the city, to the building of Sebit-seom, the world's first floating building which houses conferences, art galleries and music concerts.

Ms. Ko said the fourth phase was about "making the system 'smart' by linking each system with each other. What SMG wants to create is to have a smart city that also benefits the vulnerable, especially elderly and unreached people in rural areas."

Once smartphones became ubiquitous in the city, the city government used this technology to engage citizens, creating its mVoting system. Similarly to Oasis, the mVoting system is a communication platform where policies can be shared with citizens. As of January 2019, the mVoting app has 6,259 agendas for citizens to vote on, 2,450 policy votes, 652 voting results that reflected on policies, and around 2 million voting participants.

In addition to mVoting, the city government has also created an Open Data Plaza that attracts 670,000 users daily and has resulted in the development of 184 apps by citizens. It also actively partners with the private sector in analyzing data that could help address the city's problems (e.g., launch of the Squirrel Bus night bus lines service), as well as in providing trade-related information. IoT-based urban data management systems, which include the installation of 50,000 sensors around the city, were also introduced. Another e-government innovation is the use of artificial intelligence for chatbots to help the city's administrative personnel perform repetitive tasks.

"Our future challenge for Smart Seoul is: Are we really reflecting the voices of all our 10 million citizens, including the underprivileged groups such as the elderly and the handicapped?" Ms. Ko said.

Harnessing National Spatial Data Infrastructure

One of the strengths of Korea's e-government is its geospatial information service (GIS). As a scientific tool that visually illustrates spatial information, the GIS can help with the analysis and identification of resources, such as land and capital, into decision-making processes.

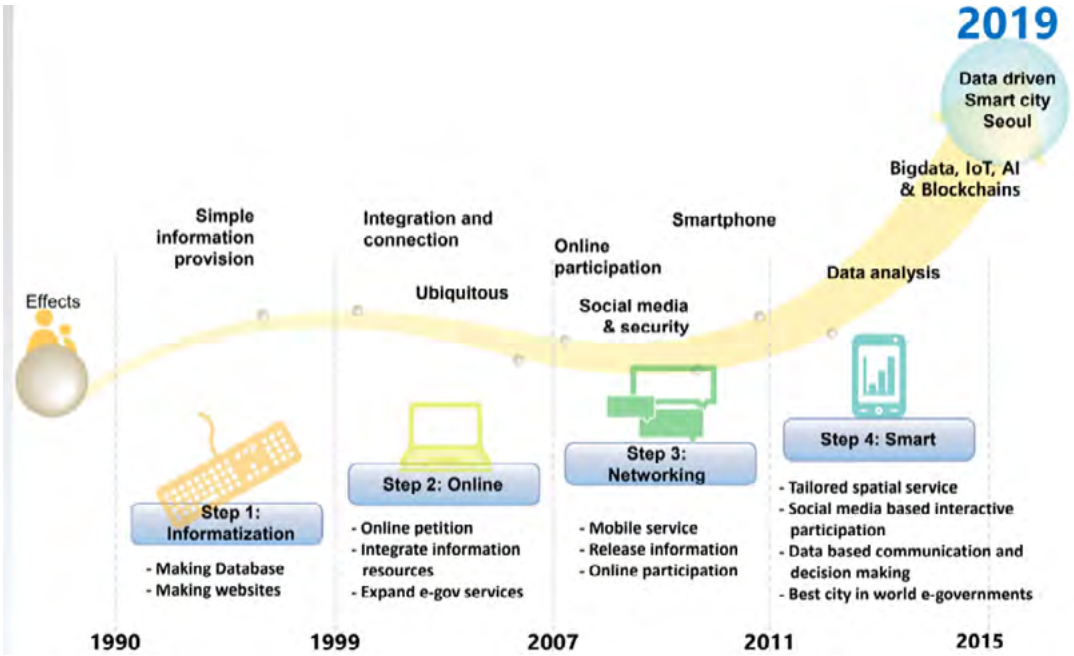
Jongile No, senior manager of the Global Business Department at Korea Land and Geospatial Informatix Corporation (LX), said public awareness on the role of GIS was only raised when two gas explosions took place in 1994.

Under its four-phase national GIS implementation plans, the Korean government has undertaken the National Geospatial Information Service (NGIS) project, with the cooperation of many local governments, GIS academies, and industries. The project's implementation covers a 20-year period.

In Seoul, the GIS project was launched in 1995 mainly to improve the quality of its service delivery. Digital maps were produced and various GIS application systems were used on planning new roads, managing water supply, sewerage, land information, geotechnical information, underground facilities, urban planning information, and a new address management system.

"Eighty percent of all data have spatial components so the GIS can also be used for disaster management, resource allocation, climate change mitigation, etcetera," said Mr. No.

PROGRESS OF SEOUL'S E-GOVERNMENT *(Image from Kyeonghee Ko, SMG)*



Session 8: GROUP DISCUSSIONS AND PRESENTATIONS

Topics/Issues	Armenia	Azerbaijan (Baku City)
1. What are **key urban challenges** that your country (city) seeks to address with Smart City solutions?	• Waste management • Housing backlog • Water supply (in regions) • Transport management • Wastewater management • Accessibility and transparency of government services • Energy efficiency • Air polution and noise in cities • Development of sustainable green cities	• Transportation management and planning • Lack of coordination in the utilities infrastructure planning • Insufficient governance strategy • Improper implementation of land use planning • Low share of green spaces • Oil pollution
2. What are your country's explicit **Smart City Strategy**? What is its status?	No holistic government strategy but fragmented elements of successful 'smart city' implementation (e.g., artificial intelligence-based solutions in the education sector, healthcare, renewable energy, crime prevention).	No strategy or roadmap drafted yet, but individual elements are present/being developed (e.g., public transport management). The Baku new Master Plan (2020-2040), which contains smart city solutions, is also being developed.
3. What particular **intervention areas** does your country focus on in the Smart City model?	Smart Mobility and Transport Smart Energy Smart Environment Smart Water Smart Climate & Disaster Risk Management Smart Education Smart Government	Smart Mobility and Transport Smart Energy Smart Government Smart Safety
4. What are your country's **Smart City projects**? What are their status of implementation?	• Ministry of High-Tech Industry to implement projects embedded with 'smart city' solutions • Establishment of an engineering city • Scaling up of techno parks in regions • Digital creative education models • Mapping of landfills, using smart technologies	• Baku City Public Transport Management System (ongoing) • Free public wifi • Intellectual Traffic Management system in Baku City, developed by Korean partners • ASAN service (one-stop shop e-services to residents and businesses)
5. What **bottlenecks** are your country facing in Smart City implementation?	• Legislation and policy • Financing	• Legislation and policy • Governance and institutional capacity
6. What **lessons** have you learned from the workshop?	• Smart city concept of Magok • Urban strategy and planning / UPIS • Wastewater treatment system • Transport • Startup hubs	• Cities should be at the forefront of progress. • Innovative solutions are key to success. • PPP success stories were demonstrated. • Government financing is essential to accelerate the application of smart technologies in cities.
7. What **possible collaborations** with ADB or Korean counterparts do you see?	• Smart and sustainable city model around the engineering city in Yerevan • Collaboration between the univerisities and R&D centers of Armenia and Korea • Development of digital infrastructure • Cybersecurity • Bridging and matching startups from Armenia and Korea	BOT model for Korean companies in smart city projects

Cambodia	Georgia (Tbilisi)	Lao PDR
• Infrastructure inadequacy • Lack of financing for smart city deployment • Safeguards • Political challenges • Human capital and institutional challenges	• Congested roads (high number of vehicles per household and the low presence of public bus and cycle lanes); vehicle fleet • High energy consumption in buildings (increasing yearly) • Chaotic building construction causing degradation of green spaces	• Rapid urbanization and urban sprawl • Insufficient basic urban infrastructure • Environmental problems • Limited capability of urban management • Low economic growth
None yet. Masterplans (e.g., land use and public infrastructure) are at initial stages. Seeking parliamentary approval for amendments to the existing investment law and the adoption of the PPP operating manual.	No strategy or roadmap drafted yet. Municipal authorities focus on improving the public transport and reduce demand for private cars.	Initial stage of applying the concept of Smart City to urban development in consultation with a development partner. Lao is a member of the Asian Smart Cities Network (Lao Vientiane Capital and Luang Prabang City).
Smart Mobility and Transport Smart Energy Smart Environment Smart Water Smart Climate & Disaster Risk Management Smart Education Smart Government	Smart Mobility and Transport Smart Climate & Disaster Risk Management Smart Government	Smart Mobility and Transport Smart Food Service Smart Banking Smart Safety
7 ongoing projects and one ADB-funded project for approval in 2021	• Municipal wireless network plan (free wifi) • Tbilisi mobile application as tourist guide • Electronic bus route boards in bus stops • Emergencies Control Center • Online processing of construction permits • Tbilisi Public Service Hall (one-stop shop) • Electronic auction for real estate • Public registry online services	• E-Government Project • E-Government in land use; • Vientiane Capital Smart City Project • Project preparation for livable cities
• Political commitment • Legislation and policy • Vision, leadership and strategy • Governance and institutional capacity • Financing for smart city programs • Human resources and skills • Mass migration	• Governance and institutional capacity • Human resources and skills	• Legislation and policy • Vision, leadership and strategy • Governance and institutional capacity • Financing for the smart city programs • Human resources and skills
• Urban strategy and planning • Energy • Building resilience for livelihood and economic development • Public involvement • Necessary law and regulation to support smart city development	• Cities should be at the forefront of progress. • Innovative solutions are key to success. • PPP success stories were demonstrated. • Government financing is essential to accelerate the application of smart technologies in cities.	• Need for strong and accurate policies of the central and local governments to implement smart city plan. • Important role of startups in cities' economic growth and uplifting living conditions of people
Smart city design and successful financing option (conventional model vs. PPP)	• Creation and integration of various • information in Big Data • Promotion of startups	• For ADB, in cooperation with SH Corporation, to organize a Country Workshop in Lao PDR. • Request for ADB support to study and write the Smart City Program and Strategies in the context of Lao PDR.

Session 8: GROUP DISCUSSIONS AND PRESENTATIONS

Topics/Issues	Maldives	Pakistan
1. What are **key urban challenges** that your country (city) seeks to address with Smart City solutions?	• Transport inefficiencies • Housing • Congestion • Lack of green spaces (liveability) • Reduced mobility and walkability	• Improvement in basic municipal services (water and sanitation, solid waste management, public spaces, transport) • Traffic congestion • Environmental issues
2. What are your country's explicit **Smart City Strategy**? What is its status?	None yet (need ADB assistance). Currently in place is the Strategic Action Plan of the Maldives.	No explicit Smart City Strategy but Vision 2025 contains smart city strategies
3. What particular **intervention areas** does your country focus on in the Smart City model?	Smart Mobility and Transport Smart Energy Smart Environment Smart Water Smart Climate & Disaster Risk Management Smart Food and Agriculture Smart Government Smart Education Smart Economy & Jobs Smart Health Smart Society & Culture Smart Safety	Smart Mobility and Transport Smart Government Smart Safety
4. What are your country's **Smart City projects**? What are their status of implementation?	• Road development • Green spacing • Waste management	• Punjab Intermediate Cities Investment Improvement Project • KP Intermediate Cities Investment Improvement Project • Punjab Intermediate Cities Investment Improvement Project Phase II • Other Public Governance projects
5. What **bottlenecks** are your country facing in Smart City implementation?	• Governance and institutional capacity • Financing for the smart city programs • Human resources and skills	• Vision, leadership and strategy • Governance and institutional capacity • Financing for the smart city programs
6. What **lessons** have you learned from the workshop?	• Planning and continuous improvement • Integration of smart technologies in services	• There must be one integrated approach. • Need to have continuous Capacity Building Programs to implement Smart City Initiatives.
7. What **possible collaborations** with ADB or Korean counterparts do you see?	• Smart and sustainable public transport system to increase the mobility, accessibility, liveability • Smart green spaces and market places	Incorporation of Smart City components in ongoing projects. Use of Smart Technology in each sector especially waste to energy, mobility, and sewage treatment facility .

Philippines	Sri Lanka	Uzbekistan
• Disaster risks: flooding, earthquakes, volcanoes • Transportation: traffic congestion, lack of public transport • Food security • Environmental protection	• Transport • Solid waste management • Waste water Management (e.g., sewers) • Storm water management • Urban flood control • Non-revenue water	• Legislation • Infrastructure • Master Plan
None yet. Only a National ICT Framework.	No strategy at national level but there are sectorial strategies on the ground.	2030 Urbanization Development Concept
Smart Mobility and Transport Smart Energy Smart Environment Smart Water Smart Climate & Disaster Risk Management Smart Education Smart Government	Smart Mobility and Transport Smart Climate & Disaster Risk Management Smart Water	Smart government (120 e-govservices) • Legislation • Smart Economy and Jobs
• Currently developing smart cities in New Clark City, Davao, Cebu and Manila • Mobile apps to provide information to LRT commuters and augmented reality app for tourist spots in Manila • Use of hazard maps and in gathering geospatial data for disaster risk assessment	• Tech City Project in several universities • Ongoing port city development • Aero City Development (concept design) • Maritime City project (beach development and logistics) • Bus modernization and transport improvement project • Solid waste management project	• Kokand Smart City • Chong He “Engineering”
• Lack of capacity of metropolitan agency • Very restrictive procurement laws • Politics • Lack of masterplan, standards, knowledge on latest technology (contractor-driven TORs)	• Several legislations and regulatory bodies • Change of national policies with government changes • Several institutions for one sector • Several enforcements authorities • Lack of institutional capacity	• Legislation • Human resources and skills
• Strong political support through legislation (capacitate legislators) • Focus on organizational capacity • Linkages with research institutes doing thinktank work • Budgetary support	• Underground sewerage treatment with odor control is possible. • T-money system (single card with multiple uses)	• Attention paid to the opinion of civil societies • Waste utilization
Collaboration among state agencies such as the Department of ICT, housing, and local government units is vital.	Collaboration with ADB or Korean counterpart for above improvements	Collaboration with ADB or Korean counterpart for Smart City legislation, waste management, and urban planning

Knowledge Series No. 11

Digital Technology for Development Unit
Sustainable Development and Climate Change Department
Asian Development Bank

Seoul Housing Corporation