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Complexities of Megacity

The Case of Seoul

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The twenty-first century will be the century of the Megacities. More than half of the world's population now live in urbanized areas and this number continues to rise. Another 2.5 billion people will accumulate in urban areas by 2050. Today, according to the 14th edition of *Demographia*, there are already 37 megacities in the world (that is, cities with a population of over 10 million), and the number of cities with over 5 million population is also rising (84 in 2017 and 86 in 2018). The list of megacities is getting longer each year, mostly in the Global South. Another striking fact is that the top of the list is dominated by Asian and African Countries; the top five megacities are all located in Asia, with Tokyo at the top of the list, followed by Jakarta, Delhi, Manila, and Seoul.

Seoul-Incheon, the focus of this issue of *IGLUS Quarterly*, with a population of 24.3 million and 13,600 people per square kilometre, has the highest density of these top five megacities, and is only behind Tokyo in terms of income. In the past two decades, Seoul-Incheon has undergone a number of development projects to increase its status as a world city, attract more foreign investment, and give the city a modernised makeover. The projects we covered in this issue are focused mainly on transportation, walkability and urban transformation and the measures that the Korean government took to reduce the adverse effects of climate change, starting with Seoul.

This issue opens with an article, which discusses the energy policies through which the Korean government has sought to reduce the harmful effects of the rising temperatures caused by global warming. By shifting towards renewable sources for energy production and trying to reduce the reliance on fossil fuels and nuclear power plants, Korea is aiming even higher than its counterparts signed The Paris Agreement . Numan Yanar and Prof. Heechul Choi provide an overview of the Korean Government's policies for a better, cleaner and more sustainable Seoul.

The second article is about the bus reform Seoul has implemented in recent years: a quasi-public system that helped Seoul to have a more efficient, fast, modern and reliable in-city transport system . Dr. Chang Yi's thorough study of the bus reform in Seoul provides insights into how a public transport system is structurally and financially managed.

The last article in this issue is on Seoul Walks, an initiative that brings together professionals and locals for a more participatory urban transformation of Seoul. Dr. Alban Mannisi's piece on Seoul Walks summarises the five projects that Seoul Walks has initiated in recent years and evaluates each of them in terms of public good, resilience, and sustainability.

And we close this issue with the extensive city report by Diego Giron Estrada, our former editor, which starts with the historical facts and then dives into the economic and social issues of the city.

We hope you will enjoy this Seoul Issue and we invite you to join the discussion at iglus.org. If you feel that there are innovative practices underway in your city/region and you would like to contribute to an upcoming edition of IGLUS Quarterly, we encourage you to contact us at umut.tuncer@iglus.org.

İpek Şen

Energy Perspectives of Korea (Republic of) with a General Outlook on Renewable Energy

Numan Yanar* and Heechul Choi**

Abstract: *As global warming has become a severe issue; the attention of world governments has started to shift towards the sustainable use of energy to reverse the previous mistakes. The main initiative in this regard was almost 200 nations agreeing, through the Paris Agreement, to undertake ambitious targets. However, these targets are not enough to deal with the expected global temperature rise. In this regard, Korea has introduced strict policies for a steep transition to renewable energy. The first step aims to reduce greenhouse gas emissions by 26 percent through raising the ratio of renewable energy to 20 percent by 2030 by investing in solar and wind power plants.*

Introduction

Over the last two decades, global warming has become an increasingly important issue. The average temperature of the Earth's atmosphere and its oceans has gradually increased from 0.4 to 0.8 °C (Live Science), which is already resulting in permanent alterations to the Earth's climate.

Global Temperature Increase

Over the past five decades the common use of fossil fuels, land clearing, agriculture, and all other human activities has resulted in a high amount of pollutants, primarily carbon dioxide and also other greenhouse gases. Eighteen of the Earth's warmest years have occurred in the last 136 years. Critically, 17 of those 18 years have occurred since 2001, with 2016 being the warmest (NASA's Jet Propulsion Laboratory, 2018). These severe effects are expected to intensify and the average temperature increase by 2100 is expected to be between 1.4 and 5.8 °C.

The increase in the heat in the atmosphere is absorbed by the oceans (Potter, Cabbage, & McCarthy, 2016), which means that oceans are also getting warmer. On the top 700 meters of oceans, there has been a 0.1678°C increase since 1969 (Levitus et al., 2009). Such an increase may seem insignificant for humans, but it creates a life-threatening scenario for ocean plants and animals, starting from plankton. As algae and plankton are the base of the food chain, this is aready having serious consequences for humans. One of the dire consequences of the temperature rise in oceans is that it hinders the photosynthesis of algae until they eventually die, while coral splits, leading to a white coloration known as bleaching. This food chain destroying situation is currently occurring in all oceans.

Furthermore, warming oceans and atmosphere further affect the ice masses in the Greenland and Antarctic. According to Gravity Recovery and Climate Experiment of National Aeronautics and Space Administration (NASA), Greenland and Antarctica lost 281 billion tons and 119 billion tons of ice, respectively, between 1993 and 2016.

In addition, all around the world the effects of global temperature increase resulting in retreating glaciers, the decline in arctic sea ice, the over-melting of spring snow cover and the intensifying rainfalls, have resulted in rising sea levels (20.32 cm in the last century).

Ocean acidification as a result of carbon dioxide absorption by oceans is also a further concern that endangers the life in the oceans and seas (NASA).

As discussed above, the results of global warming are threatening human existence.

Emissions of Greenhouse Gases and Renewable Energy

Although global warming is a natural phenomenon, the main reason behind the accelerated rate is human activities. The reliance on non-renewable energy sources

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like as fossil fuels: coal, petroleum, and natural gas has brought us to this point. Fortunately, the importance of renewable energy sources has been recognized worldwide, which is encouraging many nations to act before it's too late. In last decades, the reliance on coal has been replaced by nuclear energy, which releases fewer greenhouse gases. Nonetheless, it is controversial to rely on nuclear sources due to the ultimate adverse effects of radioactivity on humans and nature, not to mention the cost of nuclear energy. The US Energy Information Administration declared that the cost of nuclear energy is more than 50 percent greater than that of solar power or wind power (U.S. Energy Information Administration, 2017).

In order to shift toward renewable energy, world countries started to take some measurements on the basis of the Paris Agreement (Richardson, 2018). In 2015, almost 200 nations agreed to help limit the warming on the Earth's surface to a maximum of 2°C to avoid the irreversible consequences. According to the projection of the Integrated Global System Model (IGSM), the measures agreed upon are not enough to realize the goal and not go beyond the 2°C mark. The projected temperature rise, ranges from 1.9°C to 2.6°C by 2050 and 3.1°C to 5.2°C by 2100, depending on the climate sensitivity. Therefore, more realistic and stronger *targets* should be taken (Nancy W. Stauffer, 2017). In this regard, the world's largest energy-consuming countries are taking the main responsibility for application of the further measures, with Korea at one of the forefront.

Energy Use in Korea

According to the BP Statistical Review of World Energy 2018, Korea is the eighth-largest energy consumer in the world (British Petrol, 2018b). As a result of insufficient domestic resources, Korea ranks among the world's top five importers of liquefied natural gas, coal, crude oil, and refined products.

Since the 1970s, Korean energy sources were based on nuclear and coal-fired plants (Chung & Kim, 2018). The country produced an estimated 1.6 million short tons (MMst) of coal from its anthracite reserves out of total 151 MMst consumption in the country in 2017. Several coal–fired plants started operation in 2016 and 2017 as a result of forced shutdowns of some nuclear plants (safety issues before a major earthquake), which resulted in a 12 gigawatts (GW) capacity increase (U.S. Energy Information Administration, 2018a). Another large portion of the energy in Korea is sourced by nuclear plants; 24 reactors provide approximately one-third of total electricity from 23 GWe of plant (World Nuclear Association, 2018).

Energy Policies of Korea

In 2016, electricity production of the country was comprised of 41.2 percent from steam plants, 30.2 percent from nuclear plants, 17.9 percent from combined cycle plants (127 TWh), 1.2 percent from hydropower plants, 0.1 percent from internal combustion and 9.5 percent from other sources. The main energy sources were nuclear (30 percent), coal (39.65 percent), petroleum (2.6 percent, hydro (1.2 percent), and other sources (4.2 percent), for a total of 540,441 GWh electricity (Korea Energy Economics Institute, 2017). This high dependency on coal and nuclear energy is caused by the previous energy policies. However, in 2017, the Korean government introduced the 7th Basic Plan for Long-term Electricity Supply and Demand for a transition to renewable energy till 2030. The new green policies were further introduced by the election of President Moon Jae-in in May 2017. Since then, Korea has started to focus more on the transition to renewable energy. President Moon aims to increase the use renewable energy for the national electricity from just 4.7 percent to 20 percent by 2030 (Normile, 2017). Coal-sourced energy is expected to fall from about 43 percent in 2015 to 22 percent by 2030, while nuclear is projected to drop from 31 percent today to 22 percent by 2030. Furthermore, the government's policy aims to phase out nuclear power over a period of 40 years (World Nuclear Association, 2018).

Renewable Energy in Korea

Renewable energy carries great importance for the green future of Korea. According to 2017 data, Korea holds seventh place in the world for CO_2 emission, with 679.7 million tons of carbon dioxide and a 2.5 percent growth rate (British Petrol, 2018a). This is mainly caused by the

high coal consumption in electric power sector. Due to the high demand from the power sector, coal consumption increased by more than 50 percent between 2007 and 2017. However, the country's 8th Basic Plan for Electricity Supply and Demand aims to push renewable energy and suspend the plans for new coal–fired capacity as well as shutting the seven old coal plants. Furthermore, the government also plans to transform six coal projects into LNG plants to reduce carbon emission (US Energy Information Administration, 2018b).

Although internal combustion energy production and consumption is at the lower end relying in fossil fuels as a source of energy not only add to the GHG emissions, but it is also releases more toxic particles into the air than any other source. Another problem is created by the use of fuel oil, which greatly reduces greenhouse gas emissions, but also increases air toxicity significantly (Reuters, 2018). Therefore, the goal for 2030 includes cutting fine dust levels by 62 percent in addition to reducing greenhouse gas emissions by 26 percent from business-as-usual (BAU) levels; this will be done by raising the ratio of renewable energy to 20 percent by 2030 by investing in solar and wind power plants (Eun-jung, 2017). Currently, the renewable energy production of Korea is provided by solar (thermal/photovoltaic), wind, tidal-ocean, hydropower, geothermal, waste and biomass sources. As of 2017, Korea has a capacity of 5.7 gigawatts of solar power and 1.2 gigawatts of wind power. It is planned to add 30.8 gigawatts capacity to solar and 16.5 gigawatts to wind power capacity by 2030. These additional capacities will be obtained from both major and minor individual projects such as conversions of the energy sources of households, farms and small businesses to renewable energy. Korea even aims to equip one in 30 households with solar power generation by 2022 and generate the solar capacity of about 5 gigawatts between 2018 to 2022 (Reuters, 2017).

Korea also has strong roots in hydropower. The country's hydropower potential was analyzed as 505,093 GWh/year with the capacity of 57,659 MW (Table 1) (Korea Energy Management Corporation).

River system	Capacity (MW)	Potential (GWh/Yr)
Han River	18,936	165,878
Nakdong River	19,254	168,665
Keum River	8,989	78,746
Sumjin River	5,356	46,917
Youngsan River	2,903	25,435
Jeju	2,221	19,452
Total	57,659	505,093

Table 1. Hydropower Generation in Korea

Korea is a world-leader in tidal-ocean energy. These energy sources are inexpensive and available for large-size productions with clean energy. Currently, Korea has the largest tidal power plant of the world, Shihwa Lake. This tidal power plant can reduce the generation of CO_2 by 315,000 tons per year, with a capacity of 254 MW and a generation of 552 million kWh per year, which can supply energy for 500,000 houses (K-Water, 2018).

The 2030 plan also includes energy from biomass and geothermal power. In 2007, biomass accounted for 6.0 percent of new and renewable energy, but the country plans to try to expand the use of biomass by raising this to 30.8 percent for 2030. As 63 percent of Korea's land is comprised of forests, biomass is an efficient source for green energy production with the creation of new job opportunities (Asia Biomass Office).

When it comes to geothermal energy productions, there have been some recent concerns. Korea has a geothermal capacity to produce energy. The average heat flow is 64 ± 14 mW/m^2, while the area of sedimentary rock contains 74 mW/m^2, sedimentary/volcanic rock area 62 mW/m^2, plutonic rock area 63 mW/m^2, and metamorphic rocks area 61 mW/m^2 (Kim & Song). The country's first geothermal power plant was constructed in 2017 with a capacity 6.2 MW. However, due to power-plant-related suspicions regarding an earthquake occured in Pohang,

the power plant suspended operations in 2018 (Changwon, 2018).

One Less Nuclear Power Plant

These renewable energy goals of Korea are further supported by the country's city municipalities. As Seoul is the largest city of Korea and the second-largest metropolitan area in the world, with more than 25.6 million people (approximately half the entire population of the country) (World Population Review, 2018), the energy policy of Seoul has a high impact on the country's goals. Depending on the reduction in the energy consumption in Seoul, the burden of power generation in other regions would also be reduced. Through the One Less Nuclear Power Plant initiative, 2 million total of oil equivalent (TOE) energy was reduced in Seoul from 2012 to 2014. The program also aims to increase Seoul's self-sufficiency rate of energy to 20 percent by 2020.

The One Less Nuclear Power Plant initiative consists of five policy categories (Seoul Metropolitan Government):

Seoul, Dreaming of Energy Independence

Seoul, Enhancing Energy Efficiency

Seoul, Riding Green Transportation

Seoul, Practicing Green Consumption

Energy Government Made by Citizens

These categories include "increasing renewable energy-based power production" and 78 specific projects.

Conclusion

Due to the industrial developments of the previous centuries and the over consumption of energy, the Earth is suffering from the severe effects of global warming. As we are all responsible for the current situation, we must also take precautions all together to reverse or at least slow down the end of our aging earth, before it is too late.

Even though the globally accepted Paris Agreement is a good place to start, as we look at the projections about the temperature rise caused by global warming in near future, the measurements taken by the countries that signed the Agreement does not seem to generate the desired outcomes. That leaves us with one conclusion that we need to take even more critical measurements.

With its detailed 2030 plan, Korea shows that the country understands the stakes and is willing to take the necessary steps to further limit its greenhouse gas emissions and leap ahead in renewable energy productions. The overall goals include limiting the dependency on coal and nuclear energy and replacing them with renewable sources such as solar, wind, tidal, biomass, geothermal and hydropower. If all nations would join in these efforts, we might start hope in having a greener future for Seoul, Korea and the world.

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The Quasi-Public Bus Operating System in Seoul, Korea: A Successful Experiment

Chang Yi*

Abstract: *The rapid growth of private cars in the 1990s saw Seoul's bus service deteriorate from being the city's key public mode of transport to an ineffective form of transit with the lowest modal share. To ensure the city's sustainable development, as well as the rights of its citizens to move freely, it was imperative that bus operations regained their competitiveness. In 2004, the Seoul Metropolitan Government (SMG) executed a so-called "bus reform" that introduced a quasi-public bus operating system. The elements of the new bus system included installing median exclusive bus lanes, a smart card system, and sharing fare revenues among bus operators with substantial subsidies from the SMG. This article explains the mechanism of the quasi-public bus operating system. More than a decade after its inception, the article also discusses what changes the bus reform has brought to Seoul and the lives of its citizens.*

1. A Prelude to Bus Reform: The Declining Bus System in Seoul

The 1990s saw rapid growth in the number and use of private cars in Seoul. The large number of cars, and the fact that they were often occupied by only one or two people, soon resulted in problems such as road congestion, air quality degradation, and increasing numbers of traffic accidents. Furthermore, the increase in the demand for cars reduced the demand for buses. Until then, buses had been the city's key public mode of transport, accounting for the highest modal share. This trend inevitably affected bus operators and the quality of their services, further reducing demand. This cycle posed a threat to the buses. To ensure the city's sustainable development, as well as the rights of its citizens to move freely, it was imperative that bus operations again became competitive.

The modal share of bus transport continued to decrease. In 1996, the modal shares were 30.1 percent for bus transport, 29.4 percent for the metro, and 24.6 percent for passenger cars. By 2002, these shares had changed to 34.6 percent for the metro, 26.9 percent for passenger cars, and 26.0 percent for buses. Bus transport had fallen from first in the list to last. The quality of the bus services decreased as well, particularly the speed. In 1996, the average speed of travel was 18.35 km/h. By 2002, this had dropped to 16 km/h, a drop of 13 percent in six years.

Under continued financial strain, Seoul's bus operators were unable to replace buses and facilities that were nearing the end of their life cycle. Thus, bus speeds continued to drop and people no longer trusted buses to be on time. As more people began to turn away from bus transport, profits continued to fall as well. As a result, investments in buses and bus facilities became increasingly unlikely, which created a vicious cycle for the public transportation system.

Most of all, restoring the competitiveness of bus transport was challenging because bus companies were privately run, which undermined the public interest. For buses to function effectively as a mode of "public" transport, a city needs to be able to modify bus routes to adapt to changes, such as those in consumer travel patterns caused by urban management policies or construction of a new subway. Therefore, the use, operation, and adjustments of bus routes should be managed logically and efficiently in line with the city's transport policies, rather than with the profitability of bus operators.

To address this concern, the Seoul Metropolitan Government (SMG) introduced a quasi-public bus operating system in July 2004. Combining the strengths of

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Main Points	Description
- Bidding on bus routes running along 10 major axes - Institutional guarantee of a reasonable business profit - Adequate compensation for excess vehicles - Deficit management - Overcome the fundamental limitations of the private system	- Existing licenses for 57 operators to be guaranteed; only the details of their business are subject to change - Any matter requiring agreement is to be discussed with the SMG and bus operator service cooperative societies; mediating decisions of the Bus Reform Citizens Committee are followed in the event of disagreement

Table 1. Summary: Agreement on Bus System Restructuring Measures

a public system that ensures the public's interest with a private system that promotes business efficiency, the SMG adopted an extensive reform to restructure the operation, routes, and fares of bus transport system. A decade later, the results were quite positive as the implementation of this system has improved the bus facilities and services, promoted the use of public transport, and incentivised operators to improve their business management. The following sections discuss how the SMG made the bus system more competitive, as well as the background to introducing the quasi-public system and the developments, implementation, achievements, and issues that followed.

2. The Quasi-Public Bus Operating System in Seoul

2.1 Background

The SMG introduced the quasi-public bus operating system in 2004. The SMG took responsibility for managing the entire system, leaving the private sector only in charge of bus operations. In February 2004, the SMG and the bus operators' association signed an agreement on five terms and conditions, including operators having to bid for 10 major axes of bus routes and an institutional guarantee of a reasonable profit (see Table 1). Thus began a system of collective management of fare revenue. As a result, bus operators were selected via the bidding process and granted a temporary license for six years to prevent them from privatising their bus routes. The city also took over the planning of the bus routes. Other restructuring measures included modifying bus routes to meet users' needs, reorganising mass transit fares (such as transfer discounts), and improving bus management and infrastructure (for example, creating a median exclusive bus lane).

2.2 Details of the Quasi-Public Bus Operating System

This section details the main points of the new bus operating system in four parts. The first part explores the management of the fare revenue including distribution. The second part delves into the restructuring of the bus routes and the connecting the bus and the subway systems. The third part focuses on the affordability of the interchange fares, and the last part explains the infrastructure improvements for a better transport experience.

(1) A new bus operating system, with the SMG managing fare revenue collectively and distributing it to bus operators

Under the previous private bus system, bus routes had been exclusively used by each bus operator. This meant that routes could not be modified easily, even when necessary to adapt to changes in urban structure, transport demand, or major policy changes. Consequently, the gap in quality widened between the services offered on profitable and not-so-profitable routes. It required the local government to spend more on subsidies. With the new system in place, the SMG now determines the bus routes, fares, and levels of bus operation, while private bus operators offer transport services pursuant to given requirements. The city is also responsible for collectively managing the fare revenue and distributing it among the respective operators based on their performance (such as distance travelled). Now that the bus routes are shared

Organisation	Responsibilities
Seoul Metropolitan Government	• Oversees bus route planning, service assessment, route bidding, fare revenues, cost analysis, etc. • Develops standards for distribution of fare revenue and approves the use of excess revenue • Organises and runs a working-level council to determine how billing is processed according to operator performance • Provides subsidies or raises fares, if necessary, to make up for shortfalls in fare revenue • Evaluates performance and monitors bus operators → Incentives and penalties
Seoul Bus Operator Association (Joint Revenue Management Council)	• Jointly manages fare revenue (distribution, billing, management, etc.) • Requests subsidies in the event of shortfalls in fare revenue or discusses the use of reserves • Identifies other sources of non-operating income (such as advertising) and discusses various items (cost cuts, etc.)
Citizens Committee on Bus Policy	• Jointly manages fare revenue (distribution, billing, management, etc.) • Requests subsidies in the event of shortfalls in fare revenue or discusses the use of reserves • Identifies other sources of non-operating income (such as advertising) and discusses various items (cost cuts, etc.)
Korea Smart Card Corporation (KSCC)	• Issues T-Money cards and deals with affiliation, develops products, processes billing, and improves system operation

Table 2. Organisational Structure and Responsibilities for the Quasi-Public Bus Operating System

Data: Yun Hyeok-ryeol et al., *Study on Measures for Development of Seoul's Quasi-public Bus Operating System*, The Seoul Institute, 2011.

rather than privatised, the SMG can modify or add routes to provide better connections to other modes of mass transit.

An organisational reshuffle followed to enable the new system to operate in collaboration with each other (with the SMG, Seoul Bus Operator Association, Korea Smart Card Corporation (KSCC), and Citizens Committee on Bus Policy). The KSCC is responsible for billing and system operation/improvement. The Citizens Committee on Bus Policy is responsible for decision-making. According to the general work structure, bus operators claim what they have spent on bus operation after a year of operation, which is calculated and then compared with their total profit. Any shortfalls are then subsidised by the SMG. Fares collected by bus operators are managed collectively by the Seoul Bus Operator Association, with the KSCC providing the billing service. When billing is complete, the SMG pays the subsidies to the Seoul Bus Operator Association to be distributed, along with the fare revenue, among the bus operators. Billing is based on the estimated standard cost required for one bus to travel one kilometre. Another role of the SMG is to regularly monitor whether bus operators are maintaining their service quality (see Table 2 and Figure 1).

(2) Functional restructuring of bus routes and increased connectivity with metro

In the previous system, bus operators concentrated on profitable routes. Accordingly, competition was strong among the bus companies for the popular routes. The quality gap between services grew broader by region in Seoul. Efficient modifications to the bus network in line with the metro system were difficult. To resolve these issues and ensure that the quasi-public system

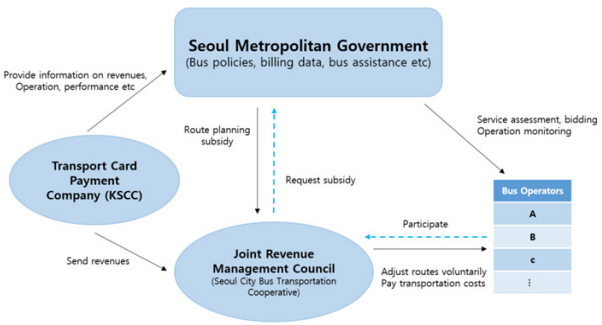

Figure 1. Roles of Relevant Institutions in the Qu-si-Public Bus Operating System

would be effective, routes were extensively restructured and categorised by function.

The bus reform proposed two route categories: trunk lines to service the demand for mid-to-long-distance trips, and branch lines for short-distance trips within a

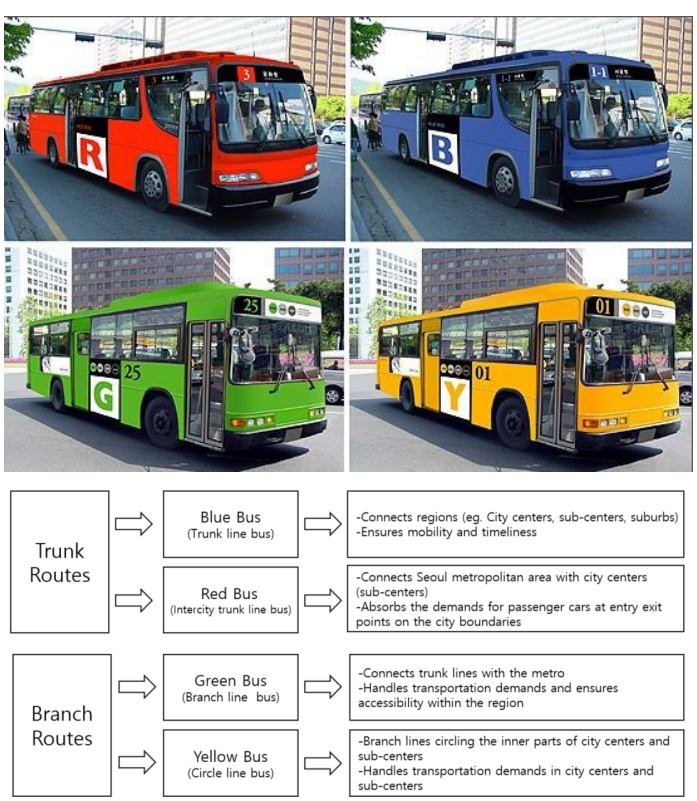

Figure 2. Bus Routes and Functional Division

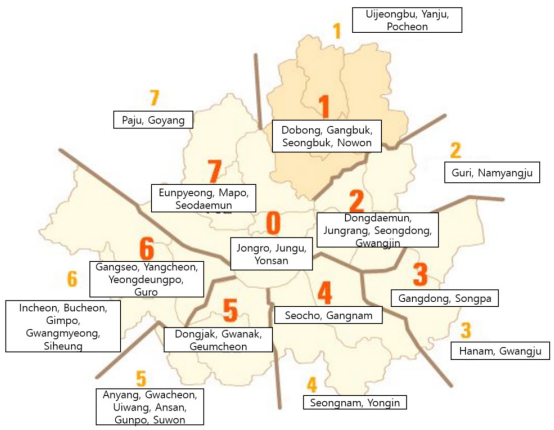

Figure 3. Zone Classification by Starting/Final Stops

region. Trunk lines can be divided into those serviced by blue buses and red buses. Blue buses travel to and from various zones in Seoul. Red buses connect Seoul to other cities and regions. Similarly, branch lines can

be divided into those serviced by green buses and by yellow buses. Green buses aim to enhance access to the entire bus network and increase the connectivity between trunk lines and the metro. Yellow buses connect nodes within a district where traffic demand is high (Figure 2).

To identify the locations of new bus stops, Seoul was divided into eight zones, numbered zero to seven. Bus route numbers are then designated systematically according to their respective zones (Figure 3).

(3) Fare system restructured to ensure that fares remain affordable after multiple transfers between different modes

In the previous system, bus fares did not vary with distance. Commuters who transferred multiple times paid the same fare for each part of the journey, making the mass transit financially onerous. The aim was to reduce the public's reluctance to make transfers. In addition, the system ensured that fares were proportionate to total distance travelled.

Under this scheme, bus users do not pay for transfers, provided that the total travel distance is less than 10 kilometres. When the total distance exceeds 10 kilometres, users pay an additional charge at a fixed rate

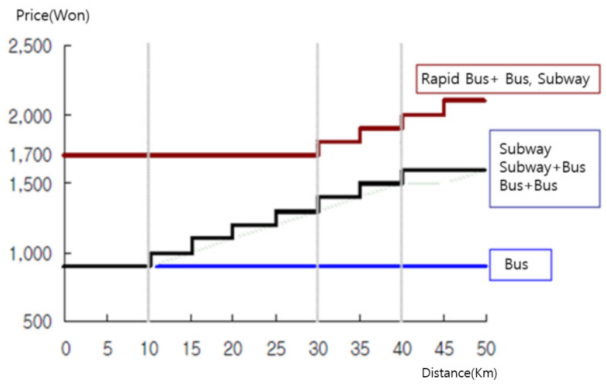

Figure 4. Seoul's Mass Transit Fare System

(KRW 100) for every 5 kilometres. When they use multiple modes of transport, the highest of the basic fares applies. Up to five transfers are free of charge and valid within 30 minutes of leaving a bus or metro. However, the time window may be extended up to 60 minutes during those hours when services are less frequent (between 21:00 and 07:00 the next morning). Regardless of the travel distance, the final fare is not greater than the sum of all the basic fares for the transport modes used (Figure 4).

Passengers now only need one transport card to pay for all journeys by public transit. This new transport card system has enabled total-distance-based fares and transfer discounts. Moreover, the entities that process billing from different transport users have finally been unified into a single entity, improving the transparency of transport revenue. Furthermore, the new system ensures that subsidies are provided in a reasonable manner. In

			Transport Card (KRW)	Cash (KRW)
Bus	Trunk Line Branch Line	Adult	1,200	1,300
		Youth	720	1,000
		Children	450	450
	Circle Line	Adult	1,100	1,200
		Youth	560	800
		Children	350	350
	Rapid Line	Adult	2,300	2,400
		Youth	1,360	1,800
		Children	1,200	1,200
Metro		Adult	-Basic fare: KRW 1,250 for up to 10 km -Additional fare: 0–50 km: KRW 100 every 5 km 10–50 km: KRW 100 every 5 km 50 km + : KRW 100 every 8 km	
		Youth	(Adult fare – KRW 350) × 80 percent, (Basic fare KRW 720)	
		Children	(Adult fare – KRW 350) × 50%, (Basic fare KRW 450)	
		Senior Citizens/Disabled/ Veterans	Free	

Table 3. Seoul's Mass Transit Fare System

Source: Seoul Metropolitan Government, Seoul Statistical Information System, 2015. (http://data.seoul.go.kr)

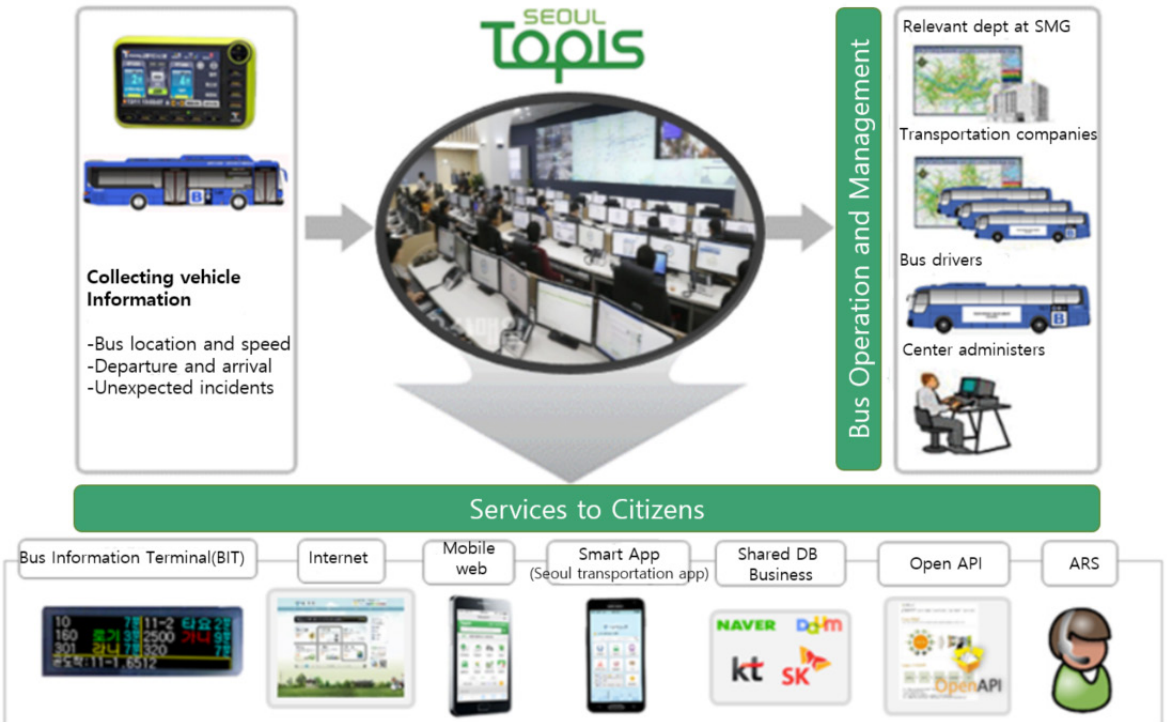

Figure 5. Schematic for Bus Operation and Management

Source: http//bus.go.kr

2004, the new transport card system was only applicable to buses within Seoul and the metro in the metropolitan area. Three years later, in 2007, Gyeonggi Province was included under this scheme as well. In 2008, rapid intercity buses (buses that offer a "seat" for every passenger) accepted the transport card scheme. In the following year, buses operating in the city of Incheon also became part of the total-distance fare system. By 2010, the scheme also included the rail system to and from the Incheon International Airport.

(4) Improving the infrastructure designed to support bus operations

① Bus Management System (BMS)

A cutting-edge bus management system (BMS) has been in place since July 2004. A BMS takes the advantage of information and communications technologies and it uses GPS units attached to the buses to collect operation data (such as bus locations or time until the next bus service), which are then provided to bus users.

② Median Exclusive Bus Lanes

Previously, bus-only lanes had been located on the curb-side. However, many elements undermined the efficiency of curb-side bus-only lanes, such as other vehicles entering or exiting from smaller roads and illegal

Figure 6. Median Exclusive Bus Lanes

parking. Because bus speed and timelines were vital for encouraging people to take the bus, a new system was required that would prioritise buses at the centre of the roadways. Unlike the curb-side bus lanes, the median exclusive bus lanes were to be occupied by buses only, 24 hours a day.

③ Bus and bus stop improvement

As another infrastructure improvement, low-floor and compressed natural gas (CNG) buses were introduced. The buses are equipped with on-board GPS units to assign bus services at reasonable intervals. Bus stops were also updated with bus information system (BIS) units.

Figure 7. CNG Buses and Bus Information System (BIS) Units

Note: BIS indicates the following: Bus #407 has departed from the previous stop; Bus #432 to arrive in 4 minutes; Bus #380 to arrive in 5 minutes

3. Decennial Evaluation of the Quasi-Public Bus System

The year 2014 marked the 10th year since the implementation of the quasi-public bus operating system in 2004. After an initial period of adaptation, the system has now reached a level of stability. The new system has helped to resolve several issues faced by the city, citizens, and bus operators, although new issues have also emerged, as discussed below. Here, statistical data from 2003, before the introduction of the system, are compared with data from 2014, a decade after the bus reform.

3.1 Improving Urban Transport Services

Following the introduction of the new bus system, the number of bus users increased significantly, suggesting that demand increased as bus efficiency improved. Also, as a positive outcome, while the modal share of passenger vehicles was decreasing, the share of buses have increased. The number of times each person took the bus also increased. These findings indicate that the restructuring of the bus system has contributed to a moderate promotion of bus use and public transport (Table 5).

Functional recategorisation has reduced the number of redundant and circuitous bus routes. Median exclusive bus lanes have helped to improve average travel speed and timeliness. Bus routes were restructured, creating trunk and branch lines that better connect different modes of public transport. Several transit stops were added to offer convenient transfer connections to other buses and the metro. Indeed, the city transport network and its functions were upgraded in their entirety.

One of the most noticeable changes since the introduction of the quasi-public system has been the significant reduction in the number of bus accidents. While this cannot be credited solely to the quasi-public system, but its influence is clear. The reduction in accidents is considered to be the result of the upgraded infrastructure and the collective management of revenue, which stabilised the revenue of the bus companies. This led to greater benefits for bus drivers, incentivising them to drive safely. Furthermore, continued efforts were made

to upgrade buses to environmentally friendly CNG vehicles. Nearly all buses are now CNG, which contributes to improving Seoul's air quality.

Introducing transfer discounts and fares proportionate to total travel distance has reduced the general level of fares. Now that passengers can take buses and the metro within the metropolitan region using a single transport card, mass transit is a convenient and easy choice for many. Another unique feature of the quasi-public system is its monitoring plan. The subsidy varies for bus operators based on an evaluation of their business management. Among other aspects, operators are assessed based on their percentage of low-floor buses, which encourages them to replace outdated vehicles. As a result, the bus system became increasingly convenient and pleasant for the mobility of disadvantaged people. Traffic accidents involving outdated vehicles have also become less frequent.

The lower fares, low-floor buses, reduced travel times and convenient information systems have meant that users are becoming increasingly satisfied with the bus services each year. This increased satisfaction has prompted people to shift from using cars to buses, promoting the use of mass transit and enhancing bus operators' businesses. As such, a virtuous cycle has been created.

		2003	2014	Change (%)
Seoul in General[1]	Population (1,000 Persons)	10,276	10,297	0.2
	Area (km^2)	606	606	0
	Roads (km)	7,988	8,215	2.8
	Total Number of Vehicles Registered (1,000 Vehicles)	2,777	3,013	8.5
	Number of Cars Owned (1,000 Vehicles)	2,042	2,387	16.9
Modal Share (%)[2]	Bus	25.6	27.0	1.5p
	Metro	35.6	38.8	3.2p
	Passenger Car	26.4	22.8	-3.5p
	Taxi	6.6	6.8	0.2p
	Others	5.0	4.4	-0.6p
Number of Times a Year the Average Person Takes the Bus[1]		144	163	13.3
Bus Route Operation[3]	Route Curve※	1.3	1.2	-0.1
	Average Extension of Route (km)	38.6	35.9	-2.7
	Duration of Travel (Minutes)	128.0	119.0	-7.0
	Number of Bus Stops[4]	5,152	6,058	17.6
	Number of Transit Stops per Route	9.7	10.3	6.2
	Extension of Centre Bus Lane (km)	7.6	11.7	53.9

Average Speed of Travel (km/h)[4]	Passenger Car	All	22.4	25.2	12.5
		City Centre	15.5	17.9	15.5
		Suburbs	22.9	25.4	10.9
	Bus		17.2	19.5	13.4
Bus Accidents[5]	Number of Accidents		8,177	3,188	-61.0
	Accident Rate (%)		106.0	42.8	-63.2p
	Fatalities (Person/10,000 Vehicles)		62.2	29.0	39.6
Air Pollution per 1 Million Registered Vehicles[5]	Fine Particulate ($\mu g/m^3$)		916.75	479.50	-47.7
	O_3 (ppm)		0.18	0.27	33.3
	NO_2 (ppm)		0.50	0.35	-42.9
	CO (ppm)		8.57	5.45	-36.4
	SO_2 (ppm)		0.06	0.06	-
User Convenience	Daily Commute Fare (KRW)**		3,650	1,250	-65.8.
	Distribution of Low-floor Buses (%)[3]				
	Distribution of Environmentally friendly Vehicles (CNG) (%)[3]		16.4	99.9	509.1
	Service Satisfaction[6]		59.2	79.2	33.8

Table 4. Changes in Transport Services in Seoul

Source: 1) Seoul Statistical Information System (http://data.seoul.go.kr)

2) Seoul Metropolitan Government, *Performance Analysis of Public Transport System Restructuring and Measures to Establish and Operate a Bus Management Organisation*

3) National Association of Bus Operator Service Cooperative Society and Seoul Bus Operator Service Cooperative Society, each year.

4) Seoul Information Communication Plaza, Daily Modal Share (http://opengov.seoul.go.kr)

5) Seoul Air Pollution Data (http://cleanair.seoul.go.kr)

6) Seoul Metropolitan Government, *Bus Service Satisfaction Survey Report 2014*, 2015

Note: * Actual length of a route divided by the lineal distance between the starting/final stops

** General fare paid by an adult who transfers from bus to metro and then to bus over an average commuting distance (14 km) in the metropolitan area (as of 2014)

3.2 Improving Business Management by Bus Operators

The quasi-public system has led to improved business management efficiency. Fare revenue is managed by the SMG, which uses subsidies to cover any losses incurred from bus operation. This helps bus operators to be transparent and enjoy stability. The total amount of subsidies has increased, but the diminishing returns have meant that the rate of the increase has decreased over time.

Since the launch of the quasi-public system, the total number of bus passengers and the number of passengers per vehicle have both seen a steady upturn. Bus operators can better manage their businesses because the SMG pays the agreed reasonable profit, in addition to subsidising the cost of operation. Included in the standard cost of transport is the wage of drivers, ensuring that driver wages increase regularly.

		2003	2014	Change (%)
Number of Annual Bus Passengers (1 Million Persons)	Total Number of Passengers	1,462	1,669	14.1
	Number of Passengers per Vehicle	183.5	223.5	21.8
Size of Business	Number of Operators	57	67	17.5
	Number of Routes	365	358	-19.2
	Number of Vehicles Owned	8,022	7,468	-6.2
	Average Number of Vehicles Owned by Each Operator	140.7	111.5	-20.2
Number of Workers	Number of Executives	203	183	-9.9
	Number of Executives per Vehicle	0.0255	0.0245	-3.9
	Number of Managerial Positions	1,840	1,175	-36.1
	Number of Managerial Positions per Vehicle	0.23	0.16	-31.4
	Number of Drivers per Vehicle	2.11	2.24	6.2
Annual Cost of Transportation (KRW 1 Million)	Total Cost of Transportation	1,050,715	1,618,920	54.1
	Cost of Transportation per Vehicle	130.98	195.2	48.0
	Labour	512,488	850,210	65.9
	Labour per Vehicle	63.3	102.5	61.9
Annual Subsidy (KRW 100 Million)	Subsidy	1,153	2,538	120.1
	Subsidy per Vehicle	0.139	0.340	144.9
	Loss from Transfers	2,210	4,706	113.0

Table 5. Changes in Business Management by Bus Operators in Seoul

Source: National Association of Bus Operator Service Cooperative Society, *Bus Statistics Handbook;* Seoul Bus Operator Service Cooperative Society, internal data, each year

3.3 Unresolved Issues Related to the Quasi-Public Bus System

Although the quasi-public bus operating system has yielded positive results, several issues still need to be resolved. It has been pointed out that while the system is an ideal measure for reducing the number of surplus buses and ensure the management efficiency of bus operators, reducing the number of buses in order to reduce the subsidies would only diminish the functions served by bus transport, thus defeating its intended purposes. Critics have also claimed that subsidies discourage operators from improving their business management and cause them moral hazards. Others are concerned that any evasion of competition by bus operators could damage the overall quality of service. It is undeniable that the quasi-public bus operating system has its advantages; it eases the burden of management on bus operators and helps them provide quality services. On the other hand, the subsidies do not vary based on performance, which deters voluntary business improvement and encourages poor performers to remain in the industry.

Fares have also been the cause of much debate. Because bus fares have significant implications for the public, fare adjustments require a social consensus, even when deficits increase as a result of rising oil prices and labour costs. Within the quasi-public system, the SMG is under direct pressure from users with regard to increasing fares. This makes it more difficult to raise fares than it was previously. However, the financial burden continues to grow heavier.

4. Closing Remarks

The objective of the quasi-public bus operating system is to promote the use of public transport in order to stimulate long-term sustainable growth for the city. Since the quasi-public system was introduced, people have become increasingly convinced that it is faster, cheaper, and more convenient to use public transport than it is to drive. The key to the success of the quasi-public system was to introduce a full – as opposed to partial – restructuring of the entire bus system, including the routes, fares, and operational structure. Initially, this resulted in confusion on the part of citizens, but now, after a decade, the system is securely rooted. Two important objectives of the quasi-public system are (1) to have the public sector manage the system to ensure business stability and (2) to have the private sector stay in charge of operation to ensure efficiency, improve user convenience, and promote the use of bus transport. This has been achieved to some extent. For example, now that the financial burden of transfers is lower, the bus serves its purpose as a reliable secondary means of transport carrying people to and from the metro.

It is widely believed that public transport is a public good. In other words, society believes strongly that public transport should not be left to the sole care of the market. The SMG's adoption of the quasi-public system was an inevitable decision that reflects such deep-rooted perceptions. The quasi-public bus operating system has contributed to creating a foundation for sustainable urban growth. However, several challenges remain, the most serious of which is the growing amount in subsidies paid by the SMG in the struggle to maintain services. The SMG faces challenges in keeping its transport system sustainable to safeguard the public nature of transit services and simultaneously ensure the health of businesses managed by the private sector. However, there is no doubt that the bus reform has benefited the citizens of Seoul and will continue to do so for years to come.

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SEOUL WALKS, Model Transfer of Socio-Urban Ecology

Alban Mannisi*

Abstract: *This study provides a brief account of the fieldwork of the Seoul Walks, an initiative organised by international experts and civil society to analyse the potentials and downsides of the Seoul Urban Regeneration Policy. By addressing the problems of five case studies, the article aims to show why it is important to create places that are in harmony with the needs and wants of their inhabitants and the environment.*

Seoul Walks is a 2015 initiative organised by international experts of the built environment and Korean civil society to examine the recent Seoul Urban Regeneration Policy. In this article we will endeavour to understand the urgency of this governance by recalling some hidden steps of the Korean urban policy, and then deal with particular cases noticed during the Workshop Series Seoul Walks, Urban Inquiry of Seoul Daily Life.

1. From a Neoliberal Niche Market to a Civic Regeneration Governance

Long over-shadowed by cities such as Hong Kong and Tokyo, Seoul now represents the new Promised Land for urban and culture enthusiasts from around the world. Korean Soft Power has done remarkable work and Seoul is attracting a wide range of visitors, from experts on the built environment to young travellers.

Besides the explosion of Chinese tourists and good accommodation options, the recent emphasis on everyday public spaces has made Seoul a liveable, if not enviable city. In the last fifteen years, Seoul's boom has been largely attributable to the interest of global investors in the city. However, as this growth-oriented approach is not really sustainable, the Korean government has felt the need to reassess its social, economic and ecological priorities in terms of creating more resilient and sustainable cities.

"The Right to the City" is the title of a book written by David Harvey, who visited Seoul in 2017, but the rule was not often applied in the modern Korean governance principles. After the Korean War, Seoul was affected by planning experts moving from privileged and controversial clans at the head of the Korean corporate Chaebols[1] towards a brutal anarcho-capitalism deployed by building construction consortiums that vandalise public spaces, commons and nature; all this made Seoul an unbearable place for civil society, terrorised by engineered infrastructures and autistic urbanity.

The Mayor of Seoul, Park Won Soon (2011-present), a leader from civil society, has sought to legislate the ambitions that are in the spirit of the times through international convention. Among other measures is the urban regeneration policy of neighbourhoods with distinctive cultural landscapes, although these are suffering from brutal economic changes that Seoul has had to praise the merits of, at the risk of seeing the developers again erase these complex living spaces (Mannisi, 2017).

In 2015, the city of Seoul implemented an urban regeneration plan that included 13 sites depicted by the national development plan. Also, a group of scholars of Alban Mannisi (landscape urbanist), Youngbum Reigh (architect) and Blaž Križnik (urban sociologist)

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[1] A chaebol is a large industrial conglomerate that is run and controlled by an owner or family in South Korea. A chaebol often consists of a large number of diversified affiliates, controlled by an owner whose power over the group often exceeds legal authority.

organised a series of seminars[2] in these places in order to learn about and contribute to the future of these areas.

The regeneration plan aimed to revitalise the city's central districts and urban diversity – two extremely important features of a capital that has become increasingly generic in recent years.

2. Inner City Blues

Due to the vastness of the Seoul (the city's area is 605.2 km², six times bigger than Paris), as well as the number and diversity of the districts, several sites have been selected from the initial regeneration plan, each presenting a specific urban typology and history of the Seoul.

Seongsu-dong- Seoul-Type Urban Regeneration

The first site investigated on June 18, 2015 is the Seongsu-dong, or Seoul-Type Urban Regeneration, which aimed to bring together a group of architects led by Euiyoung Chu involved in the regeneration projects of the city of Seoul, as well as several NPO/NGO's (NOM) and some citizens.

The site has benefited from a positive image thanks to a quality shoe-making industry that has already made the transition to luxury and designer showroom spaces. Moreover, notable projects such as the Seoul Forest Park, the Jean Nouvel Tower and a highly connected infrastructure, two subway lines and a train station, have helped to revitalise the neighbourhood and restore the socio-economic diversity of the area. Despite the early signs of uncontrollable gentrification in 2015, the district now shows an ability to mobilise its own actors, residents, and landowners to decide their own future.

Namdaemun -7017 Seoul Station Overpass Transformation

The second seminar was held in the Namdaemun neighbourhood to discuss the regeneration project of the Seoul Station Overpass, called Seoullo 7017. On June 26, 2015, the Seoul Walks team came together at Hoehyun Station and walked to the Cafe Goga Sanchekdan, a community coffee shop, where Chief Cho gave lectures about the context and issues related to the project, who works as a community leader of the Namedaemun Market district.

The project attracted interest from the international media. However, the regeneration project of the Seoullo 7017 motorway bridge connecting Seoul Station to the traditional market district of Namdaemun (the South Gate) triggered panic and caused some conflicts among communities and market owners who were feeling highly attached to this strategic site.

In 2017, the district was in no condition, because previous public authorities had abandoned the area in favour of more profitable and interesting projects like the Cheonggyecheon restoration (Zoh, 2008). Consequently, this initiative was tainted by numerous issues and controversies, such as the fear of shopkeepers and residents of the neighbourhood being expelled from their homes due to gentrification, which had happened in numerous projects before; the top-down, ill-coordinated government interventions; and the awarded-project propagating the Green and Community Washing rather than a profound understanding of the stakes and climate of the country. However, the mayor advocated consulting residents before starting the project.

The Seoullo 7017, also called "Seoul Highline", still has a controversial image, due to the MVRDV , the winner of the competition, and the local government prioritised fascinating the future investors over improving the daily lives of the Seoul residents.

The Seoullo 7017 project suffers from the rising obsession of catching up with modern city image at the risk of irreversibly damaging the legacy of the city and overlooking the needs of the inhabitants. This project was initiated before the regeneration plan and who fully benefiting today is the Gyeonggi Line.

Gyeonggi Line: Infrastructure Regeneration as Urban Commons

On September 1, 2015, the Seoul Walks team, the NPOs and other activists met at the emblematic Neuljang Market in Gongdeok-dong to explore the complexity of the site and the impressive 6.2 km2 regeneration area and to come together with the inhabitants to inform

[2] https://seoulwalks.wordpress.com

them about the participation process.

The linear park is the regeneration of the former railway line leading to Pyongyang, which was closed in 1953. The infrastructure had been neglected for a long time. Revisiting it as an urban park makes it possible to reconsider the links between neighbourhoods that the railroad disconnected (Zoh 2015).

In the Mapo disctrict, gentrification has already damaged the diversity and the urban fabric by building luxurious high-rise apartments around the green corridor in place of the humble traditional houses and small alleys that are customary in traditional Korean cities.

Yet, it is undeniable that the linear park project is a social, urban and environmental accomplishment thanks to a simple landscape treatment designed and managed by the landscape planning agency Dongsimwon. In the past five decades, the engineer-minded planning approach done more harm than good to the city, by creating detached neighbourhoods and segregated residential areas with gated communities. With the aim of reconnecting the surrounding neighbourhoods, this regeneration project created a public space that brings people together.

The project discussion continued while the partners were walking and the Dongsimwon project manager took the time to explain the details of the conflicts and opportunities of the project, which have been raised by the government, experts and as well as the civil society. This type of landscape Infrastructure is a powerful tool for social cohesion. The project ends in the Yeonnam-dong, which includes the lively neighbourhoods of Hongik University and the charming alleys of Gugi-dong's high-quality housing.

The residents received the result with enthusiasm. With its elegant design elements, this project is the first in Korea to offer a public space that is entirely free and open for all and not related to a commercial facility. The project became a phenomenal success and attracted both locals and tourists. The Gyeonggi Line is one of the finest examples of Korean environmental resilience (The Seoul National University, 2011).

Changsin-dong: Transformation of Traditional Industries & Cultures

Later in 2015, the team of Seoul Walks met the stakeholders involved in the revitalisation process of an equally emblematic but forgotten (due to the speculative dynamics of the Seoul development) neighbourhood Changsin-dong. Until the Seoul Walks took interest in the area in September 22, 2015, Changsin-dong was an economically challenged neighbourhood that was no longer attracting investment in a country whose economy is heavily dependent on global investment.

Close to Dongdaemun (The East Gate), the district was an important part of the textile sector in relation to the Dongdaemun commercial areas in the 20th century. However, starting from the 1980s, Korea's shift to digital technologies took its toll on the textile economy, which is now dominated by China and other Southeast Asian countries. The textile sector and the small shops remain somewhat active, scattered in the unique and extremely intriguing urban fabric of the district, manifesting a sharp contrast to the new developments of the gleaming but generic Seoul. Contained within steep slopes and therefore not very accessible, its social and urban ecology was almost totally forgotten by new generations of architects and planners who in the second half of the 2010s discover its tremendous potential.

It is an intrinsic problem of the planning discipline that, over the past fifty years, it has been indifferent to the needs of the local economy and cultural diversity that used the be the core values of the discipline itself. In Changsin-dong, the team met the researcher and urban planner Kooyoung Han, the director of NPO Urban Hybrid,[3] who works in the shared artisan atelier, which is one of the remnants of the remaining textile industry.

What we learned from his research, as well as from our visit to different ateliers, somewhat similar to Seongsu-dong shoe-making industry, is the ability of its craftsmen to take advantage of the new economy to propose a qualitative change. The designers of the "Made in Changsin-dong" offer new products that mass production cannot provide. As this small habitat of artisan shops accommodate a flexible economy, it proves

[3] http://urbanhybrid.co.kr/eng

a great ability of former urban fabric to adapt itself to the current urban dynamics.

It is important to know how to promote local planners and architects whose work is often strongly linked to the habits and customs of the local and therefore quite adaptable by new generations and economies. The resilience of craftsmanship demonstrates a social capital and a true asset, which is often overlooked by the local authorities who are mostly charmed by the global investment and generic urban places. However, this project re-introduces the importance of the local in the global age.

Mullae-dong Art-driven Urban Transformation

The last site to visit was the metal industry district of Mullae-dong, which has received intense media coverage over the past few years due to the presence of an artistic community that settled in a former industrial building at the heart of the district, abandoned by a polluting and noisy factory that moved out of the city centre.

On October 6, 2015, The Seoul Walks team listened to Soonbok Choi from the Design Atelier BOK: The artist's collective, who told us the background story of the district upon the arrival of the artists in the 1980s.

This process was the result of gentrification on the outskirts of the Hongik Arts University, which has developed this very special microcosm that eventually became the one of the most prominent spots of the Seoul. Although the artists have created a dynamic and rich environment, to be able to create more resilient economy, the neighbourhood needs more support.

Unfortunately, it seems that most of the Korean regeneration projects are copies of other projects that worked in other geographies and cultures (Mannisi, 2017). This project has obviously followed the model of the New York Meatpacking District that, over time, created an urban dynamic and proved itself as an urban asset, both culturally and economically. South Korea aims to succeed by following in the steps of these successful projects.

The dependence on the aspirations of the global market damages the local culture, which is itself already very rich and creative. The most problematic issue of these projects is usually that while they are trying to be a part of the global economy, they usually overlook the local mechanisms, which are the most crucial elements that make these projects possible in the first place.

3. Regeneration & Resilience

"A city is where people meet"; therefore, open and public spaces are essential in urban spaces. Contrary to the vision promoted (mostly by the real estate sector) that "Seoul would be the city of the future", the Korean economic capital continues to resemble its American counterparts, instead of building a modern urban space upon its own customs. South Korean authorities need to address the immediate problem that that urban development focused on construction, overlooking the needs of the community, would not be sustainable. Indeed, an open space costs the community but, without it, what social capital would be spoken of (Križnik , Cho 2017)?

Urban spaces with historical urban fabrics and diverse cultures were being damaged in the race of the real-estate culture in which both parties are destined to lose in the long run.

The problem of this construction-focused development is that its tunnel vision irreversibly ruins the original urban spaces and communities. In the past decade, the relentless gentrification processes have taken their toll in most of the gentrified historical neighbourhoods, such as Insa-dong, Samcheong-dong, Seochon, and Yeonam-dong.

These neighbourhoods are today mostly deserted and the gentrifiers are already looking for the next big thing in the city. Now it is very urgent to address the issue of participation. Every citizen should have the right to be at the table, where the decisions for the future of the city are being made. Participation and the simple principals of the ecological democracy should be the first things to consider in the development of cities.

Jan Gehl, who used Copenhagen as a laboratory to create cities for people, and the City Walks created by an urban researcher in Sydney (Lyons 2017), are two of the

many examples that show that practices in everyday life are attracting the interest of many planners, researchers and architects.

The protests that took place in South Korea between November 2016 and March 2017, which led to the removal of a controversial political cohort, signify that it is time to understand that designing walkable cities are not a niche practice, but are essential for the cities of the future.

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SEOUL: Urban Development

Diego Giron Estrada*

Historical Background "*Miracle on the Han River*"

As historical backgrounds go, Koreas does not shy away from controversy and tragedy. Its history extends for over four millennia, with its most significant starting from the three kingdoms Goguryeo, Silla and Baekje in 50 BC, heavily influenced and conflicted by Chinese civilisation and a chaotic overtaking amongst them. By 670 AD they had become one, under the Silla kingdom. From 900 AD to 1900 two dynasties Goryeo (10th - 14th century) and Joseon (14th - 19th century) ruled and oversaw the evolution of the country while almost falling under the Mongols rule when China fell in the 1200's. In 1394 under the Joseon ruling, the capital was mover to Hanseong (Seoul), and it was when Confucianism took over as the official religion and encroached itself into the social hierarchy (Ick Lew, 2000; K.-J. Kim, 2012). Historians suggest that Confucianism and Chinese geomantic idea of Feng Shui had a strong influence in selecting the location as well as on the urban distribution and buildings (K.-J. Kim, 2012; 高, 2005). Seoul fortress wall gates were positioned at the north, south-east and west side of the fortress and named after the characters of benevolence(仁), righteousness(義), propriety(禮), and wisdom(智) (SMG, 2009), accordingly. During this era around 1443, another milestone for Korean culture came to pass as the invention of the alphabet (Hangeul), developed under the sponsorship of King Sejong and the scholars of the time. In the 17th Korea was invaded by Japan to no avail.

In the 19th century, Korea adopted an isolationist policy and refused to trade with westerners this meant that they were falling behind other countries concerning industry and technology. In the 1880's an attempt to reform this policy was introduced using the slogan "Eastern ethics, western technology" but was rejected given the conservative nature of the people and Confucianism. Although they did trade with Japanese merchants and eventually signed a treaty that made it official. Over this period Japan started increasing their influence over Korea and consequently, treaties with other nations also came to pass. After attempted rebellions within Korea followed by aid from China and Japan and a subsequent dispute over dominion in the 1890's. The Joseon dynasty had come to an end and Japan's influence over Korea had taken a grip with new reforms coming into effect which lead to more modern ideologies and education. Furthermore, the first textile industry was established, and the first railway was built. By the 1900's Korea was a "protectorate" of Japan which meant full foreign control over them until they infiltrated Korea's government structure to take control of some internal affair as well. By 1910 the influence evolved into a full annexation of Korea. These meant that Korea was now a colony of Japan, however, in this time roads, bridges, railways and factories were also build, bringing Korea into a new era where urban population started growing. After a fail attempt to gain their independence in 1919 small reforms took effect giving Koreans more freedoms, nonetheless, in the following years, Japan stated pushing their customs and religion into their culture in efforts of assimilation. This all ended in 1945 at the end of World War II when Japan surrendered. However, they were already pawns in the strategic overtaking of the United States and Russia which had devised an agreement to split Korea among them self. Russia took control of the north while the USA took the south, divided in the 38th parallel, with an original intent to reunite them in the future, which never took place, becoming two countries. The north converted to a communist government

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and the south elected its first democratic government in 1948. From 1950 to 1953 the Korean war took place were several communist offensive attacks were launched to take over South Korea. In this time military control over Seoul was transferred four times, but eventually, the military offensive was pushed back by allied forces from the UN, USA and UK. On 27 July 1953, a ceasefire was agreed and signed; the "Korean Armistice Agreement". At this point, Korea was one of the poorest countries which after the hostilities ended it was left it in ashes. This, unfortunately, was not the end of its struggles as a new authoritarian regime took control under the current president Syngman Rhee, but in the 60's he was met by opposition from students riots and was finally toppled. Regrettably, this was followed by a military coup that landed Major General Park Chung-hee as ruler, and although presidential elections were held, he won for four periods, he was a repressive ruler until his assassination in 1979. In this period despite General Park's dictatorship Korea's economy began to flourish and had transformed from an agrarian society to a modern, industrialise and urbanised country. During this time significant urban advancement where implemented, the first public bus system was established in Seoul in the 50's and remained the primary mode of public transportation until the 90's. Furthermore, the city experienced an explosive growth in urban development and population; between 1960 and 1970 the increase in urban dwellers was from 28% to 41%. In unison, a basic urban plan was set up to respond to the growing city, tackling issues of land use, development densities, housing and other factors. Land use plans also came into function where prohibited areas are established in the metropolitan area to avoid messy expansion.

In fifty years Korea went through drastic changes, turning itself from an undeveloped, poor country into a thriving society with unforeseen economic growth, which has been nominated the "Miracle on the Han River", dragging itself from the trenches of war into an era dominated by education, advancements and technology. In the 80's yet another dictator came into power General Chun Doo-hwan, regardless of its oppressive regime Korea's economy continued growing and it became an affluent country. This also brought improvements to infrastructure and urban housing. In the mid 80's face with the pressure of its people and their nonconformity, General Chun stepped down and in 1988 held democratic elections once again. Additionally, South Korea hosted the Olympics this year, and in preparation for the event, Seoul made substantial urban upgrading and enhancement projects. In the following decades in an effort to address the explosive growth five new cities were built in the metropolitan area. Since then Koreas has become a rich country, and by the mid 90' it had established as the eleventh largest economy in the world and had joined the OECD.

Figure 1. The geographical boundary of the Seoul Metropolitan Area

Figure 1. Seoul Metropolitan Area

Source: Urban Planning and Urban Sprawl in Korea (Cho 2005)

This rich history significantly influenced the country's urban development, especially its capital. Seoul has a long history with over 2000 years, and it has been the capital of Korea for over 600 years. In this time, it has never lost its importance and has been a center for talent and creativity. An old Korean proverb stated, "If a horse is born, send it to Jeju Island and if a person is born, send him/her to Seoul" (SMG, 2009). Today Seoul is

home to over 10 million people and serves as the center for economic development and innovation, it has a reputation as a city on the avant-garde of information technology and has joined the ranks of the top 7 megacities (Seoul Metropolitan Government, 2015). Its citizens like to refer to the city as "the Soul of Asia." It has come a long way since it left the ashes of war and it continues to progress into a vibrant, tech-savvy, green, and smart metropolis.

Nowadays urban planning policies seek to preserve the natural environment and its rich cultural and historical background while improving the quality of life for its citizens with innovative, altruistic solutions strengthening the status of Seoul. SMG is committed to serve and pursue long-term solutions for the benefit of the city and all its people.

Seoul's urban growth continues and along the rank of megacity which is one of the most complex and challenging phenomena in the urbanisation narrative. Seoul metropolitan area is comprised of the Gyeonggi province surrounding Seoul and Incheon Metropolitan city. The total metropolitan population as of 2016 is 25.6 million which is more than half of the population of the country. Seoul has a population of 10.2 million with a population density of (16,861 people/km2 (2016)) that doubles that of New York (Cho, 2005; Seoul Metropolitan Government, 2017). Its spatial area is of 605 km^2.

Planning and Governance

Although urban complexity is already an aggravating factor to take into account in any city, megacities add to this already vexing paradigm and present particular problems where the magnitude of infrastructure can prove to be overwhelming, and the resources can be weak. There also needs to be a stronger connection and shared responsibilities between local and central government, and the contention of all actors (the private and informal sector) takes a more critical role.

According to the "National Land Planning and Utilization Act," Seoul planning system consists of 3 stages: master plan, living area plan and urban management plan.

Seoul urban development plans are continually being updated and upgraded. Starting from 1960's eleven plans have taken Seoul forward to the world renown smart city it is today. The plans have been:

- 1966: The Basic Urban Plan
- 1970: Modification of the "Basic Urban Plan"
- 1972: The "Revised Comprehensive Plan"
- 1978: The "Basic Seoul Urban Plan
- 1980: The "Mid- to Long-term Plan for Urban Development in Seoul"
- 1984: The "Multi-Nucleic City Development Research for Urban Restructuring"
- 1990: The "Basic Seoul Urban Plan" for the 2000s
- 1991 - 1995: A Basic Urban Plan for the Autonomous Districts
- 1997: The "Basic Seoul Urban Plan" for 2011

From the 2000's Seoul focused more on qualitative improvements and less on quantitative modifications. In preparing for the World Cup (2002), the city conducted considerable qualitative improvements in different areas including the Sangam area, urban recreation projects, Cheonggye Stream restoration and the Han River recovery.

In 2006 the "Basic Seoul Urban Plan for 2020" is a revised version of the previous plan with a vision towards 2020. The plan keeps the existing CBD (Central Business District) system to ensure continuity. The 2011 vision focused on embracing the socioeconomic aspects and in the new vision, the Plan entailed a more strategic nature, putting forward clear priorities and goals. Furthermore, it also took into account expert and public opinion, with the addition of a monitoring and index scheme. Moreover, it provided directions on the interventions for each of the five living spheres, one primary (center) and 5 secondary (city center, northeast, northwest, southwest, and southeast). This is based on the specific context (micro planning) that takes into account the nature and physical aspects of the areas; travel patterns, administrative distribution, to find critical di-

rections and task to deliver. In this way, they were able to promote a more balanced regional development. The 5 secondary centers are the following Yeongdong, Yeongdeungpo, Yongsan, Cheongnyangni/Wangsimni, and Sangam/Susaek, with 11 local centers, and 53 district centers (Seoul Metropolitan Government, 2015).

The latest upgrade was done in 2014 introducing the "Seoul Plan 2030" with the same intent as the previous one; to do a revision and supplement of the previous plan, but with an updated vision towards 2030. This plan intended to simplify the information as the prior plan proved to be broad, technical and therefore too complicated for the general public to understand. The new plan simplified its structure to 5 key issues (Welfare/education/women, Industry/jobs, History/culture, Environment/energy/safety, Urban space/transportation/improvement) and 17 goals. The addendum was strongly focus on the participation of people from diverse backgrounds making it accessible and easy to understand, in an effort to solidify a governance system, fostering collaboration from the autonomous districts that comprise the metropolitan area and all of its citizens. It intends to address issues related to the spatial structure; expansion and absorption into Seoul's urban area, demand for an improved quality of life, wealth gap between regions and to improve its global competitiveness. The plan proposes to adopt a multicentric system comprised of 3 multifunctional city centers complementing the current CBD, the centers are (the ancient Hanyang walled city area, Yeongdeungpo/Yeouido, and Gangnam) as well as fortifying 7 broader center areas (Yongsan, Changdong/Sanggye, Cheongnyangni/Wangsimni, Gasan/Daerim, Magok, Sangam/Susaek, and Jamsil), and 12 local centers, with functional connection. (Seoul Metropolitan Government, 2015). In summation, the urban master plan is a comprehensive set of strategies that encompasses several areas of the metropolitan agglomeration taking into account society, culture, welfare, envi-

Key Issue	Goal	Index
Key Issue 1 People-oriented city of equal opportunity	Develop a welfare system prepared for a super-aged society	Guaranteed minimum income
	Create an environment where citizens lead a healthy life	Number of local public health clinics
	Build a social system that helps eradicate polarisation and discrimination	Number of welfare facilities for senior citizens
	Design an education system that offers lifelong learning opportunities	Number of lifelong education facilities
	Promote gender equality and social care	Quality/quantity of childcare service provided by national/public childcare centers
Key Issue 2 Global city of cohabitation, with abundant jobs and vibrancy	Recognition as a global economic city built on creativity and innovation	Percentage of creative community to the whole
	Promote shared growth between economic entities and regional mutual development	Social/economic job rates
	Promote economic vibrancy with an emphasis on people and jobs	Employment rate
Key Issue 3 Exciting city of culture and history	Create a city of living history	Satisfaction rate with the cultural environment
	Manage an urban landscape embraced by the population	Number of cultural facilities
	Create a diverse urban culture enjoyed by all	Number of foreign tourists/residents
Key Issue 4 Safe, environmentally-friendly city	Build an eco-friendly city of parks	Percentage of regions with access to parks
		Percentage of renewable energy use
	Create a safe city where everybody looks out for each other	Change in the number of crime/disaster victims
Key Issue 5 City of close community, residential stability and easy mobility	Promote urban restoration with an emphasis on the balance between home and work	Journey time between home and work
	Create a green transportation environment where the dependence on cars is minimal	Green public transport share
	Provide more residential spaces where people have stability coupled with a wide range of choice	Percentage of public lease housing

Table 1. Goals & Indices for the Plans by Key Issue

Source: Seoul Metropolitan Government (Seoul Metropolitan Government, 2015)

ronment, infrastructure, energy and transportation in an effort to improve livability. Consequently, it is of great importance to foment participation in acquiring extensive and diverse opinions from the citizens, experts and public functionaries to create an evolving planning and executing process (S.-W. Kim, 2016).

Cities have always had a problem to engage with their citizens in any type of participation especially public policy initiatives. Seoul plans to combat this issue by getting closer to their citizen, in a city-wide effort and involve them in any and all matters. Creating a public, private (civil) and commercial body to generate a vision and a detailed action plan, which encompasses all aspects concerning the city and its citizens (urban planning, transportation, energy, environment and resources, safety and health).

Energy

South Korea generates enough energy to satisfy its own needs; its total production is 528 bn kWh which is 106% of the energy required. The extra energy is exported to other countries. Seoul consumes around 10% of the nation's energy demand and produces 4%. As of 2012 Seoul energy consumption was 15,582,000 TOE per annum: oil accounted for 5,822,000 TOE (37%); city gas, 5,127,000 TOE (33%); electricity, 4,062,000 TOE (26%); district heating and other energy, 572,000 TOE (4%) (Yu-jin, 2015). The energy policies are promoting self-sufficiency, fomenting a reduction in energy consumption and an upsurge in renewable energy production, with a goal of 20% on sufficiency by 2020. Since Seoul Sustainable Energy Action Plan (One Less Nuclear Power Plant initiative) was enacted in 2012 to 2014 the efforts to reduce energy consumption have come to a realisation saving approximately 2 million tonnes of oil equivalent (TOE), this is equivalent to the energy produced by one and a half nuclear power plants. Presently an extra 1.6 million TOE have been saved, by rising energy efficiency and utilising renewable energy sources. By 2020 Seoul has set a goal of an extra reduction of 4 million TOE and 10 million tonnes of CO2 in the implementation of Phase 2 of "One less nuclear power plant". The core values of Phase 2 focus on

Energy Self-reliance; lower reliability on traditional

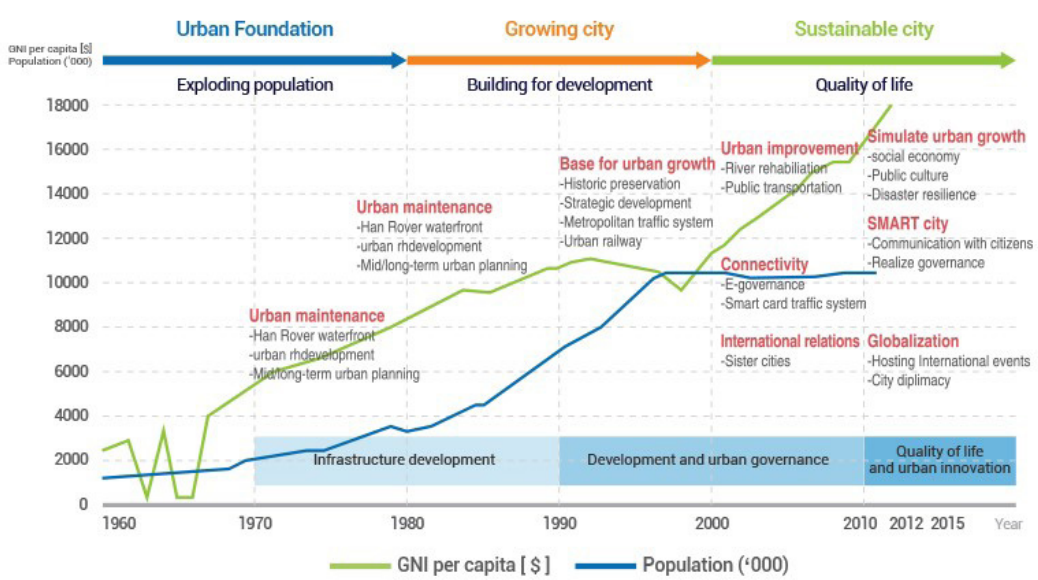

Figure 2. Evolution of Urban Development
Source: Seoul Institute

energy sources including nuclear. Ensure sustainable energy production and energy-related development.

Energy Sharing; sharing energy services and resources with the underprivileged in a present and future setting in addition to cooperating with other regions.

Energy participation; secure the voluntary participation of citizens in the generation of sustainable energy, establishing a transparent governance system.

Under the aforementioned values four energy goals where created:

Decentralized Energy Production City

A strategy of decentralising energy production will be implemented converting Seoul citizens form costumer to producers. Key action includes the retrofitting of existing buildings and the incorporation of legislation for new buildings to include renewable energy production technology and the creation of communal energy grids. The target is set to produce at least 20% of the energy consumed.

Efficient Low-Consumption Social Structure

Introduction of energy diagnostic programs integrating all energy-related information, LED substitution schemes in an effort of engaging directly with the citizens where they are stewards of the production and efficiency of use.

Sustainable Energy Jobs through Innovation

Fostering renewable energy innovations to create new sustainable jobs. Regional based energy solution such as BEMS (Building Energy Manager Systems), smart grids, social enterprises and entrepreneurs in green energy, among others will be encouraged and supported.

Energy sharing Community

Underprivilege citizens will be helped and supported in regard to their basic rights in energy services, guaranteeing access in the creation of communal grids.

As mentioned above, buildings present a challenge in energy consumption, the built environment in Seoul is responsible for an annual emission of 32.96 million tonnes of CO2; this represents 69% of the city's GHG

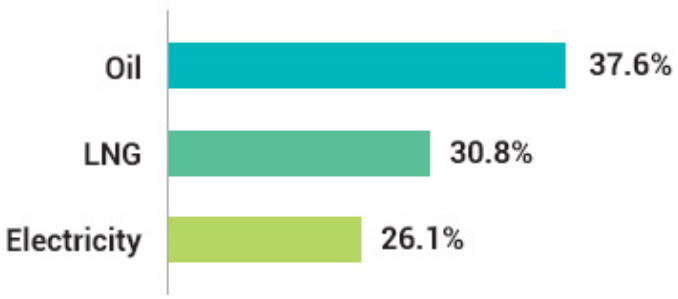

Figure 3. Seoul energy source

Source: Seoul Metropolitan Government

emission. In this regard and as a part of the "One Less Nuclear Power Plant" policy Seoul has developed the Building Retrofit Program (BRP), to support the retrofitting of governmental, commercial and residential buildings. Moreover, new development activities as constructions have to take into consideration the environmental conditions and follow a sustainable development criterion such as reduction in energy consumption and production of renewable energy, predominantly in public infrastructure projects setting the example (C40, 2017).

Transport

Form its conception the transport systems in Seoul has been continually changing, as the city's population and economy grew so did the demand for public transport. Up to 1945 trams where the most used mode of mobility, satisfying more than half of the population needs but in the late 60's the system was dismantled as it couldn't keep up with the demand, moreover, the space was needed to make room for more vehicles. To supplement the needs of the people, bus routes were added from the ear-

Period	Major Events
1960	Comprehensive transportation policy developed
1965	Express bus licenses approved for 301 buses running on 10 routes
1968	Tram services discontinued
1968	Gyeongin Expressway (Seoul – Incheon) opened
1970	Gyeongbu Expressway (Seoul – Busan) opened

Table 2. Major Changes in Mobility 1960s

Source: Seoul Metropolitan Government

ly 60's. In this period the number of vehicles also started increasing as buses and taxis became the preferred mode of transport. In 1967 Seoul approved a bus oriented public transport policy, resulting in 54.4% of the modal share. By the 70's the number of vehicles had soared to 60,000 out of which the majority were buses or taxies, but the wealthy also began acquiring personal vehicles (J.-H. Ko, 2017; Pucher, Park, Kim, & Song, 2005).

The increase in the road network that connected different regions served as drivers of economic growth, due to the reduction of time and cost of travel time. Consequently, in the 70's a priority was made to connect significant points of economic activities. Additionally, the first subway was built in 1974, and in the beginning, the share was around 6-7% of all trips. The bus services suffered a decrease in its use due to inefficient management, and the system was sold to the private sector which retrofitted the service and converted it into the leading mode of transport accounting for 73% of all trips. In the effort of improving operational efficiency, the first city traffic control center was created and installed an electronic signal system in 97 intersections (J.-H. Ko, 2017).

Period	Major Policies
1971	City traffic control center launched
1973	Plan developed to modernise intersections and signal systems
1974	Subway Line 1 opened (construction started in April 1971)
1977	Basic Design for Seoul Urban Plan developed
1979	Use of reversible lane system decided

Table 3. Major Changes in Mobility 1970s

Source: Seoul Metropolitan Government

In the 80's the executive management and policies behind urban transport systems took a reactionary approach due to the flourishing industrialisation and the overwhelming ten-fold growth of the car park, reaching 1.2 million by the late 80's. In comparison the road system only grew 20% in the same time frame. Thus the existing infrastructure could not handle it, exacerbating the traffic problems. Adding to the stress of the system Seoul was hosting the Asian Games (86)

Period	Major Events
1984 - 1985	Subway Line 2 (May 1984) and Line 3 & 4 (October 1985) opened
1986	Olympic Expressway built
1987	Transportation Impact Assessment conducted
1989	TMS program implemented

Table 4. Major Changes in Mobility 1980s

Source: Seoul Metropolitan Government

and the Olympics (88). Seoul stated focusing on satisfying the mobility needs of its citizens and formulated sustainable public solution while innovating in their efficiency and control implementing Information and Communication Technologies (ITC). The city stated ushering the subway era as the already planned lines 2, 3 and 4 of the subway were in operation by the mid 80's and started gaining more attraction accounting for 16.5%. By the end of the decade, the Transportation Systems Management (TSM) program was operational. Although there were substantial efforts to improve the transport system there was still a crucial gap which was criticised; transports modes where operated independently with no link with each other causing major efficiency problems (G. Kim & Rim, 2000; J.-H. Ko, 2017).

As infrastructure development in any other city in the world, by the 90's the road network could not keep up with the radical increase in demand. By 1995 the number of vehicles had reached 2 million. In response, Seoul amplified the road infrastructure by building expressways. Moreover, autonomy in local governments had been adopted giving each district the power to solve transportation-related issues. Although the bulk of insufficient infrastructure was too high for individual districts to handle alone. By the mid-90's the subway lines continued to grow introducing line 5, 7 and 8 and acquiring a 30.8% of the trips by the end of the 90's passing the share of the bus system which had 29.4% and threatened the bus operators. Another policy reformed that proposed to alleviate the traffic congestion was the transport demand management policy which intended to discourage vehicles from entering the city center introducing a congestion impact fee. Furthermore, a pilot project was implemented introducing Intelligent

Period	Major Events
1990	Congestion impact fee system introduced
1995	Transportation Demand Management system introduced for companies
1996	New subway lines opened: Line 7 (Oct. 1996), Line 8 (Nov. 1996), and Line 5 (Dec. 1996)
1996	Congestion charges introduced for drivers using Namsan Tunnel 1 and 3
1997	FTMS introduced on urban expressways

Table 5. Major Changes in Mobility 1990s

Source: Seoul Metropolitan Government

Transport Systems (ITS), this system provided a variety of services which permitted a more efficient operation of the infrastructure and public transport, in addition to valuable information gathered for the operators, city managers and citizens. Complementary to the ITC the Freeways Traffic Management System (FTMS) was also implemented in the expressways (G. Kim & Rim, 2000; J.-H. Ko, 2017).

In continuing with the negative pattern, the infrastructure kept falling to accommodate the needs of mobility in the city. The increase in vehicles meant an increase in accidents, air and noise pollution. With the introduction of a worldwide trend of Environmentally Sound and Sustainable Development (ESSD) efforts were made to upgrade policies that took into account the environment, economic, energy, transport and social aspects. The government proposed to reinforce the transportation demand management regulation, to reorganise the transport system with an environmental friendly approach and to improve pedestrian environment. Other pilot projects presented where car sharing scheme and no driving day (which reached a 40% of participation) as well as improved connections between different modes of mobility. Voluntary participants in some of the projects were given incentives as discounts in parking and tax reductions. Moreover, actions were also taken to incentivise the use of bicycles in a modal sharing scheme, and plans were made to increase infrastructure for alternative means of mobility. By the mid-2000's the restructuring of the transport system started which included:

- New transport cards, thus;
- Fare integration
- Fares according to distance travelled
- Exclusive bus lanes
- Increased bus transferred points
- Improved connection to other means of transport

In the late 2000's another aggravating challenge of the transport sector came to light as the energy consumption of the sector had the second highest rate accounting for 31.9%. Overall road transportation was responsible for 95.2% of GHG. At this point Seoul began updating the public transport fleets introducing more electric and compressed natural gas (CNG) buses, some of the car sharing platforms were also changed to electric cars, and an aggressive promotion of eco-friendly vehicles for citizens consumption was launched, all in an effort to reduce carbon emissions.

In 2007 Seoul launches Seoul Transport Operation & Information Service (TROPIS), an integrated traffic management system that oversees, analyses and collects information on the city's traffic. It includes traffic related organisations, such as the Bus Management System (BS), enforcement system, traffic broadcasting, traffic card system, the Korea Expressway Corporation and the National Policy Agency. Simply put, it is an integrated traffic center that plans, construct and operates Seoul ITS (S. Lee, 2015). Seoul continues to improve

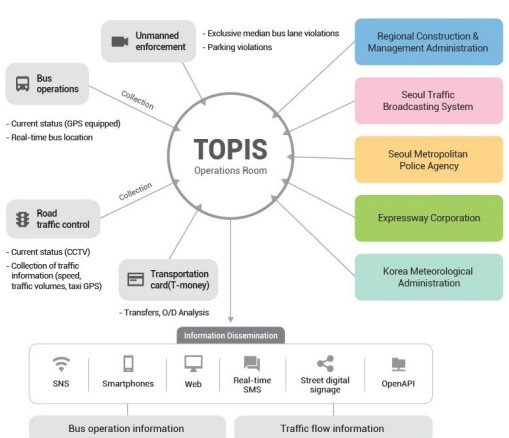

Figure 4. Integrated Transport System - Efficient Management

Source: Seoul Metropolitan Government https://youtu.be/YA7BNfNi9vE

Period	Major Events
2003	Weekly No-Driving Day program launched
2003	Cheonggyecheon Overpass removed
2004	City bus system restructured (bus system reform)
2007	Seoul Transport Operation & Information Service (TOPIS) implemented
2010	Eco-friendly electric buses begin operating on Nam Mountain (3 routes, 15 buses).
2013	Car-sharing services introduced
2014	First transit mall opened (Shinchon-ro)

Table 6. Major Changes in Mobility 2000
Source: Seoul Metropolitan Government

Seoul continues to improve its infrastructure, transport systems and policies that relate to them taking an integrated approach. Presently Seoul transport system continues to have the majority rate of the modal share with around four billion users annually.

As of 2014 Seoul Metropolitan Government (SMG) introduced the Plan for 2030 which includes the Vision of Transport in Seoul for 2030 "Seoul, a city whose advanced transportation network makes private car ownership unnecessary!" (Seoul Metropolitan Government, n.d.). This mobility plan frames the

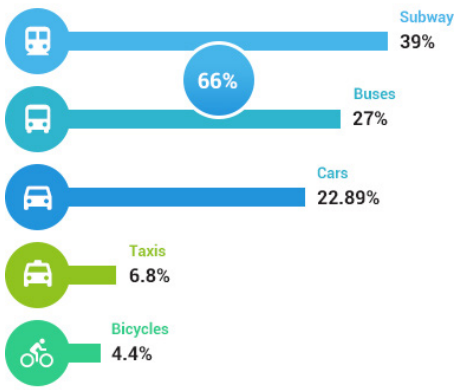

Figure 5. Modal Share
Source: Seoul Metropolitan Government

way forward for the transport of the city in the coming years. The plan offers eleven actions (under three main themes) to achieve what they are denominating the "*Triple 30*", namely, a 30% increase in the use of green mobility (walking, bicycle and public transport), 30% reduction of personal vehicle travel and 30% reduction in commuting time by public transport, by 2030 (OECD, 2017; Urban Solutions, 2015).

Values	Actions	Description
People-Oriented Traffic	1. Creating a pedestrian-oriented traffic environment	· Doubling the surface area of pedestrian ways
	2. Creating a bicycle-centered environment	· Expanding pedestrian-only and public transport-only zones
	3. Realizing a 'Road Safety Conscious Metropolitan City'	· Expanding the public bike network with close integration with the public transport networks
	4. Creating obstacle-free traffic conditions and providing services that everyone can use	· Reducing road fatalities by introducing a 30 km/h speed limit on all residential streets by 2030
		· Converting all buses to low-floor buses Increasing the number of on-demand taxis for disabled users
All Sharing Traffic	5. Constructing an efficient railway-centered public transportation system	· Constructing an artery express subway line connecting the three urban cores of Seoul
	6. Providing fast and convenient public transport services	· Restructuring the bus service as a secondary complement to the subway system through coinciding bus schedules to train arrivals
	7. Promoting the Common Sharing Traffic culture, a culture of sharing road space and transportation	· Providing public transport services without time breaks by expanding night buses (Owl Bus) and on-demand taxis
		· Applying the notion of "Complete Street" by incorporating the space for walking, cycling, driving and riding public transport in parallel on the road
		· Improving the accessibility to car-sharing stations within a five-minute walking distance across the city
Environmentally-Friendly Traffic	8. Lowering the unnecessary movement, 'low mobility society'	· Introducing a distance-based congestion charging scheme
	9. Transforming the transportations and facilities into environment-friendly transports	· Transforming roads as a clean energy generator by implanting solar panels and self-regenerating pavement
	10. Creating a clear congestion-free traffic environment	· Establishing a new urban transport governance model, based on close-knit engagement of citizens, in particular vulnerable users, in policy planning
	11. Communicating and reaching a consensus with the public throughout the whole process of the government's promotion and establishment of its traffic policies will result in the creation of an advanced, citizen-oriented, 'traffic-culture city.	

Table 7. Seoul Traffic Vision 2030
Source: Seoul Metropolitan Government & OECD

Year	Award	Awarded by
2006	The 2006 Sustainable Transportation Award	Institute for Transportation & Development Policy (ITDP)
2006	The 2006 UITP Award for Innovative Solutions	The International Association of Public Transport (UITP)
2007	EASTS Outstanding Transportation Project Award	Eastern Asia Society for Transportation Studies
2011	Golden Chariot Awards	Parliament of the Russian Federation, The Minis- try of Transport, The Government of the Russian Federation
2011	UITP PTx2 Regional Award	The International Association of Public Transport (UITP)
2011	UITP PTx2 Showcase Award	The International Association of Public Transport (UITP)
2013	Local Government Award	The Intelligent Transportation Systems Society

Table 8. Transportation Awards
Source: Seoul Metropolitan Government

People-oriented signifies the importance of the basic means of mobility in the city. The target is to create more pedestrian areas and more car-free zones. Pedestrian first also implies that the infrastructure that previously gave more importance to the use of cars (traffic lights) now will be reoriented to give the importance to people. Accessibility is also a central focus modifying the infrastructure for easy access for all its citizens.

Bicycles also take an essential role in a city focused on people, the city is concentrating efforts to promote its use by improving and extending the infrastructure dedicated for bicycles. Furthermore, complementary measures will take place as reduction of vehicle speeds in the inner city.

Sharing has different connotation from the efficient and fast connectivity in the city and amongst brothering cities, as of sharing of the space and the resources, each city provides its citizens, to enabling the urban space to be more inclusive and balanced in regards to all modes of transportation while taking into account environmental impacts. It also signifies the different platforms of car and bicycle sharing. By 2030 Seoul plans to have 1,200 stations for car sharing services accessible within five minutes.

Environment has been left out for a long time, in the consideration of how cities operate and the resources it needs to function, nature has taken a step back for too long. The transport sector is one of the biggest polluters, thus it is imperative that significant changes occur. Public transport will undergo an upgrade into the zero-emission era, while the use of private vehicles will be disincentivised by different measures transferring the cost of infrastructure and environmental impacts to their users (Seoul Metropolitan Government, n.d.; Urban Solutions, 2015).

Although Seoul transport system has had its problems and still does, the city's methods have always taken a progressive approach for which it has won many awards, and it is currently used as a benchmark around the world. By 2030 Seoul guarantees freedom of movement for all of its citizens with a development focused on people and public transportation and on the basis of sustaining natural environments.

Water

Seoul is divided by the Han River which has always symbolised progress and modernisation to the city, in the 60's it was attributed with the economic success and hailed "The Miracle of Han River". The rives keep's providing for Seoul as its an abundant source of water (Government, 2015).

The Han River (largest river in South Korea)

- Length: 41.5km (Flowing through 11 autonomous districts, Gangdong-gu ~ Gangseo-gu)

Indicator	Units
Population served	10.2 million
Water supply ratio	100%
Water consumption	1.113 billion m3
Production capacity	4.45 million m3/day (advanced water treatment 3.57 million m3/day)
Daily production	3.17 million m3/day (capacity 3.49 million m3/day)
Average daily supply per person	303L (maximum 335L)
Water purification centers	6 (two treating more than 1 million tons)
Intake stations	4
Sewer pipeline	10,615km (2015)
Water supply pipeline	13,648km (2016)
Revenue water ratio	95.3% (non-revenue water 4.7%)
Service reservoirs	102 (capacity 2.42 million m3/day)

Table 9. Major Changes in Mobility 2000
Source: Seoul Metropolitan Government

- Width: 0.6 ~ 1.2km

- Area: 39.9km^2(6.6% of the Seoul Metropolitan City's administrative area)

Only fifty years ago Seoul had problems supplying safe drinking water to its citizens. However, today's system provides one of the highest qualities in the world and surpass the standards recommended by the World Health Organization (WHO). Arisu (Seoul's water system) was the first in the world to be accredited by WHO's National Sanitation Foundation (NSF) (Seoul Metropolitan Government., 2014).

The current water supply system began in 1908 with the construction of Tukdo WTP, in the Japanese colonial period, however, during the Korean war most of the system was damaged. After the ceasefire and with the help of international aid a restoration project was deployed.

In the same regard as other services in the 60's with the unprecedented growth in population the demand for water grew. By the late 60' and early 70's even though 310,000 m3 of drinking water were produced daily, 57% of it was lost due to the run-down waterworks infrastructure, the service rate was 59.8%. Citizens began suffering water shortages, and it had become more than apparent that an expansion of the system was needed. SMG sought to implement and expansion project and with the help of state subsidies and municipal bonds proper funding was acquired to begging development. Because of the expansion of the water infrastructure and the efforts to slow pollution, water supply began to stabilise (Seoul Metropolitan Government, 2017). The key projects were:

- 1962~67: Expanded the Ttukdo, Noryangjin and Guui Arisu Water Purification Centers; Constructed Bogwang Arisu Water Purification Center.
- 1971: Constructed Yeongdeungpo Arisu Water Purification Center
- 1972: Established civil service departments in each water supply office
- 1978~79: Started water supply to Seonyu, Paldang and Sinwol Water Purification Centers

(Seoul Metropolitan Government., 2014)

Early 80's the city had problems with the source of the water supply (Han river) because it was too polluted and the treatment involved high quantities of chemicals. With the Asian Games and the Olympics on the horizon, SMG made exertions to improve the situation including the Han River Development Plan, expanding and building wastewater treatment plants (Choi, 2015).

By the late 80's the service rate had reached 98.8% and 99% the following year. In the late 90's a new policy measure was implemented, the "improvement of waterworks management via control of water quality and increase of Revenue Water Ratio (RWR)". RWR is an indicator that measures the amount of water produced versus the amount of water billed, the higher the RWR less water is being lost. This new policy also brought the launch of Seoul Water Authority and the goal of the service turned from quantity and quality to the efficiency of the system (Choi, 2015). Consequently, new management and technology were adopted to address this demand which at the same time meant greater economic benefits. The technical actions taken to meet the new

system was:

- Construction of reservoirs for balanced water pressure

- Replacement of old pipes

- Leakage monitoring via a small-scale block system and measurement of minimum night flow

- Leakage surveillance

- Prioritized management of regions with pressurised water supply

- Establishment of GIS with database on locations and materials of pipes.

The administrative actions included:

- Creation of a special organisation for the RWR improvement project

- Meticulous evaluation scheme for institutional performance based on RWR

- Detection of fraudulent activity such as faulty metering and illegal connections.

(Seoul Metropolitan Government, 2017)

The effects of the policy could be seen in the early 2000's as Seoul's Water Author became financially self-sufficient. In 1989 Seoul's RWR was 55.2% when the Water Authority started, and in 2015 it reached 95.2%. In other words, in this time period, the reduction of water supplied was of 7.5 billion m3 (could satisfy the need of the city for five years) and represents 4.2 trillion KW (USD 3,7 trillion) (Choi, 2015).

In this decade the Arisu started the production of bottled water and was registries as a trademark. Later it launched the Arisu Quality Certification System and implemented automated round the clock water quality monitoring. Moreover, Arisu implements tap water quality tests for 170 substances as recommended by the WHO including direct tests on five major substances such as residual chlorine, turbidity, hydrogen ion con-

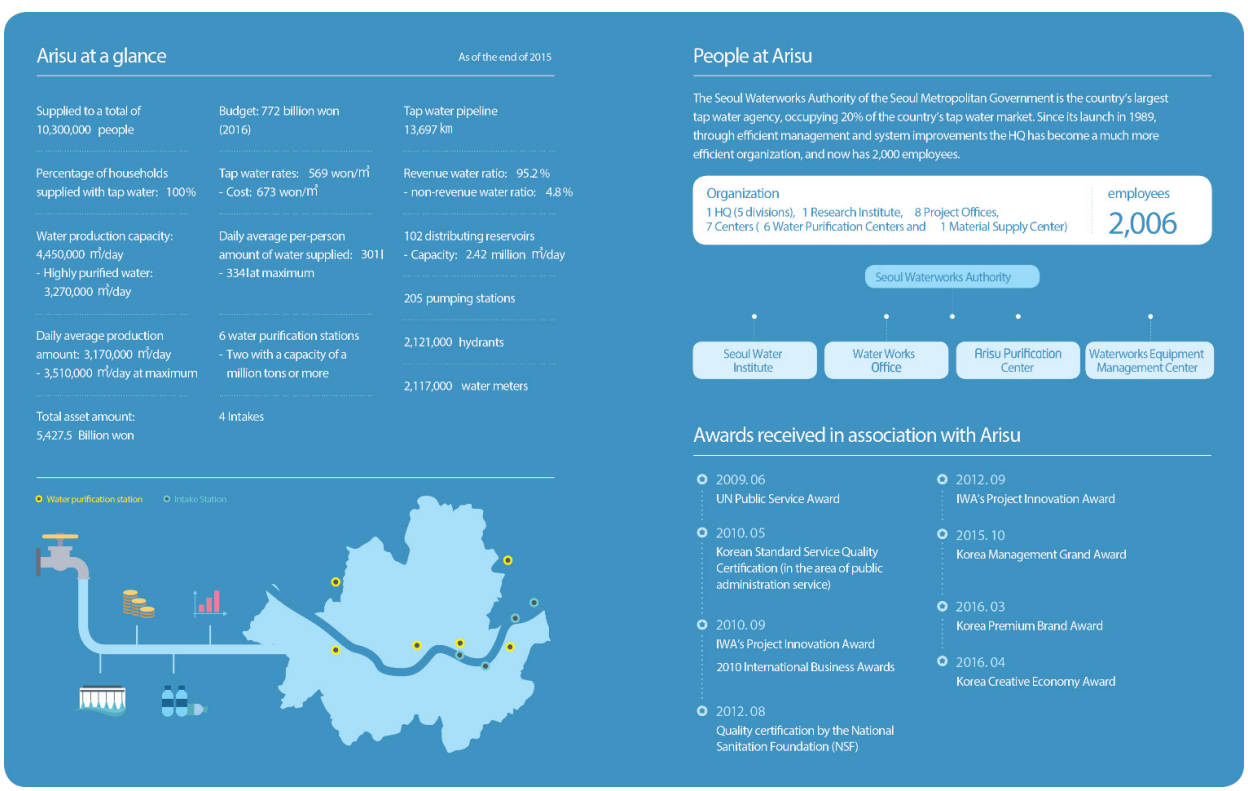

Figure 6. Arisu Overview
Source: Seoul Metropolitan Government

centration, iron and copper.

The Cheonggyecheon restoration project was also conducted during this time (2000-2005) as an effort to secure the safety and purity of its waterways and bring nature into the city, reviving the ecosystem and safeguarding an environment for aquatic diversity. Additionally, it also addressed cultural factors that where left behind. Cheonggyecheon is a 10.9Km stream flowing across downtown Seoul, and in 1925 it was covered in concrete. The project intended restoring the natural landscape of the river while integrating it into the urban

Figure 7. 1970's Shantytown at Cheonggyecheon
Source: Seoul Metropolitan Government

Figure 8. 1990's The Elevated Highway
Source: Seoul Metropolitan Government

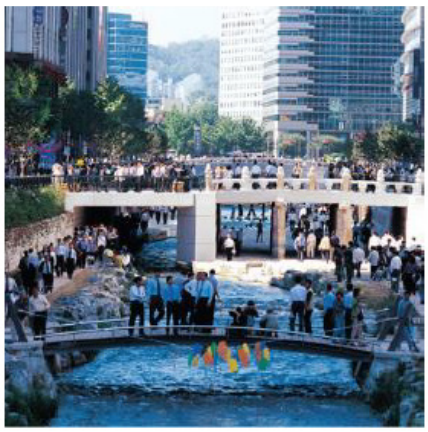

Figure 9. 2000's After the Restoration Photos
Source: Seoul Metropolitan Government

space (CABE, n.d.; Seoul Metropolitan Government, 2016).

Seoul also strengthened the sewage system and introduced advanced treatment facilities. The city operates four sewage treatment facilities that treat 5 million tons of sewage water, manure and food waste leachate per day. Seoul remains dedicated to implementing more stringent and advanced water treatment technology and policies to ensure its citizens of future safe and secure water supply (Wwap, 2017).

Making Han River the center of citizens' lives even after 100 years

Based on the master plan "2030 Seoul Plan" in securing clean and safe tap water, what matters most is the management of the water sources. Because Seoul has four seasons, the precipitation changes in each season affect the quality of the water significantly. Additionally, the river is subject to diverse sources of pollutants within the metropolitan region. In order to address this issues, the city firmly manages the quality of the water at their source and at different strategic points applying pollution control measurements.

In this regard, Seoul developed a plan for Making Han River the center of citizens' lives even after 100 years, which delivered the following principles, following four sectors (Nature, Land Use, Accessibility and Landscape)

Management Principles

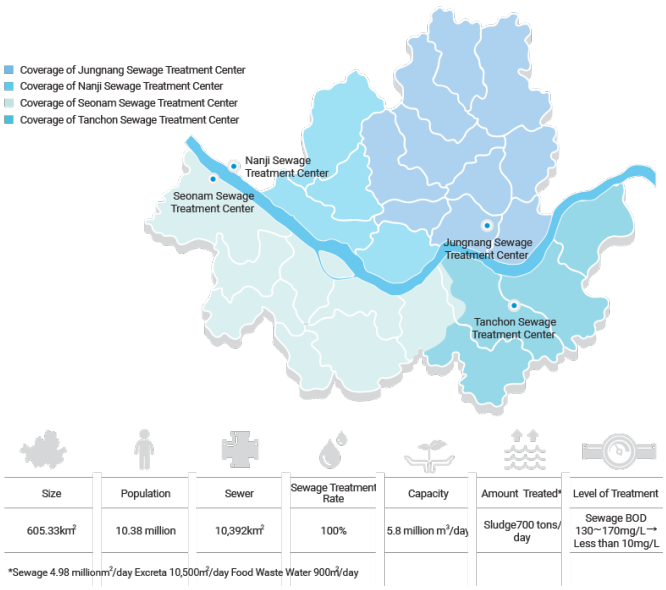

Figure 10. Sewage Treatment Centers
Source: Seoul Metropolitan Government

- Restore the river's ecosystem, water quality, and enable eco-friendly usages.

- Activate the riverfront with various water-related leisure activities, restoration of historical cultural resources.

- Increase accessibility by green transportation, pedestrian access, and better green connection. Expand opportunities to enjoy the scenery of the river, create a dynamic and diverse skyline, induce beautiful architecture.

(Seoul Metropolitan Government, 2009)

Waste management

In the early 60's Seoul had no designated landfills, and with the rapid growth, it found itself with a considerable problem. Identifying plots for landfilled requires a strict process that includes detailed site investigation, identification of suitable areas, evaluation of capacity and cost, comparison of plots, and final site selection. However, in the 70's due to the urgency Seoul opened the Nanjido site because of its convenient location, designating it a "Waste Management Facility". Nanjido manages 78% of the waste produced. Nonetheless, the site was not carefully assessed, and housing facilities were already planned in the area which presented other challenges. At this stage, the city was generating 7,000-14,000 tons of waste per day and managing this missives amount was becoming a serious issue. As with the other services SMG commenced a project to accommodate the aggressive increase in waste production. The landfills constructed included Gunja, Sangwolgok, Eungam, Yeomchang, Bangbae, Apgujeong, Jangan, Gueui, Cheongdam and Songjeong (Song, 2014).

The following two decades waste management in Seoul relied almost entirely on landfills producing up

Figure 11. Han River
Source: Seoul Metropolitan Government

to 30,000 tons of waste. Nanjido, the first landfilled site close operations in 92 and it had accumulated 92 million m^3 of waste, and its exhaustion raised concern regarding impacts on human health and the environment. In response, SMG constructed the larges landfilled "Sudokwon" located on Gimpo district on a 20 million m^2 of land and which receives a daily amount of 13,400 tons of waste and its expected to accumulate 228 million tons. The site was chosen after the Ministry of Environment took over the project and did a careful assessment of twelve sites. The selection process took into account the negative implication of separating the dumping sites too much based on traffic, environmental and sanitation for the new areas. A final decision was made to create the landfill reclaiming land from the sea in Gimpo district, despite the complications of leachate management, this would avoid the need to purchase the land. The site receives 44.5% of waste from Seoul metropolitan area, 16.5% from Incheon and 39% from Gyeonggi-do. With its environmental friendly operation, advance waste processes and technology, the negative implications have been averted.

Accompanying the efforts of finding suitable sites for landfilled, policies were also enacted. In 1994 the pilot project for the "Volume-based waste disposal system" was executed and by 95 the full program was in place at a national level. Volume-based waste is founded on "The Polluters Pay Principle". In other words, if a person produces more waste, that person pays more for managing it. This came to change the previous system which was based on the gross area of the property and was managed as a tax.

In the 2000's the Volume-based waste Fee (VBWF) was introduced and it was just designated to waste generated from households, commercial sector and small business. The principle behind it was to acquire mandatory standard bags in order to discard waste, and it followed the "pay as you throw principle". This effort meant to encourage people to reduce the amount of waste produced. At the same time, an awareness and educational campaigns informed the citizens on how to be more responsible and accountable for their consumption.

Today waste management policies strive to reduce waste, grounded on the reduction of waste production. SMG is committed on providing efficient and technological savvy waste disposal system that can satisfy the needs of its population. Seoul strives to reduce 30% of its landfilled waste as well as it food waste and to reach 71% recycling rate by 2020. SMG aims for a city that uses resources responsibly and recycles by dynamically promoting it.

Additionally, SMG operates four energy-waste recovery centers (Yangcheon Facility, Nowon Facility,

Figure 12. Current status of landfills
Source: Seoul Metropolitan Government

Figure 13. Recovery Facilities in Seoul
Source: Seoul Metropolitan Government

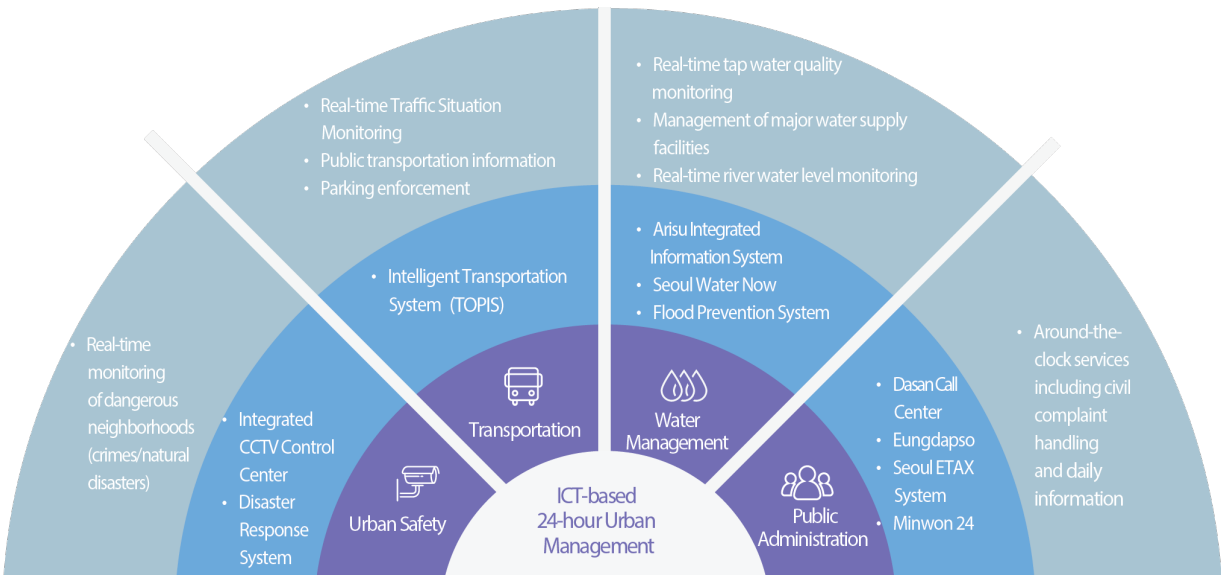

Figure 14. Smart City Seoul
Source: Seoul Metropolitan Government

Gangnam Facility and Mapo Facility), with a capacity of over 400 tonnes daily (I. H. Lee, Ahn, Park, & Kim, 2014; S. Lee & Gyeong Hur, n.d.).

The incineration felicities were part of the efforts to manage waste that began in the 90's. The initial plan was to build 11 plants that could handle 16,500 tons per day nonetheless to this day only four are functioning. With the introduction of waste prevention policies, a significant amount of waste was reduced by the 2000's which was when the forth plant came into operation and at the moment the four plants are enough to process the waste generated.

Facility	Assigned Area at Design Phase	Capacity (Ton/Day)	MSW in 2002 (Ton/Day)	MSW in 2012 (Ton/Day)
Yangcheon Facility	Yangcheongu	400(1.00)	212(0.53)	101(0.25)
Nowon Facility	Nowongu	800(1.00)	201(0.25)	121(0.15)
Gangnam Facility	Gangnamgu	900(1.00)	294(0.33)	305(0.34)
Mapo Facility	Mapogu, Junggu, Yongsangu	7500(1.00)	-	453(0.60)

Table 10. Capacity of Incinerator facilities in Seoul and Actual Volume of MSW
Source: Seoul Metropolitan Government

International Overview

International Evaluation of Seoul

- World's No. 1 in municipal e-governance (Rutgers University, USA) for seven consecutive times (2003-2016)

- Ranked 3rd in the world in the number of international conferences hosted (UIA 2015)

- Ranked 6th in the world in global city competitiveness (Mori Memorial Foundation,

- Japan 2016)

- Ranked 8th among the world's 'smartest' cities (Forbes, USA 2016)

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