

## **TITLE: THE “TTAREUNGYI” PUBLIC BIKE SHARING SYSTEM IN SEOUL**

### **ISSUE AREAS**

- ICT and SMART technology
- Sustainable mobility
- Land use and nature-based solutions
- Clean energy
- Sustainable solid waste management
- Building energy efficiency
- Innovative urban governance
- Behavioral change

### **OVERVIEW**

The Seoul Metropolitan Government (SMG) introduced ‘Ttareungyi’ in 2015 as a main public bicycle rental service, to reduce road traffic as well as GHG emissions. Ttareungyi’s cumulative membership exceeded three million in May 2021, meaning that one in every three Seoul residents has a Ttareungyi membership. Operating in 25 autonomous districts in Seoul, the shared-bike system has brought convenience to its residents, while also contributing to the city’s carbon reduction. It is found that the Ttareungyi is most frequently used during weekdays as a first- and last-mile transport mode after using other public transportation, such as buses and subways (Seoul Metropolitan Government, 2021). According to the “Seoul Transportation Data Report 2020” published by SMG in March 2021, the number of public transportation users has dropped 26% in 2020 compared to 2019 due to COVID-19 outbreak, while the number of Ttareungyi users has increased 25% in 2020, compared to the year of 2019 (2020 Seoul Citizens’ Public Transportation Report Card, 2021). By September 2021, the cumulated number of public bicycles users reached more than double the number of 2019 users, reflecting the great potential of Ttareungyi in leading a sustainable mobility system in Seoul.

### **THE CHALLENGE - WHY HAS THE CITY TAKEN ACTION**

#### **Urbanization and traffic congestion issues**

Seoul has experienced rapid economic and population growth between the 1960s and 1980s. With an increase in income, the number of vehicles has increased sharply since 1980. Increased use of private cars has thus led to serious traffic congestion, where average roadway speeds were only 20 kilometers per hour (km/hr). This was followed by high levels of air pollution, noise, and traffic accidents. While Seoul’s public transportation system is extensive and well-developed with busses and subways, first- and last-mile journeys are filled by taxis, shared cars (Namun car) or by walking. Shared bicycles can serve a different catchment area from public transportation stations and bridge the gap to existing transport networks.

#### **Climate change and the warming city**

In 2020, Seoul’s annual mean temperature reached 13.2°C, which is 2.4°C higher than in 1980 (Seoul Metropolitan Government Weather Statistics, 2021). Due to the overcrowded characteristics of the city along with high population density, Seoul is situated in a highly vulnerable situation where population, facilities, and natural environments can be severely affected by global warming, urban heat island effect, and extreme climate conditions.

### **GOALS AND OBJECTIVES**

- To promote bicycles as one of the main transportation in Seoul
- To reduce GHG emissions by increasing cycling’s modal share
- To improve residents’ health through daily use of bicycles

## HOW DID STI PROVIDE A LOW CARBON AND CLIMATE RESILIENT SOLUTION?

(STI as a means of implementation)

- Improved decision making
- Offering a low-cost solution
- Inclusive decision making
- Improved governance
- Behavioural change

(STI as a direct technical solution)

- Cleaner/more eco-friendly infrastructure
- Cleaner/more eco-friendly equipment
- Faster/better/larger data availability/processing

### ● How was it innovative?

**“Bicycle riding ability certification”:** In order to foster safe bike riding culture, SMG has implemented a “bicycle riding ability certification” system in which the city provides financial benefits to people who successfully acquired certification after completing the safety education. People with the certification could receive a maximum of 30% deduction in the shared bicycles daily usage fee for two years, which is expected to encourage more people to use shared bicycles. Safety education is divided into two parts: online education via Google Meet and offline practical training, which can be registered at the Seoul Lifelong portal to acquire the certification (Seoul Metropolitan Government, 2021).

**Shared bicycle safety training center in metaverse platform “Roblox”:** Targeting teenagers and MZ generations<sup>1</sup>, SMG is planning to introduce a shared bicycle safety training centre in the metaverse platform “Roblox”, where participants can learn about traffic regulations and experience virtual bicycle riding by using avatars. The bicycle track in Roblox is designed similar to the real bicycle lanes used in the “bicycle riding ability certificate” examination, allowing young people to effectively prepare for the test. SMG aims to strengthen the safe bicycle riding culture, as teenagers' usage of Ttareungi increased by 8% between 2020 (Jan - July) and 2021 (Jan - July) (Seoul Metropolitan Government, 2021).

**Enabling policy:** In 2013, the SMG announced its Seoul Transportation Vision 2030, which serves as a root plan for the city's entire spectrum of traffic policies by 2030. The Transportation Vision 2030 Plan is built upon three core values of ‘People, Sharing, and Environment’, seeking to shift the city’s heavy dependence on private cars to a more sustainable, shared, human-oriented paradigm. With such expectation, the slogan “Livable Seoul without relying on cars” has been adopted, followed by 11 specific promises targeting three core values. Through this Vision 2030 and 11 promises, the city plans to achieve ‘Triple 30’ goals by 2030: reduce car traffic by 30%, shorten the average commuting time by 30%, and expand the use of different modes of green transportation by 30%. In managing the transportation demand, the city aims to lower unnecessary movement and minimize the need to travel by implementing different strategies to foster a “low mobility society”. In managing transport supply, the city will also work toward shifting from energy-consuming transport modes to environmentally-friendly modes.

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<sup>1</sup> MZ generation is a generic term for millennials born in the early 1980s to early 2000s and Generation Z born in the mid-1990s to early 2000s. Generation MZ is known to be familiar with the digital environment and is characterized by pursuing the latest trends and exotic experiences different from others.

**Enabling legislation:** Article 10-2 of the *Act on the Promotion of Bicycle Usage* stipulates that the mayor and/or the head of district may operate public bicycle operation projects for the purpose of improving the convenience of bicycle use. Article 12-2 of the *Seoul Metropolitan Government Ordinance on the Promotion of Bicycle Utilization (installation and operation of public bicycles and public bicycle rental stations)* stipulates that the mayor may install and operate facilities for public bicycles. Moreover, under the same ordinance, article 12-1, the mayor may contract-out public bicycle installation and operation to public institutions or the private sector via supporting the expenses within budget. Pursuant to article 4-3 of the *Ordinance on the Entrustment of Seoul Metropolitan Government's Administrative Affairs to the Private Sector*, the Seoul city mayor asked the Seoul Metropolitan Council for its consent to contract-out public bicycle operation in 2015 and was approved.

- **What science and technologies were used?**

Ttareungyi system is a dockless bike-sharing system. However, unlike the dockless bike-sharing system in other international cities like Beijing, Singapore, the Ttareungyi dockless bike-sharing system requires the cyclists to return the bicycles to designated stations to better organize the city space and prevent bike theft. The dockless bike-sharing system is supported by a combination of a bike-sharing network plan and an innovative application.

**Ttareungyi application :** Since 2020 March, Seoul Facilities Corporation (SFC), the facility-specialized public corporation responsible for managing major infrastructure in Seoul, introduced shared bicycles with QR code scanning function installed (Seoul Metropolitan Government, 2021). The users can easily unlock the bicycle by scanning the QR code attached to the bicycle, via the Ttareungyi application. This QR-code-attached-Ttareungyi is an upgraded version from the previous LCD-Ttareungyi, which operated only through wifi installed in the rental center. The problems of LCD screens are their vulnerability to weather and frequent breakdown. Since the upgraded QR code Ttareungyi is operated through Bluetooth installed in the rental station, bicycle and smartphone, users can easily find the location of the bicycles using the Ttareungyi application and unlock them easily. According to the Ttareungyi system general manager, Sangsun Kim, such Internet of Things (IoT) technology is one of the unique features of the upgraded Ttareungyi and the Ttareungyi application. He also said that the previous LCD model cost 380,000 KRW (380 USD) per bicycle; therefore, the current model has successfully reduced the cost of production and increased the quality of technology used in the bicycle operation. Likewise, IoT technology not only increased the convenience of using Ttareungyi, but also contributed to the sustainable operation of Ttareungyi by improving the general maintenance system. The application also allows the users to check the accumulated amount of carbon reduced by the total traveling distance using a bicycle. While strengthening the image of eco-friendly low-carbon transportation of Ttareungyi, the application is expected to allow users to easily check their contribution to carbon reduction as well as air quality improvement.

**Safety technology:** In March 2021, Seoul Facilities Corporation (SFC) announced the 'Five safety measures', which include but are not limited to expanding the reflective tape and chain tensioner attached to the shared bicycles in order to prevent night accidents. The reflective tape is intended to make the bike more visible and recognizable at night. The chain tensioner is a device that prevents the bicycle chain from being loosened. Improved safety technology is significant in that it is likely to strengthen the public image of Ttareungyi as a safe public transportation mode, which would

further encourage more people to utilize these eco-friendly bicycles. Below are the 'Five safety measures' released by the SFC.

#### **Five Safety Measures:**

1. Reinforcement of night visibility
2. Prevention of bicycle chain loosening
3. Expansion of lighting at Ttareungyi bike stations
4. Mandatory safety video training for children before riding
5. Expansion of maintenance centers

#### **KEY AREAS OF CONSTRAINT/SUPPORT**

##### **> INFRASTRUCTURE REQUIREMENT (by Sep, 2021)**

- Bicycles
- Bicycle racks/stands
- Bicycle lanes/cycle rapid transit (CRT)
- Shared bicycle rental centres
- Shared bicycle maintenance centres
- Shared bicycle storage stations
- Shared bicycle operation facilities: e.g. Seoul Facilities Corporation
  - Shared bicycle call centres
- Shared bicycle delivery vehicles: e.g. trucks

#### **Shared bicycle rental centre:**

The SFC accepts requests for constructing the Ttareungyi bike stations via its main Ttareungyi website. A rental centre is largely composed of bicycles and bicycle racks, and can only be installed in areas with a sidewalk width of 3.5 meters (m) or more and a length of 5 m or more. Moreover, there has to be no interference with raised blocks for the visually impaired or with nearby facilities, such as fire hydrants. The location has to be considered as well, as there should be no difficulty in delivering bicycles, meaning that the bicycle rental centres cannot be constructed in a congested area or a spatially small area. If a requester wants the centre to be installed on a private land, the consent of the property holder is required. In the case of apartments, tenants' and owners' consent are required. Similarly, for the centres to be installed within the university campus, an official request by the university is required. If a store owner applies for a rental centre in front of the owner's store, the bike-sharing station can be named after the store name.



*Figure 1: Ttareungyi (Source: Seoul Bike Main Website)*

### **Bicycle lanes:**

The total length of bicycle lanes has expanded from 674 km in 2012 to 941 km in 2019, allowing the percentage of bicycle lanes to increase by 3.2% in the same period. Bicycle lanes are essential infrastructure needed for the effective operation of Ttareungyi rental service.

**Table 1: The percentage of bicycle lanes in Seoul (%) (Source: SMG Transport Division)**

	2012	2013	2014	2015	2016	2017	2018	2019
Regular roads (km)	8,174	8,197	8,214	8,215	8,241	8,243	8,246	8,282
Bicycle lanes (km)	674	708	725	779	869	889	916	941
The percentage of bicycle lanes (%)	8.2	8.6	8.8	9.5	10.5	10.8	11.1	11.4

### **► POLICIES AND REGULATIONS**

In 2019, a controversy was raised regarding the use of Ttareungyi as a means of transportation for the delivery business. According to the delivery industry, many couriers who do not own any means of transportation or simply cannot afford one often use Ttareungyi in operating delivery service, due to its low cost (Yim, 2019). The SFC, however, after receiving such feedback from users via the Ttareungyi application, put a brake on such business activities. According to the SFC, the use of Ttareungyi for profit or commercial purpose is prohibited based on Article 16 of Terms and Conditions of Use of Ttareungyi (“User’s duties and responsibilities”) (Seoul Bike Main Website, 2018). Based on these terms and conditions, the corporation sent proof of its request to “refrain from using Ttareungyi for-profit” to several delivery agencies. There have been mixed reactions from the public towards SFC’s responding action. While some of them argued that it is necessary to prohibit the use of Ttareungyi for commercial purposes, due to the shortage of Ttareungyi, others criticized that such prohibition is not justified and SFC has to consider couriers’ situations better. Furthermore, commuting to work can be perceived as a commercial means to earn income. Despite the debate, SFC and SMG maintain the stance that the Ttareungyi bikes should not be used for commercial and delivery purposes as they are public property.

### **► THE SCALE OF THE PROGRAMME/PROJECT**

According to a report released by the SMG Urban Transportation Department, the total number of Ttareungyi operated in the city was 37,500 by 2020, which is a 50% increase from the number of its previous year (2019). In response to a growing demand for public bicycles since COVID-19 and to manage transportation supply, the city plans to operate a total of 40,500 bicycles by the end of 2021. SMG will further introduce 3,000 new bicycles next year, making the total number of bicycles 43,500 by the end of 2022 (Seoul Metropolitan Government, 2021). Its goal is to ensure people have access to bicycles within a walking distance. Through this policy, Seoul aims to achieve its goal of 2,300,000 cycling transit per day, as well as the expansion of main bike roads by the year of 2025.

**Table 2: The scale of Ttareungyi service (Source: SMG Transport Division)**

	2018	2019	2020	Sep, 2021
The number of bicycles	20,000	25,000	31,500	37,500
The number of bicycle rental center	1,537	1,540	2,228	2,523
The number of bike rack	19,293	19,545	28,365	31,133
The cumulative number of membership (1,000 persons)	1,093	1,729	2,785	3,254
The cumulative number of users (1,000 persons)	16,818	35,892	59,598	84,642

**➤ COST AND FINANCING /BUSINESS MODEL**

The total budget in 2021 for shared bicycles is approximately 30 billion KRW (25.1 million USD) (2021 Seoul Metropolitan Government Transportation Office Report, 2021) The budget has been expanding every year since the first year of operation in 2015. The financing of the Ttareungyi highly depends on the mayor's preference as well as the political support. The charges for Ttareungyi rental can be referred to Table 4.

**Table 3: Budget for Ttareungyi service (unit: 1 million KRW) (Source: SMG Transport Division)**

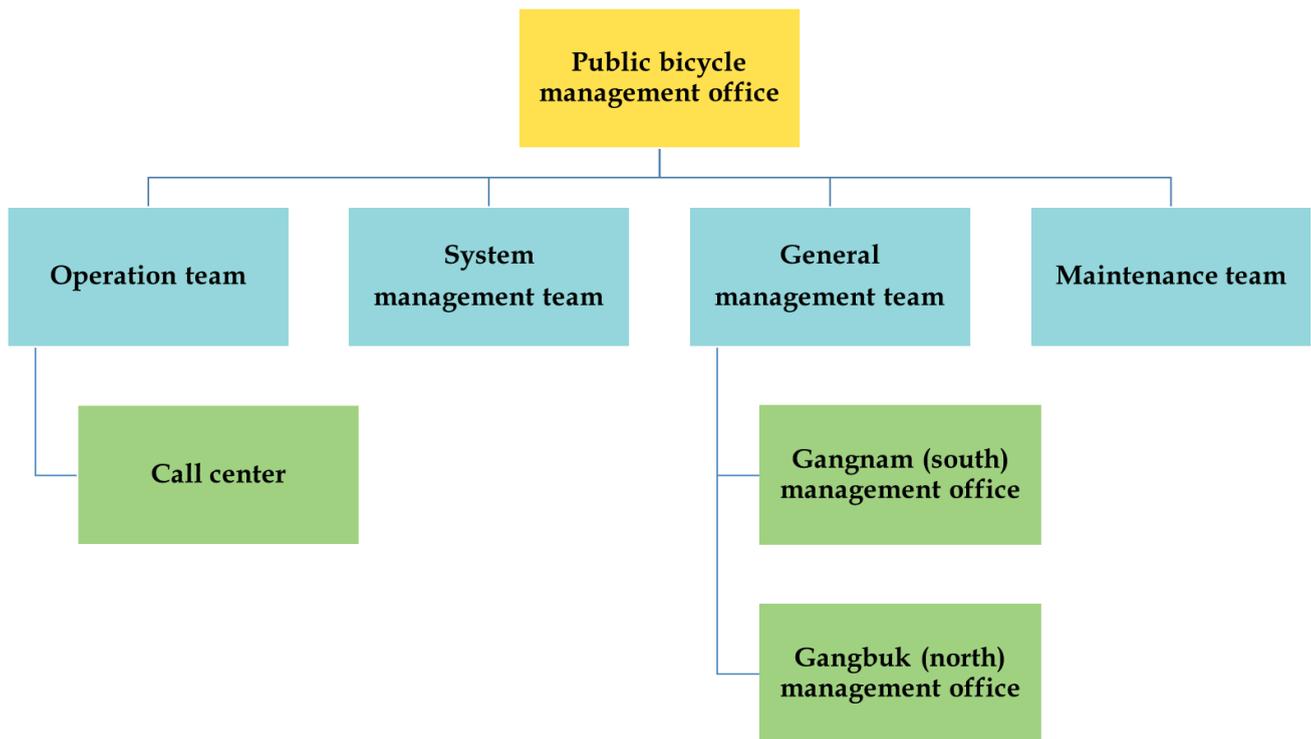
		2015	2016	2017	2018	2019	2020	2021	Total
Expenditure	Construction	964	2,485	14,395	7,132	9,928	10,047	26,280	71,231
	Operation	1,096	3,421	6,985	11,979	18,013	21,730	6,042	69,266
	Sum	2,060	5,906	21,380	19,111	27,941	31,777	32,322	140,497
Income		N/A	895	2,889	5,130	9,051	11,832	7,730	37,527

**Table 4: Ttareungyi rental fee (Source: Ttareungyi application)**

Item	Regular			One-day	
Type	Days	1 hour	2 hours	1 hour	2 hours
Fee	7 days	3,000 KRW	4,000 KRW	1,000 KRW	2,000 KRW
	30 days	5,000 KRW	7,000 KRW		
	180 days	15,000 KRW	20,000 KRW		
	365 days	30,000 KRW	40,000 KRW		

## HUMAN RESOURCE CAPACITY

The Public Bicycle Team under the Transportation Department in SMG is responsible for the construction of bicycle lanes and relevant infrastructure. Since March 2016, the SFC has been contracted by SMG serving as an implementation agency of the Ttareungyi initiative. Currently the contract is until 2025, however it is likely that SFC will continue serving as a main operating agency for Ttareungyi. The Public Bicycle Management Office within SFC is currently (end of Sep, 2021) divided into four teams: operation, system management, general management, and maintenance team. The operation team is in charge of managing the budget and revenue, as well as promoting Ttareungyi. The customer call centre consisted of 45 employees working directly under this operation team, responding to Ttareungyi users' concerns and suggestions. The system management team is responsible for the Ttareungyi application and unmanned rental and return system. The general management team is responsible for the general maintenance of the whole Ttareungyi system while managing two management offices: Gangbuk (the metropolitan district north of the Han River) and Gangnam (the metropolitan district south of the Han River). The maintenance team is responsible for general maintenance of bicycles. Currently, there are six maintenance centres in Seoul, located at Sangam, Isu, Yeongnam, Gaehwa, Jungnang, and Training Centre.



*Figure 2: Seoul Facilities Corporation Public Bicycle Management Office organizational chart (by Sep, 2021)*

According to a report released by the SFC Public Bicycle Management in September 2021, there are 271 people responsible for the Ttareungyi operation in SFC, in addition to 78 non-regular employees responsible for delivery (Table 5). In addition, 214 people, including regular and non-regular

employees, are responsible for delivering bicycles, where 106 and 105 workers are responsible for delivering Ttareungyi in the Gangnam area and the Gangbuk area respectively. By September 2021, a number of 127 vehicles are used for delivery. There are 60 people who are responsible for maintenance jobs, accounting for 22.14% of the total regular employees. Currently, all 60 people are regular employees, which indicates improved management of human resources in the maintenance of bicycles. This is noticeable as in 2018, there were only 36 regular employees maintaining bicycles, along with 24 non-regular employees. The increase of regular employees in the maintenance department thus shows SMG’s efforts to increase Ttareungyi maintenance efficiency and to ultimately improve the bike-sharing system in Seoul. In order to further increase the efficiency of maintaining bicycles, the SFC introduced a special “bicycle workbench” for maintenance workers in April 2021, which is aimed at easing the physical stress of maintenance workers when repairing bicycles (Seoul Facilities Corporation, 2021). According to SFC, it takes approximately 20 to 30 mins when maintaining one bicycle per worker; therefore, improved maintenance facilities, such as “bicycle workbench”, are likely to improve the maintenance efficiency while ensuring a quality working environment for employees. As SMG plans to replace the old bicycles and locate more bicycles, an increasing number of maintenance workers will be required in the future to ensure efficient operation of the shared-bike system.

**Table 5: Human resource status by Sep, 2021 (Source: Seoul Facilities Corporation, 2021)**

Administration & technology	Bicycle management			Total
	Delivery	Maintenance	Information	
33	136	60	42	271

**➤ POLITICAL COMMITMENT**

Budget and the scale of the Ttareungyi service operation highly depends on political support and mostly the mayor's preference. In October 2021, it was revealed that SMG decided not to make new purchases of bicycles in 2022 for the first time since the introduction of Ttareungyi in 2015, which sparked a backlash from the public. In response to the public’s voices, SMG announced that additional 3,000 bicycles will be purchased and made available by the end of 2022. Yet this is much fewer than the number of bicycles increased in the previous years (table 2). Likewise, the mayor's decisions or priorities in programs may influence the scale of Ttareungyi operation to a large degree. Long-term bi-partisan political commitment is needed in order to develop a sustainable and consistent shared bike system in Seoul.

**➤ KEY BENEFICIARIES**

Seoul residents

**TIMELINE**

2015 Sep - present

## IMPACTS

### **Carbon reduction**

According to the SMG, the total amount of  $CO_2$  reduced through using Ttareungyi is 55,472 tons, which was calculated based on the total distance traveled by Ttareungyi (239,099,326,863 km) by a total number of 61,324,770 people. The fuel efficiency of a normal car is used based on the assumption that each bicycle trip replaces a car trip. In order to calculate the reduced amount of  $CO_2$  (kg) per kilometer through use of Ttareungyi, the kilometer-travelled for Ttareungyi is multiplied by the fuel efficiency of a passenger vehicle.

### **Resilience**

The existence of the Ttareungyi rental service before the COVID-19 pandemic has reflected the city's resilience, as a number of people chose bicycles as a safe alternative transportation mode. Public transportation in Seoul is usually very crowded, especially during rush hours; therefore, many residents have voluntarily chosen to commute using the public bicycles to practice social distancing. According to "Seoul transportation 2020" published by SMG in March 2021, the number of public transportation users has dropped 26% from 2019 due to COVID-19 outbreak, while the number of Ttareungyi users has increased 25% in 2020, compared to the year of 2019.

### **Co-benefits: job creation**

The shared-bike system in Seoul has created job opportunities, especially during COVID-19 era. The SMG Job Policy Division is operating a "Ttareungyi Quarantine Team," which mainly consists of middle-aged people in their fifties and sixties. The team is responsible for sterilizing bicycles and bicycle rental centres, as well as managing hand sanitizers for commuters. This Quarantine Team is evaluated as an exemplary case for local government job projects targeting socially vulnerable groups. A total of 200 workers were recruited in 2021, with 100 workers for the first half of the year and 100 for the second half. More specifically, 50 people were allocated to the metropolitan district south of the Han River and the other 50 in the metropolitan district north of the Han River (Seoul Facilities Corporation, 2021).

## FACTORS FOR SUCCESS

### **The management of bicycles through GPS and security system**

In order to prevent bicycles from being stolen and to manage the operation of Seoul bicycles, SMG collects personal location information through the terminal attached to bicycles. Such security technology allows the city to operate Ttareungyi rental service in a more efficient way by making sure that bicycles are available for the wider public and not being used for an individual's personal use. This system thus allows Ttareungyi to be managed effectively as an environmentally friendly public transportation.

### **User-friendly Ttareungyi application & QR code model bicycle**

Ttareungyi application has allowed users to easily rent bicycles through its reservation system and QR code system. The users can first check out bicycles located nearby and make a reservation via the Ttareungyi application or the Ttareungyi website. Moreover, the QR code model bicycle allows users to easily unlock bicycles just by scanning the QR code, attracting many users due to the ease of use and convenience.

## LESSONS LEARNED

### **Opportunities:**

- The existence of the Ttareungyi application serves as one of the biggest strengths of Seoul's Ttareungyi service, as it can not only increase the convenience of the service but also enhance the communication between the service provider and the beneficiary, which in this case is the SFC/SMG and the Seoul residents.
- There is a possibility that Ttareungyi will run with the paid advertisements starting next year to compensate for the deficit of approximately 20 billion KRW (16.8 million USD). Even though this is not confirmed fully, there has been news reporting regarding this possibility since October 2021 (Huh, 2021). Although Ttareungyi, as a public service, is not fundamentally set up for gaining profits, the city has been exploring effective ways to cover some of the deficits. By upgrading the bicycles to QR model, the city has improved operational efficiency. According to the explanatory material provided by SMG (Seoul Metropolitan Government, 2019), the city has aimed to save approximately 10 billion KRW (8.4 million USD) of operational and repair costs by replacing the terminals of Ttareungyi from LCD to QR. Therefore, cutting the cost of repair will save the budget available to develop better systems and technology.

### **Challenges:**

- The construction of the bicycle lanes is raised as one of the main challenges for expanding the shared bike system in Seoul, as many existing roads are constructed for private cars and buses. Building completely new bicycle lanes requires a huge finance budget, which is difficult to secure, especially with the deficit occurring in the operation of Ttareungyi service.
- Challenging for elderly to use bicycles as it requires using smartphone technology such as scanning QR code via Ttareungyi application.
- There has been increasing concern on the issue of bicycles being parked everywhere - not in the designated returning spots. Although users can still find the location of bicycles via the Ttareungyi application, this will cause huge inconvenience for residents when walking and driving.
- Due to the reservation system in Ttareungyi application, there have been conflicts between users. There have been cases where a person has been waiting in the rental centre to rent a bicycle but it is no longer available because the other person has already booked it.

## **SUSTAINABILITY**

Many of the shared bikes are broken and not being repaired in time because they are not returned back to the rental stations. Aimed at improving the efficiency of maintenance as well as revitalizing alley business districts, the SFC announced on 30 March 2019 that it will start the "Ttareungyipo" project, in which the SFC will collaborate with local bicycle agencies in carrying out repairs and maintenance of public bicycles (Seoul Facilities Corporation, 2019). The SFC publicly recruited private bicycle dealerships wishing to participate in the Ttareungyipo project from 20-28 February 2019 through which 42 agencies were selected initially. According to the "2021 Ttareungyipo Operation Plan" released in January 2021, 100 to 150 local agencies will work together with SFC between March 2021 and November 2021, followed by the evaluation in December 2021. The SFC will first handover the broken bicycles to individual stores for repair, then rearrange them to public bicycle rental centres. The 2021 Ttareungyipo plan is also aimed at providing support to small

businesses during the COVID-19 epidemic, by establishing a public-private maintenance cooperation system (Seoul Facilities Corporation, 2021). Thus, the Ttareungyi project is a great example of sustainable operation of shared public bicycles, as it allows more bicycles available to residents with faster repair processing and better quality of maintenance service.

### **EFFICIENCY/EFFECTIVENESS**

The city's effort to improve the efficiency of Ttareungyi service has been evident, as it is open to receiving comments and suggestions from the residents regarding difficulties or issues. The SFC gathers residents' comments and reviews via the Ttareungyi website and application, which shows the city's capacity to work toward improvements.

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