A Study on the Living Lab Utilization Plan for the Creation of a Smart City in Naepo New Town in Korea

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Abstract -*This study diagnosed the projects and current status planned in the expansion stage for the construction of a smart city in Naepo New City, and suggested considerations for the smart characterization of Naepo New City in three dimensions as follows. First, the construction direction of the Chungnam-do smart city data hub supply project and improvement plans to be considered were presented. Second, a sustainable Naepo New City Living Lab was created and an operating plan was presented before entering the completion and maturity stage in the expansion stage. Third, the policy direction for smart city realization and general matters for service realization were classified by item, and problems of current service items and future policy and practical tasks were presented.*
Keywords: Smart City, Living Lab, Naepo New Town, Operation Plan, Organizational Structure

1. INTRODUCTION

1.1. Background and purpose of the study

Chungcheongnam-do created Naepo New Town with the relocation of Chungnam Provincial Office for provincial integration and balanced development, and the creation of a central city in Chungcheongnam-do according to the expectations of local residents and balanced national development in line with the 21st century globalization era. By forming a spatial base city within the region, it resolves regional development and regional polarization, provides efficient and equitable administrative services for local residents, and preserves the history and cultural traditions and identity of the Chungcheongnam-do region.

Naepo New Town has established a paradigm for sustainable urban formation by giving the identity and symbolism of the city where the Chungcheongnam-do Provincial Office is located, and strengthening balanced regional Development and national competitiveness. Through this, it aims to build a self-sufficient and balanced central city in the Yellow Sea region, lead the balanced development of Chungcheongnam-do, and pursue a creative and international-level new city through smartization of the city. Building a smart city is meaningful in improving the competitiveness of new cities and the quality of life of residents by utilizing smart city technology, and in enhancing urban values through undergrounding, cyberization, and networking of facilities. Therefore, this study aims to improve the qualitative maturity of the future Naepo smart city by citing problems and proposing improvement measures centering on the current status of the expansion phase (after 2020) of the smart city construction of Naepo New City (Sadowski, 2016).

The goal of this study is to diagnose the projects and current status planned in the current expansion stage of the smart city construction of Naepo New City, and from this, propose considerations for the smart characterization of Naepo New City in the following three dimensions. First, the construction direction of the smart city data hub supply project in Chungcheongnam-do and the

improvement plan to be considered are presented. Second, a sustainable Naepo New City Living Lab is to be created before entering the completion and maturity stage in the expansion stage and an operating plan will be presented. Third, the policy direction for smart city realization and general matters for service realization are classified by item, and problems of current service items and future policy and practical tasks are presented.

1.2. Method and scope of research

The name of the project is Smart City in Naepo New Town, Chungcheongnam-do. The construction time range is from 2012 to 2022.01. For the business district designation date, the 3rd stage is already completed. Its creation stage is from 2012 to 2015 and it has six (6) services. The development stage is from 2016 to 2022) and has 13 services. The spatial scope of this project involves Hongbuk-eup, Hongseong-gun, Chungcheongnam-do, Sapgyo-eup, and Yesan-gun (area 9,951,729㎡). Its business scale is KRW 39 billion. The scope of content involves construction, management and operation plan of smart city infrastructure (communication network, integrated city operation center), provision of smart city service, annual investment plan and financing plan, etc.
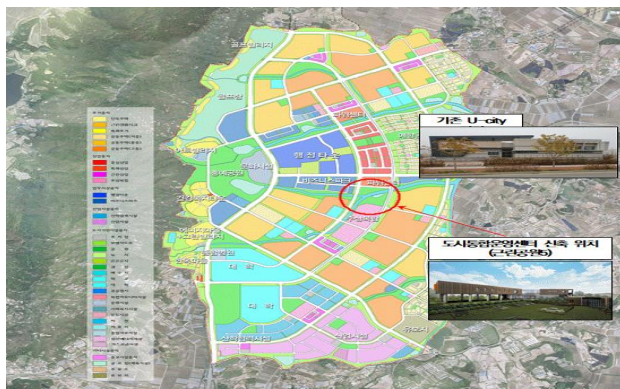

Figure 1. Naepo New Town Smart City Planning Map

This project integrates cutting-edge smart technologies (ICT, energy, environment, etc.) into urban space to provide various smart city services such as administration, transportation, and crime prevention to new city users, and to build a smart city in Naepo New City through efficient city management. It is a project to promote the improvement of the quality of life of residents by enhancing competitiveness and providing various innovative services. This project secures a 24-hour new city safety net, provides services for a healthy residential environment, and sets the direction for the construction of a dynamic smart city that integrates ICT technology and urban infrastructure. The project operator

is Korea Land and Housing Corporation, Chungnam Development Corporation. This project's plan was approved for implementation last December 2012 and Phase 1 was completed by August 2014. Phase 2 was completed last July 2017 and Phase 3 was in December 2022. The implementation method of this project is public development, and it is implemented in parallel with the Naepo New Town development project set forth in Article 3 of the 『Smart City Creation and Industry Promotion Act.

2. THEORETICAL BACKGROUND

2.1. Considerations for Smart City Creation

Naepo New City is currently being designated and approved as a smart city construction company by Korea Land and Housing Corporation and Chungnam Development Corporation, and the construction project is being carried out in cooperation with the Chungnam Provincial Office and related administrative departments, and services of partially completed facilities are being operated. It is necessary to derive the current development situation and future considerations, and organize specialization plans for smart cities unique to Naepo New City. As a scope, it is necessary to review the smart city data hub supply project, the creation of a sustainable living lab, the review of smart city service items, and the establishment of a new organization that can control them.

2.1.1. Chungnam Smart City Data Hub Distribution Project

The smart city data hub distribution project based on Naepo New Town develops a data hub to systematically collect and manage various data generated in the city and use it for city operation and service provision, establish a data hub nationwide, connect local governments nationwide in the form of a cloud, and establish a city information network. In addition, a data hub is established at the level of regional governments, and it is established in a form that is jointly utilized by basic local governments within the metropolitan area. This project operates a convergence city service by storing, analyzing, and processing data generated in the city, and utilizes data hub technology (S/W open source), a national R&D achievement, to realize a smart city, thereby building a wide-area road. It is targeted for joint use of cities and counties, and unit services for living areas beyond administrative districts (Liu, 2019).

2.1.2. Data Hub Construction Plan

By establishing a smart city data hub in the Chungcheongnam-do Integrated Information Center and the 『Chungnam Smart City Metropolitan Integration Center』, it connects networks with 15 cities and counties in the province, and collects and manages data through the connection with the Chungnam data portal 『Oldam』 and the administrative network. It also collects real-time information such as web crawling, analyzes necessary data, and stores databases. Furthermore, the collected and stored data is used to provide services for all citizens and administrative convenience through big data analysis, and to provide additional convergence city services through systematic collection and management. Essential modules (core module, security module, API gateway) among data hub configuration modules are then built to standard specifications through verification procedures. In line with this, NGSI-LD, an international standard, is applied mutatis mutandis to expand data hub-based convergence services, such as international interoperability and public confidence (Liu, 2019; Dong, 2022).

2.1.3. City Data Collection and Management Plan through Data Hub Utilization

The basic data for realizing convergence service is first utilized to the fullest extent from Chungcheongnam-do data portal Oldham data

(public/administrative/private). Second, sensor-based IoT real-time data such as fine dust and odor monitoring accumulated in cities and counties and data generated from smart city solution business results are collected and stored in the smart city data hub. Third, the Chungnam-type city data regenerated through the data hub convergence service is stored again in the data portal Oldham [3].

2.2. Chungnam Smart City Data Hub Distribution Project Operation Plan

2.2.1. Data Hub Common Service: City Safety Infrastructure (Safety 2.0)

Smart cities establish and respond to social safety policies through prediction of social safety (crime). These cities can also analyze and predict social security through machine learning based on urban big data such as 112 events, floating population, and urban infrastructure. In particular, it is composed based on utilization data of 7 categories including 112 control room event information covering qualitative and quantitative data types, temperature/humidity, floating population, CCTV image information, land use data, bus stop data, and safety emergency bell installation location [3].

Table 1. List of city safety infrastructure (safety 2.0) service utilization data

Data Type	Source	Main Item
112 Situation Room Event Information	Regional Police Agency General Situation Room	Incident/accident events received at the 112 Situation Room
temperature/humidity	Korea Meteorological Administration	Weather information by day and season
floating population	Oldham	Chungcheongnam-do data portal real-time floating population data
.CCTV video information	Smart City Metropolitan Center	City, County CCTV video information
land use data	Public data portal	Use zoning district information, land connection (land use planning, urban planning)
bus stop data	Korea Transportation Safety Authority	City, County CCTV video information
Safety emergency bell installation location	Department in charge	Management number, purpose of installation, installation location type, installation location, road name address, latitude, longitude, connection method, police connection, management company connection, installation year, management agency name, management agency phone number

Through the urban safety infrastructure (Eonjeon 2.0) service, safety policies, responses based on social safety (crime) predictions, and safety maps (safety management areas, CCTV priority installation areas, human resource allocation, patrol base area derivation) can be established to present the city integrated operation center monitoring optimization service (Dong, 2022; Cici, 2016).

In particular, through the results of seasonal trend analysis, such as crime occurrence time and day, it predicts the time required for intensive monitoring and the corresponding day and season to improve future predictive power (Cici, 2016).

Among smart city functions, in case of fire or emergency patients, real-time traffic information, fire detector location information, and firefighting activity data (accident risk area, facilities subject to intensive management) are used to respond quickly to emergency situations and reduce emergency situations that occur to citizens. In particular, it is composed based on utilization data of 13 categories including 112 situation room event information, navigation, fire activity data, fire hydrant and fire water location information, weather information, gas station, electric vehicle filling station, AED location information, civil evacuation facility, civil defense alarm facility, safety emergency bell installation location, resident population, and floating population (Cici, 2016).

2.2.2 Data Hub Specialized Service: Emergency Rescue Service

Table 2. List of emergency services utilization data

Data type	Sources	Key Items
119 Situation Room Event Information	Wide Area Integration Platform	Event occurrence date and time, event type, location (address), event content, latitude, longitude, occurrence area code
Navigation	T-map	Navigation considering traffic conditions, Origin-Destination (OD) information
Fire Activity Data	Fire Department	Accident risk area, facilities subject to intensive management
Location Information of Fire ydrant and Fire water	Public Data	Branch address, hydrant classification (ground, underground, water supply tower, water storage tank), Water outlet pressure, installation year, pipe depth, pipe diameter, latitude, longitude
Weather Information	Public Data	Date and time, weather observation point number, ground temperature, precipitation, average Relative humidity, average ground temperature, maximum wind speed, maximum wind speed, the highest temperature, lowest temperature, daily precipitation
Gas Station	Opinet Korea National Oil Corporation	Gas station name, road name address, gas station trademark information, Gas station phone number, refiner, self-fueling status, latitude, longitude
Electric Vehicle Charging Station	Opinet Korea National Oil Corporation	Charging station name, road name address, facility size, telephone number, latitude, longitude
AED Location Information	Emergency Rescue Standard System	Administration number, installation location name, administrator contact, latitude, longitude

Civil Defense Evacuation Facility	Public Data	City/city name, area, evacuation description, evacuation facility classification, road name address, lot number address, management agency name, number of persons available for evacuation, latitude, longitude, facility classification, building name
Civil Defense Warning Facility	Public Data	Facility name, facility type, installation location, road name address, latitude, longitude
Safety Emergency Bell Installation Location	department in charge	Management number, purpose of installation, type of installation place, installation location, road name address, latitude, longitude, connection method, police connection, management company connection, installation year, name of management agency, telephone number of management agency
Resident Population	National Statistical Office	Number of people by region, number of people by gender, and number of people by age
Floating Population	Oldham	Floating population by grid, moving population by day of the week

Through emergency rescue services, the actual disaster relief time can be shortened by improving the on-site information sharing process between relief departments, and it can be used as a base technology to support securing golden time. In addition, various predictive information can be provided by spreading it in connection with various safety services, the Ministry of Public Administration and Security, and the disaster stabilization network in local governments. Furthermore, the time required for the designation of the safety center through SW to select the dispatch department is reduced, and the transition from a general accident to a large accident is prevented by quickly identifying the surrounding threats (Yang, 2020).

Table 3. Key Performance Indicators (KPI) of Data Hub Distribution Projects

Recommended Assignment	Key Performance Items	Key Performance Goals	Note
City Safety Infrastructure (Safety 2.0)	Continue to reduce and maintain the number of crimes by strengthening safety monitoring in preparation for crime	5% reduction in total crimes	
	Prompt response and mobilization hotspots (priority safety management areas) identified through patrol bases by city and county	Identify 10 key safety management areas	Long-term planning
	Open Convergence Data	2 Types of Convergence data open	Oldham connection
Emergency Rescue	Continuously reduce and	Total number	

| Service | maintain the number of fires by strengthening fire safety monitoring | of fires entered and maintained below 2,000 | |
| | Derivation of big data analysis results to reduce emergency dispatch time | 2 analysis results | |

Table 3 shows the key performance index (KPI) of the data hub dissemination project. Table 4 on the other hand shows the modification key performance of data hub distribution projects. This is based on the specificity and feasibility of the performance goal which Chungcheongnam-do Province has organized and derived and is in progress (Sang Ho et al., 2022).

Table 4. Modification Key Performance Indicators (KPI) of Data Hub Distribution Projects

Recommended Assignment	Key Performance Items	key performance goals	Note
City Safety Infrastructure (Safety 2.0)	First, additional CCTVs are installed in CCTV reinforced areas.	50 additional installations per year in the priority installation area	
	Selection of key safety management areas and improvement of safety index	Increased the safety level index of 10 key safety management areas by one level	
	Additional opening of data through data convergence analysis	2 Types of Convergence data open	Oldham connection
Emergency Rescue Service	Selection and improvement of areas vulnerable to fire suppression	Selected 100 places, improved 20 places	
	Use of analysis results	2 analysis results, 2 cases of policy reflection	

As a key performance indicator improvement plan for the data hub dissemination project, the quantitative distinction between the reference point and the target point should be clear, but if quantification is inevitably difficult, a qualitative indicator should be used instead. The current KPI is divided into 5 key performance items for each of the 2 implementation tasks, and the following improvements are required. First, CCTV priority installation in CCTV reinforced areas requires quantitative design of the quarterly achievement rate, separating the designation of key safety management areas from the safety index of each designated area, and designing it as a quarterly safety index. Second, additional data opening through data convergence analysis should be set to at least two types of convergence data opening, and both designation of fire suppression vulnerable areas and improvement of fire suppression vulnerable areas should be quantified and

designed. Last, the use of data analysis related to emergency rescue should be quantified into the number of quarterly data use, the number of data analysis results, and the number of policy reflections. In summary, the existing 5 key performance items should be modified and supplemented with 7 key performance items, and key performance indicators should be designed with quantitative numbers (indicators) and visualization prominently (Sang Ho et al., 2022).

3. ESTABLISHMENT AND UTILIZATION OF LIVING LAB FOR SMART CITY CREATION

3.1. Living Lab Creation Background

In order to create an innovative smart city based on resident participation, the Naepo New Town needs to promote the 'Smart City Living Lab' in the project area,

led by residents in the entire process from discovering urban problems to solving them and managing performance. In particular, it is necessary to improve the sustainability of the city by discovering services with high resident demand, improve the problems of existing services from the user's point of view, and reflect them in city services to ultimately improve residents' experience. In line with the smart creation of Naepo New City, the efficiency of city operation and business purposes are clarified to establish a living lab promotion plan in which residents participate, and it is necessary to prepare a company-wide performance management system such as solution construction and verification. In particular, a successful living lab foundation is established. Therefore, it should be developed as a policy agenda for the future Naepo New Town. The scope of the project and content is limited to the Naepo New Town, but Chungcheongnam-do is set as the region, 15 cities and counties are allocated a sampling of Living Lab participants, and the current construction stage, completion stage, and subsequent operation stages are covered.

First, establishment of a plan to promote smart living labs with residents' participation and operation of living lab. Second, promoting the living lab and implementing customized living lab training for local residents within the project area. Third, the satisfaction survey was conducted through before, during, and after the curriculum. Fourth, the expected effect of operating a resident-participating smart living lab is the realization of a smart city model that can be experienced by residents and improved residents' experience. Fifth, by operating services and solutions according to resident demand, the concentration and efficiency of services in Naepo New City are doubled. Last, it is possible to discover new urban values by analyzing problems based on big data and collecting residents' opinions (Fernando, 2020).

As a promotion strategy and basic direction, the purpose and direction of the Smart City Living Lab are operated so that the Living Lab is efficiently linked within the scope of the ongoing Naepo New Town smart city development project, and considering realistic circumstances, the opinion of the Living Lab resident participation group is maximized. There is a need to develop detailed implementation plans to reflect this. In addition, by examining the conflicts and cases of smart city-related plans, such as the upper plan and informatization business plan between the smart city planning department of 15 cities and counties in

Chungcheongnam-do and the Naepo new city planning department, the feasibility of the living lab and the existing plan is presented. And it is necessary to review various directions for linking with information systems and realizing business advancement and efficiency, and filtering out whether the business is redundant due to living lab operation (KuiHwa, 2022).
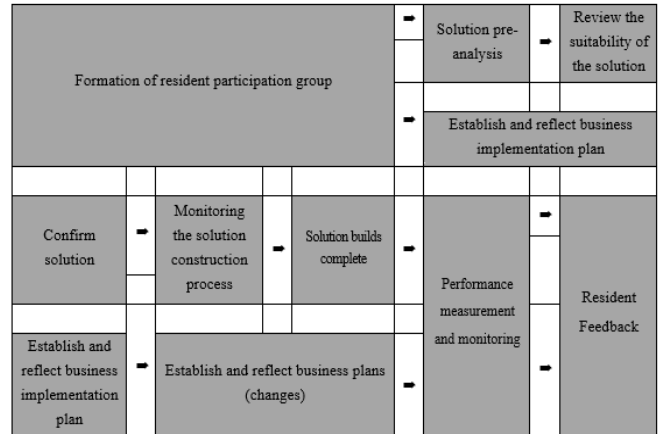

Figure.1 Smart City Living Lab Promotion Process

In order to create a smart city, public relations plan to increase the voluntary participation of local residents and the interest of local businesses should be established. This will be promoted in various forms such as using the homepage, opening SNS, operating a band, using local newspapers, and online media.

There should also be an establishment of detailed operation plans such as number of times and techniques for efficient operation at each stage of Resident Living Lab operation. In the operation of the Living Lab, the composition of residents is derived by considering the region, population, gender, and age according to the Sampling and Allocation Act, and subject agendas are set at bi-weekly intervals, but opinion sharing, discussions, lectures, and facilitation are held according to the main agenda. Plans are used in a variety of formats. In addition, in order to promote operational efficiency, the contents derived along with regular meetings are shared through workshops and conferences, and the information is continuously linked with the person in charge and public officials. Prior to the implementation of the Living Lab, it is important to educate the participatory group on smart cities, smart solutions, and Living Labs and concentrate on the appropriate level of technology and elements for the introduction of smart solutions, appropriateness of construction cost, validity of location and quantity, sustainability of maintenance and service, connectivity with other integrated platforms or information systems,

rationality of performance goals and performance indicators, etc. It is necessary to support and design so that discussions can be induced, and results that can lead to cost minimization and efficiency maximization can be derived. It is also necessary to establish a linkage with the competent government office to analyze the problems of the derived solution construction method, suggest supplementary points, derive desirable solutions to share with residents, and secure sustainability even after the project is completed. In order to promote development through continuous management after completion of the project, it seems necessary to conduct training in advance to enable follow-up management by the person in charge of the competent authority through the Smart City Living Lab organization, and to authorize follow-up management through the follow-up management manual (HwanYoung and Gul, 2020).

3.2 Adjustment of service function of smart solution to be built

A plan should be prepared for sufficient consultation with experts on services derived from the Naepo New City smart city development project, related company advisory, and project owners. When reflecting residents' opinions on services, when it comes to resident participation, it is necessary to establish a consultative body that can adjust plans to reflect the opinions of children and adolescents, residents who have difficulty participating, and residents of the vulnerable class. Review and reflect the priority of the detailed functions (components) that make up the smart service of the construction solution. Select priorities by comprehensively considering the priority survey of the residents' participatory group, consultation with experts, opinions from related organizations, feasibility, ease of application, and necessity, etc., and focus on detailed functions of the solution rather than adjusting the smart solution already reflected in the business plan Check. For the service of the selected smart solution, a proposal is prepared by stylizing the components of the solution, construction cost, performance index, and service contents so that it can be packaged and used in other expansion projects. Comprehensive analysis of the current status, problems, and demands of the Naepo New City area, a preliminary survey of residents of the project site, and interviews with related organizations. Data is collected through data analysis such as civil complaint data and policy proposals in Naepo New City and keyword search such as major local news, incidents, and accidents, and requirements for local issues that can be obtained from recent and past online such as social networking services (SNS), Investigate and analyze issues.

3.3 Living Lab organization and management

To form a governance expert group for the expansion of Living Lab, experts in related fields such as city experts and facilitators should be selected, and the governance (expert) manpower pool should be composed of experts in the field of smart solutions and living lab. In addition, the expert advisory group for technical, legal and institutional advice should be those belonging to industry, academia, research, and government, but include many experts in the necessary fields. The establishment and operation of the governance system is formed in consideration of the characteristics of the resident participatory group, such as distribution by region and solution, gender, and age group, and can be adjusted according to the characteristics of the smart solution and site conditions and prepare a program to enhance continuous participation until the project is completed. In addition, for efficient operation and management of smart solutions, participation plans of public institutions (local governments, police and fire departments, facility corporations, etc.) and related departments are considered, and a living lab management team is formed to support the operation and management of the overall living lab, and a resident participation group Plan and implement a kick-off (launching ceremony) and prepare living lab publicity plans. As for the operation method through sustainable governance, governance is to create a sustainable local environment together with residents, the private sector, and the administration, and is the core network of smart city living lab operation. In particular, in the case of resident representatives among governance participants, their understanding of governance needs to be enhanced. The basic values of collaborative governance in smart cities are communication, network, and cooperation. The private sector, activists, and the administration should communicate and go through an interactive network to the stage of cooperation. In order to reconfirm the direction of data collection governance through Living Lab, we induce organic linkage between governance and Living Lab through smart city user data, public data, and policies and plans related to smart city in Naepo New City, and regular residents' opinion survey and reflect the results of the investigation; In addition, service quality must

be upgraded to expand the sustainability of smart cities (HwanYoung and Gul, 2020; ChangTaek et al., 2021).

3.4 SMART CITY LIVING LAB OPERATION PLAN

3.4.1. Living Lab Educational

In connection with the existing projects of 15 city and county urban regeneration support centers, such as the Chungnam Urban Regeneration Support Center, the accumulated local community and governance resources are used to secure a driving force for expansion, and to be carried out in connection with smart city-related projects being promoted by other local governments. As an educational method, platforms such as online mechanisms are used to respond closely to COVID-19, and offline face-to-face education is also conducted in consideration of educational conditions. As an educational program, support for vitalizing the digital life of residents of Naepo New City and increase understanding of services, and build capabilities and support systems that can secure sustainability by specializing the educational process step by step to increase participation in this project. With online education, it consists of basic and advanced lectures through the existing smart city project, but it is provided free of charge by using the platform in accordance with resident education, and customized education is also implemented in consideration of the characteristics of each education participant (HwanYoung and Gul, 2020; ChangTaek et al., 2021).

3.4.2. Qualitative Investigation and Analysis

A survey is needed to analyze qualitative data that is difficult to survey and analyze quantitative data. This survey measures the understanding of smart services and solutions in Naepo New Town and to collect residents' opinions on future education programs and facilities. The survey period is about a month apart per session, and the sample design and extraction method are constructed with panel data that can track changes in each case, and the same questions are designed during and after the project is implemented so that recognition and understanding can be derived. The survey is divided into three stages (pre-construction, under construction, and post-construction). For the sample design, the residents of Living Lab implementation area (sample allocation from Naepo New Town, Hongseong-gun, and Yesan-gun folding

area) were included. The sample was identified by allocating the samples considering regional distribution, age, and gender based on the total population in the area where Living Lab is implemented. The survey aims to find out the measurement of the degree of change, such as understanding of smart services in cities. It also aims to measure the degree of change, such as understanding of smart services in cities, Regional Governance and Living Lab Construction and Operation: Governance is established in two parts residents and consumers/experts and the public. Governance participants are sampled to divide the time points into before, use, and after the establishment of a smart city corresponding to the laboratory and three establishments with panel data that tracks changes in the sample over time and derived through analysis of changes such as satisfaction (ChangTaek et al., 2021).

3.4.3. A promotion plan for Living Lab

To promote the Living Lab, content materials that can publicize the process and results of community activities externally should be created and photo materials such as activity videos should be used. It is also good to produce promotional contents such as card news and leaflets and distribute them through social media and offline, or producing and distributing press releases: Promoting through methods such as producing and distributing articles, forming a pool of online PR personnel such as SNS, and creating a living lab community (Living Lab) public relations committee) is also a good idea. The strategy for discovering living labs involving residents is to discover potential participants for residents of Naepo New City using an open platform or by using administrative agency channels (SNS and offline channels of administrative agencies and related organizations). Participating residents are provided with a small activity fee and a certificate of completion of the Living Lab community activity involving residents. Through these promotional activities, the sustainability of the Living Lab is improved, and the possibility of increasing the use of smart solution services in the city and expanding the business is enhanced. Marketing of solutions and services is promoted by linking with public data portals, using SNS and self-promotion, and securing competitiveness by differentiating solutions and services so that customer demand and requirements can be customized (WonBae et al., 2021).

4. GENERAL CONDITIONS FOR REALIZING SMART CITY

4.1. Policy direction and purpose of pilot project for smart city realization

Naepo New City is installing and operating service items for smart city implementation through the existing urban purification policy, which is currently being promoted by LH in accordance with the development plan. Prior to the current project, 12 projects (smart governance, citizens, platforms, innovation, economy, mobility, health care, education, energy, water management, environmental management, safety, etc.) were presented at the 2018 Naepo New City Smart City pilot project discovery debate. The principles of discovering business items include discovering feasible business items considering the purpose and conditions of new town development and current status of development, avoiding hardware businesses, discovering business items centered on software and humanware, and discovering business items that can receive government budget support (Lee, & Han, 2019).

4.2. Basic problems for implementing smart city services

Although smart city offers promising services, some problems exist that need to be given some regard. First, there is a lack of civic awareness and participation. This is because it is difficult for most citizens to grasp the capacity, understanding, and feeling of modern technology and new policies for implementing smart cities. Second, weak infrastructure maintenance. Another important aspect of implementing sustainable smart city services is maintenance, where hardware and software required for smart cities need continuous maintenance to maintain performance. In particular, it is necessary to update regularly the public S/W to solve security loopholes such as bugs caused by S/W development, and all costs should be continuously secured. Third, it is necessary to monitor continuously strategies and prepare a budget for future expenses such as battery replacement of Iot sensors, and to prepare various environmental alternatives such as carbon neutrality. Fourth, legal and institutional improvements are needed to secure data in the public and private sectors, such as controversy over personal information and privacy infringement caused by collecting large amounts of data using cameras and sensors for numerous applications such as traffic

monitoring and safety. Fifth, big data analysis by data collection can be a useful policy background in various aspects of smart cities because the data used for analysis has a wide range from past data to real time. Accordingly, it is necessary to improve the consistency of the analysis according to the data section and range setting, and since there is room for bias by data attribute, it is necessary to secure objectivity (Lee & Han, 2019; Yoo et al., 2019).

4.3. Policy and practical tasks for realizing smart cities

To be able to have a seamless implementation of policies and promoting smart cities, it is important to do as follows: First, it is necessary to improve the sense of awareness of the residents by raising their interest. Various channels that can encourage citizen participation should be secured and performance evaluation thereof should be continuously managed. Second, it is necessary to strengthen links between organizations and local governments to revitalize the urban innovation movement. It is necessary to strengthen think tanks for urban innovation and secure driving engines by seeking mutually cooperative urban competitiveness measures through solidarity with overseas and other cities. Third, bold and experimental pilot projects reflecting the innovation of the new city and post-regulation improvement are needed. Reflecting the innovation and vitality of the new city, the existing success stories are promoted, and regulatory sandboxes are discussed regularly by focusing on a small number of pending projects. In addition, in order to discover development purposes and strategies for inducing specialization, it should be classified and reset into project levels (pilot projects, focus projects, strategic projects), and excessively supplier-oriented projects should be pursued. Fourth, the function of urban control centers should be expanded. The current functions of the Naepo Smart Integrated Control Center should be performed, but the service area should be expanded by adding consumer-centered functions such as urban facility information, administrative remote control, and urban environmental information. Finally, the company-wide integrated management system of Naepo, Hongseong, and Yesan should be established. It is necessary to establish unified regional governance for each administrative district, implement company-wide smart city services through this, and share joint business strategies. In particular, it is important to establish a resident-participating living lab to form a network

effect, a virtuous cycle monitoring system, and to discover items centered on living services to improve residents' feelings (Yoo et al., 2019).

5. CONCLUSION

Naepo New City should continue to expand and promote the 'Smart City Living Lab' led by residents in the entire process from discovery of urban problems to solution to performance management based on resident participation. Discovery and monitoring of services with high resident demand can enhance the sustainability of the city and ultimately improve residents' perception by reflecting them in urban services from the user's point of view. Currently, the project should be run on a pilot basis with a small living lab budget prepared in creating the data hub project in Chungcheongnam-do, and the living lab should be operated as a whole business unit after expanding the budget. Through the implementation of the living lab in which residents participate, a foundation for the company-wide performance management system, such as the construction and verification of solutions, should be prepared, and an opportunity to spread the policy agenda of the new city of Naepo through a successful living lab should be prepared in the future. It is also necessary to link the results of the Living Lab with related organizations of the integrated smart city platform. In two dimensions, first, the linkage plan with the safety of the smart city integrated platform is to link the crime prevention information of the CCTV installed in the city and the crime prevention information using the IoT sensor with the S-safety of the smart city integrated platform, and then link it to the entire smart city. It is designed to be used as the basic data for the safe environment of the community by using it as crime prevention information. It can also be used as information for real-time safety support for local residents in connection with the emergency response and on-site dispatch service of the smart integrated platform. Second, the smart city integration platform is designed to link village information such as vacant house information provided by smart cities with related institutions to use as basic data for balanced development of smart cities, and local community such as special products and local events. Publicity information is disseminated to related organizations and promoted nationwide to contribute to regional development.

Declaration of Conflicts of Interests

Authors declare that they have no conflict of interest.

Consent for Publication

All authors read and aware of publishing the manuscript in Revista de Gestao Social e Ambiental

Declarations

Author(s) declare that all works are original and this manuscript has not been published in any other journal.

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