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Chapter

The Effect of Smart City on the Promotion of Entrepreneurship

Jae Eun You and Jong Woo Choi

Abstract

As smart cities are early markets, there are many opportunities for new services, technologies, and platforms to enter. The smart city ecosystem is also necessary for sustainable smart cities. The smart city plan can serve as an opportunity for startups to take a new leap forward at a time when various regulations and fierce competition are entering a stagnant period. The brilliant ideas of prospective entrepreneurs have become new vitality in the smart city field. Prospective start-ups will come up with solutions and service ideas for a more convenient and safe life by analyzing market demand and gaps. If there were no various regulations in the smart city and various support policies, chances for start-ups would increase.

Keywords: smart city, entrepreneurship, start-ups, innovations, strategies

1. Introduction

From the beginning, smart cities received a lot of attention from both developed and developing countries regardless of their national technology level. Developed countries are promoting smart cities for optimal utilization and efficient management of existing urban infrastructure to solve urban problems, and developing countries have been interested in skipping technology levels by applying new urban infrastructure construction [1].

On the other hand, the general argument is that the concept of smart city varies depending on the economic level or policies of each country, region, or city, and there is no universally available concept. For example, the International Telecommunications Union [2] investigated the current status of global smart cities and identified 116 similar but different smart city definitions.

Recently, as smart city discussions continue, smart cities generally agree that information and communication technologies are applied to urban spaces to efficiently utilize urban resources [3].

In response to the fourth industrial revolution caused by the development of IT technology, the word smart city means a combination of urban space and technology [4, 5], transforming the city into a new technology creation space. Due to the hyperconnection of virtual space and physical space, an industry that maximizes efficiency by collecting people, assets, and data based on platforms and sharing goods and services, as in the case of Uber and Airbnb, is rapidly growing. In addition, the fourth industrial revolution is difficult to predict due to its rapid development and constant

convergence with other fields [6], and regulatory reform for the acceptance and spread of fast-growing new technologies is an important role for the government and a place to experiment [6]. In response to the fourth industrial revolution, the smart city approach of foreign countries also deals with "data-based platform access and demonstration in urban space," and Korea is also introducing such smart city policies.

Smart cities have something in common in that they actively utilize the characteristics of making the most of the city's resources based on information and communication technology, but there are some differences in the background, major means, and goals. As can be seen from the individual appearance of smart cities, mobility minimization, expansion of civic exchanges, efficient solutions compared to investment, data and platforms, urban demonstration, and regulation are suggested as major means. Due to different backgrounds, the scope of smart cities is expanding, and as a result, difficulties exist in promoting smart city policies. In order for the smart city policy to be successfully promoted, it is necessary to clarify the goals and means to be achieved.

Although there are differences among works of literature, the components of smart cities are largely presented in the technical sector, the human resource sector, the institutional sector, and the innovation sector. Hwang [7] presented seven layers of smart city components such as urban infrastructure, ICT infrastructure, and spatial information infrastructure, focusing on the technology sector.

Smart cities can be largely divided into technology and infrastructure sectors, institutional sectors, and human resources sectors. The technology and infrastructure sectors include physical "urban infrastructure" such as roads and bridges, information and communication infrastructure such as communication networks, and information and communication-related technologies and platforms represented by ICBM. In the institutional sector, the areas covered by smart cities are wide, and due to the characteristics of convergence and complexity by field, it shows high importance at the stage of actual management and operation of smart cities. The human resource sector acts as an important means of creating innovative services and achieving a smart city ecosystem by promoting innovative ideas, cooperation with the private sector, and citizens' participation, reflecting the characteristics of rapidly developing and evolving information and communication technology.

The components of smart cities can be largely divided into infrastructure, data, services, and institutional sectors, and are included in seven detailed elements for each sector. The infrastructure sector includes urban infrastructure that can apply related technologies and services as physical and technical elements for building a smart city, ICT infrastructure that connects the entire city, and spatial information infrastructure necessary to fuse real space and cyberspace. The data sector is an area related to the production and sharing of data necessary to develop and operate new urban services, and IoT technology is a key element. The service sector is an area that provides actual urban services and includes algorithms for data utilization, reliable services, and urban innovation elements that are the basis for social and institutional.

2. Creative smart city composition

2.1 Open lab operations

Based on NB-IoT technology, this place provides a cooperative system and opportunity to develop innovative devices and creative services with mobile carriers in

the IoT market. By securing compatibility between various smart city products and services, it aims to improve user convenience, promote new product and service development, and create a smart home industry ecosystem that coexists with small and medium-sized companies. It supports the development of open smart city linkage technology and services. It helps develop IoT interworking technologies for interoperation between various products and devices of various manufacturers.

In addition, IoT convergence service models are discovered through collaboration between large and small businesses based on interlocking, and open smart city testbeds are operated and demonstrated. It demonstrates the interoperability, compatibility, and commercialization appropriateness of various products and services. It also provides consulting services for commercialization of related small and medium-sized enterprises. It prepares and distributes standards for open smart city linkage technology. It supports the operation of open IoT consultative bodies that participate in industry, academia, and research.

Open lab actively supports development companies and manufacturers to commercialize ideas by supporting development spaces and 3D printers, including NB-IoT communication modules and development boards. Open lab receives business proposals for innovative devices and creative services to revitalize the IoT ecosystem.

2.2 Start-up incubating

It will build a "start-up incubation support platform" that can be operated continuously by combining hardware elements such as space, facilities, and equipment for cooperation with companies in industrial complexes with software elements such as research resources and capabilities.

Spigel [8] classified the ecosystem of start-ups into cultural, social, and physical dimensions, and saw it as a process in which components of three dimensions interact with each other and resonate [9]. The cultural dimension refers to a risk-taking entrepreneurial culture or a successful model to benchmark, the social dimension includes social networking within the region and mentors that companies must follow, and the physical dimension encompasses national or local governments, infrastructure, research, and investment institutions [8]. This means that policy should create an environment in which entrepreneurs can start their own businesses without fear of failure. Fails in the growth of companies and entrepreneurs need to not become a burden on the economy to help.

Classification	Contents
Supporting Target	Regional-specific convergence VR and AR technology-based enterprises and startups
	• Enterprises in specialized industries and content production companies with 5G, VR, and AR technologies
	• VR and AR content tasks composed of consortiums with local companies
Supporting field	Specialized industries such as aviation, IoT, and 5G-based VR and AR contents
	• 5G-based content: High-capacity, high-quality content types that enable uninterrupted real-time experience and interaction with cloud servers and 5G wireless networks.

Table 1.
Fostering realistic content.

3

It is to complete a circular structure in which start-up companies can lead to new investments again through growth and spread. Therefore, early start-up companies should not have difficulty raising funds and securing talent.

2.3 Fostering realistic content

This project will be carried out as a project to foster new industries that foster innovative growth bases for industries by establishing 5G-based VR/AR platforms in connection with strategic industries, which are future growth engines. The main task is to create and utilize a development environment in VR and AR production base centers. It supports equipment and systems for technical support such as production and demonstration of convergence VR and AR contents (**Table 1**).

2.4 Building a cluster for revitalizing the unmanned aircraft (drone) industry

This project is a cluster construction project that builds a drone-only flight test site, in the landfill, in the Seoul metropolitan area, supports drone-related companies, and creates a space for civic experience (education) to create a foundation for fostering new industries.

The project will establish a foundation for revitalizing the drone industry by providing a drone-only test site so that safety tests can be freely performed for a certain period of time at the request of operators (users) to support various flight test conditions such as night and altitude. It will build infrastructure facilities such as control towers, maintenance warehouses, offices, and take-off and landing sites.

The expected effect of this creates a foundation for establishing the drone industry promotion policy of the Ministry of Land, Infrastructure, and Transport, thereby providing conditions for fostering new industries. It creates a synergy effect of expanding the base of unmanned aerial vehicles, such as attracting related industries. Policy and technical support through the support of experts from the Ministry of Land, Infrastructure, and Transport and the Korea Aerospace Exploration Institute will be needed (**Table 2**).

2.5 Supporting innovation growth in robot industry

There is a need for bold fostering and support policies to enhance the competitiveness of the robot industry. It is necessary to establish a mid-to a long-term plan to foster the robot industry as a specialized industry by setting five major policy directions.

Stage	Content
1. Securing the site	• Establishment of drone cluster construction plan and securing site
	• Completion of a drone-only flight test site
2. Perform Design	• Perform basic design for drone cluster construction
	• Supporting drone flight test sites and creating a citizen experience space
3. Operation	• Corporate support for drone clusters and operation of citizen experience space

Table 2.
Building a cluster for revitalizing the unmanned aircraft (drone) industry.

Specifically, it will create a representative robot ecosystem through the successful creation of Robot Land. It is necessary to establish a support system to discover and intensively foster the specialized robot field and foster the robot industry by supporting the innovative growth of robot companies and establishing and spreading robot culture among citizens.

The main task is to create infrastructure to foster the robot industry such as Robot Land. By creating the Robot Land, robot industry promotion facilities will be activated, and robot test and certification support centers will be established. It fosters robot start-ups and supports the innovative growth of robot companies.

Furthermore, it spreads robot culture among citizens. Through this, cultural projects that can raise awareness of robots and induce citizens' interest are carried out. Robot characters and content are developed and citizen participation in robot competitions is held.

Also, specialization creates the demand for robots. Through supply–demand matching, conditions for creating and revitalizing the robot industry ecosystem are created. Improve the organizational system and system for upgrading the robot industry system. Establish a cooperative system for robot companies and strengthen system improvement and support organizations (**Table 3**).

2.6 Recruitment and operation of private start-up training institutions

It is necessary to select a private fostering institution with the capability and infrastructure to discover and foster big data and AI-based startups that will lead to new industries by linking smart cities and bio-fusion. It supports private organizations

Strategy	Content
Creating a robot ecosystem	Development of robot-related industries, businesses, theme parks, housing, and commercial facilities
	Building a cluster of robot industries by attracting and revitalizing robot industry promotion facilities (Robot Tower, Robot R&D Center)
	Based on standards and technical standards, testing, inspection, calibration, and certification services such as reliability, performance, and safety of Korean robot companies are provided
Innovative growth of robot companies	Robot start-up discovery, start-up space operation, start-up, and job support
	New R&D Support for Robot Companies
	Support for patenting, testing, and certification of robot products
	Support for participation in promising domestic and foreign exhibitions in the robot field
	Networking support for robot companies
	System Improvement and Policy Development for Robot Industry Development
Spreading robot culture to citizens	Development of robot characters, establishment of robot experience center, and holding robot-related competitions robot idea contest, promote robot-related cultural events
	Robot training, camp operation

Table 3.
Supporting innovation growth in robot industry.

and companies that have the capacity and infrastructure to support startups and meet the qualifications.

As for the contents of the support, space to discover and foster startups and common and specialized startup programs (evidence, R&D, education, etc.) are supported. The selection of tenant companies shall be promoted through the formed committee. Rent for space will be provided free of charge for up to 5 years to tenant companies, and major fostering industries through common and specialized startup programs will be selected as fourth industry-specialized fields, such as big data, AI, blockchain, and IoT.

3. Smart city strategy

Currently, many local governments are promoting or planning to promote platform-oriented smart cities. It is also aware of the importance of the platform when promoting smart cities, but it is still in the early stages of settling down where the results of the smart city platform are not as expected.

The distribution of urban integrated operation centers, which can be said to be the physical infrastructure of platform-oriented smart cities, is held by many local governments from the beginning, and local governments using self-communication networks are also showing a high rate. In addition, an integrated platform with a public nature is also expanding its construction through distribution and diffusion projects to local governments every year. While the distribution of physical infrastructure and integrated platforms is being structured or rapidly spreading, the data linkage and utilization sector, which is the core of platform-oriented smart cities, is still insufficient, causing low achievement of platform-oriented smart cities. In order for platform-oriented smart cities to be implemented, the most important direction is to promote policies so that more data can be linked and utilized, and in addition, platform policy directions should be established so that various subjects can participate and spread spatially. In fact, it will be possible to achieve the goals pursued by platform-oriented smart cities only when public and private data are linked and integrated, and at the same time, their joint use gradually spreads locally.

3.1 Seeking ways to link with private data

The current level of domestic smart cities is limited to linking and utilizing public data between different service fields. In the case of overseas, there are some cases in which private big data is used together with public data based on the platform of the urban integrated operation center. The biggest problem in linking private data with the platform in the domestic urban integration operation center is linked to the Personal Information Protection Act. Local governments' opinions also argue that the integrated platform should be partially opened to increase its utilization.

Due to the existence of personal information in the integrated operation center and platform, local government officials are reluctant to actively develop and link solutions, and they are burdened by the law in terms of introducing and linking smart city solutions. While interest in platform-linked smart cities is mentioned, as the highest target type of local governments, the fiscal investment sector is the lowest so far. Therefore, there is a need to promote platform linkage as a national project so that smart city solutions suitable for the characteristics of local governments can be

discovered. If a pilot project linking private and public data is promoted by combining various newly introduced regulatory sandboxes, local governments will be able to push for a more distinctive smart city with the central government's budget support.

Among the current government's smart city promotion strategies, problem-solving smart city-type urban regeneration targeting areas with innovative industries through national pilot cities have clear goals. However, in the case of existing urban areas, including new cities, where construction has been completed, there is an area where the identity of the goal is ambiguous. Therefore, as one of the goals of upgrading smart cities, it is necessary to seek ways to upgrade to data-oriented smart cities in the form of discovering and distributing private and public data-linked services as well as the current integrated platform distribution project.

In terms of technology, the current closed smart city platform, which is disconnected from the external network, should be upgraded to an open smart city platform so that information can be disclosed and provided. Due to regulations related to personal information protection, the current smart city platform is cut off from the outside world. Since there are definitely limitations in linking only public services, there is also a need to convert to a platform form in which data can be opened in order to expand its functions. Since it is practically impossible to switch from a closed platform to an open platform, due to current regulations, the most realistic alternative would be to apply it first using the regulatory special cases of the national pilot city currently being promoted and gradually spreading after a successful demonstration.

3.2 Smart city with innovative space creation

Smart cities that create innovative spaces can be seen as a type that lags behind in Korea compared to advanced countries abroad. The creation of innovative spaces includes demonstration and inter-city networks, and in the case of demonstration, there are many factors to consider, such as deregulation, goal-oriented performance indicators, open data policies, living labs based on civic participation, and new industries. Since inter-city networks simultaneously play a role as knowledge exchanges and potential overseas markets, global network support is needed at the national level.

Since discussions on innovative space creation-type smart cities have recently begun in the domestic smart city policy sector, it is necessary to consider various strategies. As can be seen from the results of the local government's survey, there are few local governments that are currently promoting innovation space creation in smart cities in Korea, but as can be seen from domestic keyword analysis, keywords related to innovation have increased significantly over the past 2 to 3 years.

3.3 Introduction of practical regulatory sandboxes

With the recent revision of the Smart City Act, national pilot cities have introduced and operated regulatory sandboxes. However, domestic regulatory sandboxes have the nature of regulatory exceptions for prescribed industries such as self-driving cars and drones, which the government believes have potential rather than discovering unexpected new innovative industries. Regulatory sandboxes promoted in Japan are more comprehensive than national pilot cities in Korea because they try to introduce a method of granting regulatory deferral by deliberating on proposals from private companies that want to test new industries. Therefore, it is necessary to expand the subject of regulatory grace in the direction of Japanese-style regulatory sandboxes that can further expand the scope of regulatory sandboxes.

As in the case of Japan, in order to implement regulatory sandboxes, the legal system needs to be improved in the short term, and it is also necessary to consider the management and operation of regulatory sandboxes. First, an organizational system related to the regulatory sandbox should be formed after the revision of the law in the form of a complete regulatory sandbox in the current form of special regulations. Two support organizations are needed to manage and operate regulatory sandboxes.

First, it is necessary to evaluate private companies' proposals for testing new industries in the regulatory sandbox, and at the same time, to monitor the performance and side effects of the new industry testing process of private companies. The role of the support center is to establish standards for allowing proposals, review the contents of proposal evaluation, determine acceptance levels, continuous monitoring of performance and side effects in the experiment process, and secure and promote markets for new industries that have been successfully demonstrated.

Second, a one-stop regulatory improvement center is needed. Most of the new industries that are newly tested in the regulatory sandbox are industries that are difficult to spread to other regions due to regulations. Therefore, it is necessary to operate a regulatory improvement center that monitors the tested process and supports the promotion of regulatory improvement at the same time if there is a high possibility of success. In general, it takes about 2 years until regulations are improved and legalized, so tests and regulatory improvement preparations need to be carried out in parallel so that they can be used immediately after a successful demonstration [10].

3.4 Promotion of special industry classification in smart urban industries

On the other hand, although the concept of smart cities is ambiguous and the definition and classification of related industries are unclear and extensive, efforts need to narrow the scope of smart city industries to revitalize the smart city innovation ecosystem. As seen by integrated platform construction companies, the standard industry classification code is a mixture of manufacturing and software developers, and there are limitations that it is difficult to define the smart city industry based on the existing classification criteria. Therefore, it is necessary to quickly establish special industry classifications related to smart cities by referring to special classifications, such as the spatial information industry, and gradually supplement them in the future.

3.5 Improvement of smart city certification and standardization system

It is expected that new services will be derived by converging and combining existing services in relation to the smart city industry. Standardization should be supported, so that different services are linked and compatible under these conditions of convergence. Therefore, when various smart city services are developed, it is necessary to present guidelines related to standard procedures and frameworks to enable convergence, complexity, and interoperability based on compatibility [11]. These efforts are related to entering not only domestic but also overseas smart city businesses, and for this, international cooperation related to smart city standardization is also needed.

3.6 Social and cultural innovation

Sociocultural innovation can be said to be the most abstract and difficult to present measures compared to the innovations of the assets discussed above. In the case of networking assets discussed in urban innovation spaces, a culture that allows people to

interact and talk with each other may be a more appropriate model for the West than for the Asian region. However, in Korea, if various community activities are activated and an environment where people can gather is created, the possibility of physical networking can increase. In fact, the prerequisite in terms of revitalizing platforms and networking assets is that cities should play a role as a place where various people meet, share opinions, and communicate offline as well as on online platforms.

3.6.1 Fostering an adventurous entrepreneurial spirit

First of all, socio-cultural innovation is needed in relation to the training of talents who are the basis of networking. It was found that domestic companies lack entrepreneurship to enjoy the adventure without fear of risk, and job seekers prefer stable jobs (Asan [12]). It can be seen that this trend of job preference does not solve the most fundamental problem of forming a smart urban innovation ecosystem. Therefore, it is necessary for the public and private sectors to cooperate to educate entrepreneurship so that the start-up culture of enjoying and attempting new adventures can spread (Asan [12]).

In addition, it is related to socio-cultural changes, and even if necessary manpower is trained in many universities, their careers cannot be connected to related majors and there is a problem of preferring stable jobs such as public officials. As such an example, a survey of high school students' future hopes showed that 50% preferred stable jobs such as public officials and professionals (Asan [12]). For this reason, it is necessary to recognize the perception that business activities related to start-ups can be stable for those who are worried about their careers. This direction can be resolved in a way that the government bears the failure, as previously discussed in the policy related to the revitalization of start-ups.

3.6.2 Promoting citizens' awareness of participation in smart city policies

If there is a difference between the smart urban innovation ecosystem and the general economic innovation ecosystem, it may be related to improving the quality of life of citizens. In other words, in order to revitalize smart urban innovation ecosystem, solving urban problems recognized by citizens, and creating a better city is a condition for revitalizing the smart urban innovation ecosystem. Therefore, it is necessary to collect opinions from citizens and create a system so that they can participate in urban policies and contribute to the city by providing urban problem solutions.

The way to influence citizens' smart city policies is to use civil petition data. However, it is necessary to introduce a direct democracy method rather than an indirect method using civil petition data to create a system so that citizens can directly propose urban policies and actively engage in urban management, and encourage citizens to participate in policies. In terms of technology, digital democracy using blockchain technology is under discussion, and there are cases that implement this. If direct democracy such as digital democracy is expanded, citizens' interest in policy participation could increase.

4. Conclusions

This study presented a framework for establishing the concept and analyzing components of the smart urban innovation ecosystem in detail through literature research. The smart urban innovation ecosystem framework includes platforms,
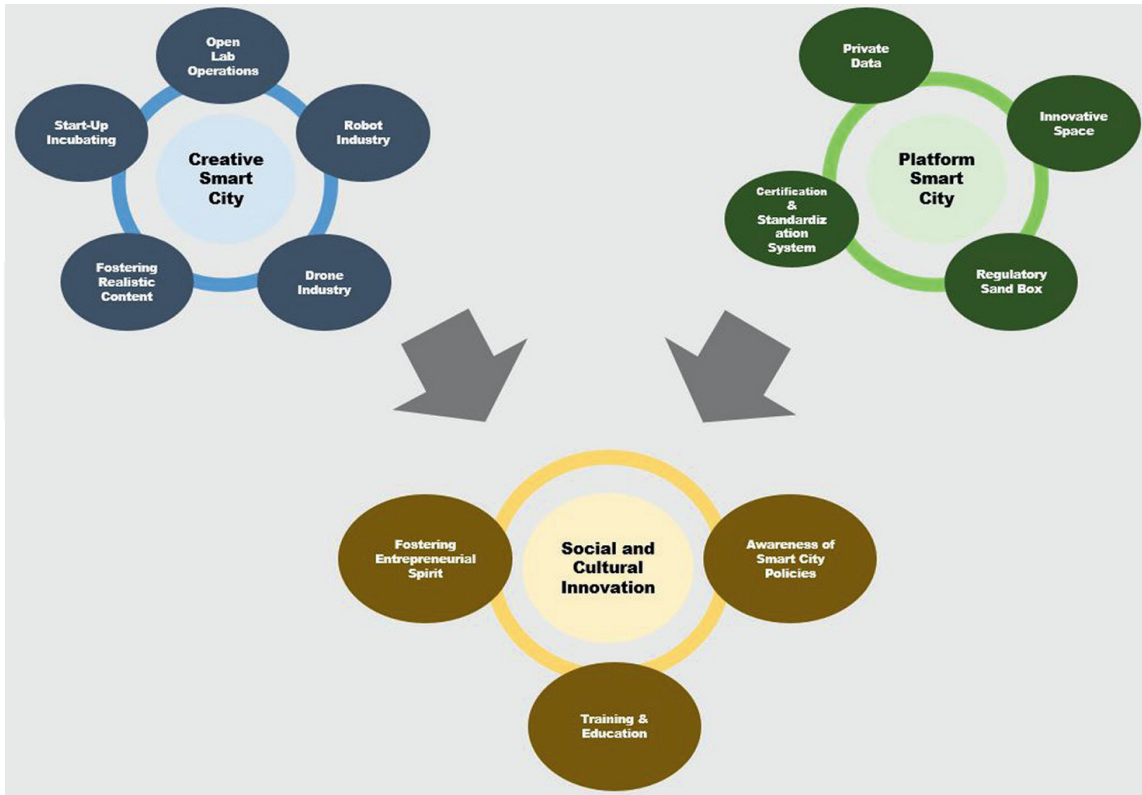
Figure 1.
The framework of the smart urban innovation ecosystem.

physical assets, virtual assets, human assets, economic assets, institutions, and social culture as components, among which platforms, that is, networking assets, are the most important (**Figure 1**). Here, the platform is a platform as a city mentioned in a smart city and refers to both a digital platform in a virtual space and a platform in a physical space and a virtual space that encompasses networking assets discussed in an urban innovation space.

Based on the smart urban innovation ecosystem framework, this study discussed ways to improve the innovation of each innovation ecosystem component and revitalize the overall innovation ecosystem, focusing on the platform. As the term ecosystem implies, which means the circulation of matter and energy, there is a connection between each innovation ecosystem component, and if the connection between them is not smooth, the spread of innovation and innovation of the components is difficult to occur. For example, human assets affect not only virtual assets, such as the collection of big data and analysis using artificial intelligence in terms of technology development, but also economic assets in terms of entrepreneurship and smart urban industry.

In the case of the startup ecosystem related to the innovation ecosystem in terms of economy, it may seem related to the industrial economy, but as seen in Urban Tech, it is an important element of the smart urban innovation ecosystem in that there are many startups related to urban problem-solving. These startups emerge, spread, and lead to innovation in physical and virtual assets. To lead this creativity, talent needs an entrepreneurial spirit to enjoy the adventure without fear of risk, which must be accompanied by socio-cultural innovation that supports new attempts and helps them recover even if they fail.

In terms of institutional aspects, existing smart city policies have carried out various institutional support projects such as infrastructure construction, R&D projects for technical support, and talent training projects. It is true that such institutional

support contributed to the development of domestic smart cities, but the private sector and citizens were passive in the process of implementing these policies due to the government-led top-down ordering method. In the future, there should be institutional support so that the private sector and citizens can play a leading role in establishing smart city policies. In addition, it is necessary to improve various regulations, such as improving the Personal Information Protection Act, and ultimately seek ways to realize comprehensive negative regulations. In addition, in order to present specific measures for the creation and revitalization of the smart urban innovation ecosystem, it is necessary to preemptively present the concept and scope by introducing a special classification of the smart urban industry.

Ultimately, it is necessary to activate the platform so that the innovations between these assets can be smoothly connected. Until now, it can be said that discussions are underway rather than implementing smart cities as platforms. As an ideal platform, smart cities are not only virtual city platforms that collect, analyze, and simulate urban data, but also online and offline platforms that integrate physical and virtual environments by expanding physical networking to exchange ideas through offline community activities.

Author details

Jae Eun You[1] and Jong Woo Choi[2*]

1 Graduate School of Public Administration, Seoul National University, South Korea

2 Digital Agriculture and Technology Management Lab, Department of Agricultural Economics and Rural Development, College of Agriculture and Life Sciences, Seoul National University, South Korea

*Address all correspondence to: youchoi817@snu.ac.kr

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