Citizen Engagement in Smart City Planning: The Case of Living Labs in South Korea

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Article

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Abstract
The smart city is recognized as a new city model for inclusive urban planning. Many local governments are making smart city plans to develop new policies that manage urban issues in South Korea. They identify issues through citizen surveys and decide which issues should be managed with priority. Some governments test developed policies based on citizen engagement. Most local governments use the living labs to encourage citizen engagement in smart city plans since these are public spaces where planners engage citizens to develop innovative and inclusive ideas. This study conducted a content analysis of smart city plans of local government. We analyzed the various approaches to the living lab and examined the stage of the planning process it is utilized in. Additionally, we identified the barrier to the living lab by interviewing people who participated in the smart city plan. According to the analysis, a barrier to citizen engagement exists in smart city plans; most citizen engagement is only used when planners develop ideas for setting visions and goals. It implies that citizen engagement occurs at a limited level in smart city plans and may cause planning to be less inclusive. We suggest that citizen engagement should be considered in the whole planning process to improve the inclusiveness of smart city plans and encourage sustainable citizen engagement.

Keywords
citizen engagement; inclusiveness; living lab; local government; smart city plan

1. Introduction

Urbanization has improved citizens' intimacy with cities and made their lives more pleasant, but citizens also face numerous problems with an urban environment, such as sustainability and quality of life issues (Basiri et al., 2017). To address problems, city planners and local governments have tried to design a more sustainable and pleasant city. However, it is questionable whether these efforts have observable effects on citizens or whether these policy efforts are meeting their needs. Additionally, some problems should be addressed through social consensus by synthesizing the opinions of various groups; still, it is questionable whether all these processes have been sufficiently conducted in traditional urban planning.

In this regard, local governments have tried to find alternatives to manage urban issues and meet the needs of citizens in urban planning, for which a smart city is a powerful alternative addressing the limitations related to city management and fulfilling citizens' requirements (Kirimtat et al., 2020).

A smart city is a new model for contributing to cities' sustainability and managing the problems that modern cities face (Bibri & Krogstie, 2017; Kirimtat et al., 2020). The smart city is generally conceptualized as an innovative city that uses information and communication technologies (ICT) and other means to improve the quality of life, efficiency of urban operations and services, and competitiveness of the city (International Telecommunication Union, 2014). For urban management, a

smart city is considered a city that monitors and integrates conditions of all its critical infrastructure, optimizes its resources, plans its preventive maintenance activities, and monitors security aspects while maximizing services to the citizens (Hall et al., 2009). Additionally, a smart city means smarter urban areas made by investments in human and social capital and traditional and modern (ICT) communication infrastructure which fuel sustainable economic growth and high quality of life, with a wise management of natural resources (Caragliu et al., 2013). Moreover, the smart city can induce citizen participation in addressing controvertible issues through innovative communication technologies such as e-participation or e-government (Conroy & Evans-Cowley, 2006; Zheng, 2017), so these cities have an advantage in using citizen participation for urban management (Tadili & Fasly, 2019). Therefore, urban planners are expecting smart cities to address the challenges faced by conventional urban planning efforts since a smart city is not only built on an intelligent combination of endowments and self-decisive activities but also pursues sustainable growth and high-quality of life through participatory governance of citizens (Caragliu et al., 2013; Chourabi et al., 2012; Giffinger et al., 2007).

Regardless of the type or ideal of a city, it is essential to ensure that governments and planners respond to the needs and demands of citizens to solve city problems (Fung, 2015). Therefore, using citizen participation is considered the hallmark of effective democratic governance (Barber, 2003; Teorell, 2006; Verba et al., 1995), which can be well utilized in the smart city. Considering the purpose of a smart city, which is to solve the city problems experienced by citizens, citizen participation is an essential element in smart city plans (SCPs), and local governments are exploring possibilities to let their citizens participate through new interaction platforms (Coleman & Blumler, 2009). As a new method for promoting close interaction with grassroots initiatives (Buscher et al., 2010), the living labs are being actively used in numerous city planning initiatives, including SCPs. A living lab aims to stimulate an inclusive and collaborative system for shaping smart cities (Bifulco et al., 2017; Santonen et al., 2017). SCPs induce citizen participation in living labs to identify main issues and propose smart city strategies. For example, Amsterdam has tried to use citizen participation to develop smart city solutions, strategies, and services by encouraging citizens to provide feedback for services and advancement processes. Likewise, although the maturity of citizen participation differs from representative cases such as Amsterdam, most cities also use citizen participation to identify planning issues and establish SCPs in South Korea.

The differences between citizen participation levels using living labs in smart cities may be attributed to differences in the perception of whether it is beneficial. The dominant orthodoxy surrounding citizen participation in city planning states that citizens play a crucial role in smart cities regarding their participation in governance (Meijer & Bolívar, 2016; Przeybilovicz et al., 2022; Webster & Leleux, 2018). Przeybilovicz et al. (2022) argue that citizens or communities are the city components that make smart city initiatives responsive and balance the needs of different stakeholders for inclusive planning. However, other scholars skeptical of citizen participation in the planning process point out that it is necessary to discuss the conditions that justify citizen participation costs instead of simply putting blind faith in its positive aspects (Barnes et al., 2003; Michels & De Graaf, 2010). The skeptics also question whether its cost is economically reasonable and, more fundamentally, whether it is genuinely in the common interest of all citizens. However, despite this debate, there is a consensus that involving a wider variety of actors in the planning process based on citizen participation is significant for inclusive planning. For better citizen participation, it is necessary to review the limitations faced by citizen participation and find ways to improve them. While the focus is slowly shifting from "smart technologies" toward "smart citizens," citizen participation needs to be induced and the traditional top-down approach should be connected with a grassroots or bottom-up approach (Baccarne et al., 2014). In other words, it is necessary to build and operate smart cities with the active participation of "smart" citizens who are passionate about citizen participation at the center, rather than being centered on smart technology. This change is apparent in that the municipality's paradigm shift emphasizes citizens' contributions over its predecessor's tech-driven design (Angelidou, 2017). In this regard, this study analyzes local SCPs to identify how living labs are used in them as a citizen participation tool and examines the stages in which living labs are mainly applied. We also conduct a thematic analysis of the barriers and limitations of utilizing living labs for citizen participation in the SCPs.

2. Citizen Participation in the Planning Process

2.1. Citizen Participation in Urban Planning

Unlike when urban planning was the exclusive domain of planners and local governments, it has recently been changing to reflect inclusive opinions through the participation of various stakeholders, including citizens. As the interest and importance of citizen participation in the planning process increase, the conditions for citizens to participate in various stages of this process through various tools are also expanding. It has received interest ever since Arnstein (1969) presented the "ladder of citizen participation" study in academic fields (Konsti-Laakso & Rantala, 2018). Arnstein's (1969) classic highlighted the importance of citizen participation in various fields, especially in urban planning where inclusive opinions on a single objective such as the quality of citizens' lives are important.

Citizen participation is essential in inclusive policymaking because it is a strategy that allows non-

stakeholder groups to participate in sharing information, setting goals and policies, and deciding how to allocate tax resources (Konsti-Laakso & Rantala, 2018). Additionally, citizen participation has become routine and an expected feature of public policy-making such as urban planning, because of its implication for the right way to inclusive planning (Bingham et al., 2005). It tends to be applied in urban planning based on its purposes: identifying and collecting data, establishing legitimacy for the planning effort, and addressing the moral and ethical commitment of planners to ensure that those who are the most affected by a given decision have a hand in making it, developing robustness by bringing the widest possible set of views to the table (Seltzer & Mahmoudi, 2013). In other words, citizen participation can contribute to creating new knowledge and perspective and diffusing knowledge to other stakeholder groups (Konsti-Laakso & Rantala, 2018; Tritter & McCallum, 2006).

According to the above argument of citizen participation, we can assume that citizen participation will be more powerfully valuable for the urban planning process because urban planning is the comprehensive process of policy-making that derives a joint and inclusive agreement from different values for the same space. Regarding citizen participation in urban planning, IAP2 (2018) classifies the level of citizen participation into five stages: information, consult, involve, collaborate, and empower. In the "information" stage, citizen participation aims to provide information to help citizens understand problems, alternatives, and solutions in passive steps by providing data and building websites. In the "consult" stage, planners try to get feedback for decision-making through hearings, surveys, and public meetings based on citizen participation. Further, citizens directly participate in the planning process in the "involve" stage by utilizing workshops, discussions, and votes. In the "collaborate" stage, citizens earnestly work with policymakers in each aspect of the decision, including developing alternatives and identifying preferred solutions. Lastly, citizens make a final decision through citizen juries and referendums in the "empower" stage. Recently, most planners have been trying to apply citizen participation at a level like involve, collaborate, and empower stage, away from the information and consult stages, which can be attributed to recognizing the limitation of traditional citizen participation methods (Innes & Booher, 2004). In other words, traditional methods such as hearings, comment procedures, and reviews, are organized to satisfy legal requirements, not to cause learning and provide space for new ideas to emerge (Innes & Booher, 2004; Konsti-Laakso & Rantala, 2018).

There is a tendency for the application of citizen participation to be more potent in innovative urban models like SCPs, and the above efforts are prominently marked there. Unlike traditional urban planning, there is a tendency for lots of projects to be implemented based on

the citizens' needs, with them actively participating in the planning process of the smart city. The reason for this is that citizen participation is the key challenge to developing a smart city project since the main objective of the smart city is to improve the quality of citizens' lives (Tadili & Fasly, 2019). The development of innovative communications technologies, such as ICT, also contributes to inducing better citizen participation in the smart city (Zheng, 2017). Using technology, they can access various information and share content with ease. They can also participate in the planning process without restrictions on space in the city. This technological improvement in the convenience of citizen participation through this technological leap promotes participation in line with the recognition of the importance of citizen participation in smart cities.

Although a participatory environment sufficiently supports citizen participation in the urban planning process, why are only a few citizens involved in the planning? Empirical evidence suggests that relatively few citizens participate when given the opportunity (Rydin & Pennington, 2000) and it has led to an interest in the issue of who will participate under what circumstances (Wandersman & Giamartino, 1980). Parker and Murray (2012) argue that if people do not get involved, it is not enough for planners to blame this on apathy. They also note that although improving relevant knowledge and awareness of the citizens' motives should be supported, interest in them is too negligible (Parker & Murray, 2012). Regarding the limitations of inducing citizen participation, developing the human capacity, like cities' social capital, is recognized as the basic ingredient in urban planning (Angelidou, 2017). Citizens' knowledge of the region helps make policies (Baker et al., 2007; Li et al., 2020) and local members' continued efforts to diagnose problems and make solutions are more likely to form a basis for a city to be resilient (Mahdavinejad & Amini, 2011). Therefore, it is noted that not only environmental improvement mentioned above but also educational measures to improve the awareness of society and interest in urban planning are essential for enhancing citizens' motivation to participate.

2.2. Living Lab: A Citizen Participation Tool in Urban Planning

The importance of citizen participation has been espoused in planning for decades. To this end, the existing urban planning stipulated a citizen participation system using tools such as surveys, disclosure of information, listening to residents' opinions, and public hearings (Greater London Authority, 2004; The City of New York, 2021). Although citizen participation has become a common practice in the field of urban planning, the related studies highlight a slender influence on the actual planning process (Backlund & Mantysalo, 2010; Beresford & Hoban, 2005). One of the reasons identified is the inadequate and uncomfortable methodology, such as public

hearings and written statements (Innes & Booher, 2004; Kingston, 2007). There is also doubt about whether the information collected through citizen participation influences the planning outcomes (Koontz & Thomas, 2006). That is, such a traditional method for citizen participation usually may end with monotonous and passive participation. Recognizing the limitation of traditional tools for citizen participation, planners and local governments have recently been trying to use citizen participation in the planning process, aiming to establish plans that can reflect the various demands of citizens, breaking away from the top-down method. They are also making an effort to develop the city as a laboratory to generate innovative solutions (Juujärvi & Pesso, 2013), an approach that aligns with the living lab concept.

The living lab is in line with an innovative change in urban planning related to citizen participation as mentioned above. A living lab is an appropriate tool for citizen participation in urban planning, which is a concept of user-centered, open innovation ecosystems based on a systematic user co-creation approach in public–private–people partnerships, integrating research and innovation processes in real-life communities and settings (European Network of Living Labs, n.d.). In the living lab, the public–private–people partnership structure, interactions between public, private, and people act as a core competency of citizen participation (Kuronen et al., 2010). Participants are given the same status as existing innovative entities (public, private) and expand the scope of cooperation between subjects to enhance the continuity of citizen participation. These can enhance user participation in the activities occurring in living labs (Seong & Park, 2015) and expand cooperation with existing entities to accelerate development. The living lab also functions as a method to embody and solve the problems experienced by residents by operating on a bottom-up governance basis (Kuronen et al., 2010), unlike other citizen participation tools. In this way, living labs can effectively identify the problems felt by citizens and develop field-oriented alternatives by collecting opinions from various stakeholders. Living lab's characteristic allows citizens to learn about pending issues in the region where citizens live, away from existing passive participation. In other words, there has been a notable shift from passive user feedback to a more active approach based on users' involvement (Cardullo et al., 2018). The characteristic of the living lab has established itself as an effective tool to achieve the purpose of citizen participation in urban planning.

Although the usage of living labs has positive effects in encouraging meaningful citizen participation in the planning process, why do only a few local governments adopt it? Moreover, why do some local governments hesitate to use living labs for citizen participation? First, the difficulty of organizing the participants for the operation of living labs is the representative reason. Empirical evidence already suggests that relatively few citizens participate when given the opportunity (Rydin & Pennington,

2000). Furthermore, as mentioned before, the skeptical need to discuss the conditions that justify citizen participation costs instead of simply putting blind faith in its positive aspects (Barnes et al., 2003; Michels & De Graaf, 2010) may hinder the adoption of living labs for citizen participation. This study initiated the identification of these problems and tried to analyze the barriers to the usage of living labs and present suggestions for addressing them based on semi-structured interviews about SCPs in South Korea.

3. Method

3.1. Data

This study aims to analyze how citizen participation is performed under SCPs and identify barriers and suggestions to living labs in SCPs. In South Korea, the Act on the Promotion of Smart City Development and Industry states that local governments need to establish an SCP first before starting a smart city project (The Ministry of Land, Infrastructure, and Transport, 2021). As of September 2022, out of a total of 229 cities, 45 cities including most of the metropolitan areas, such as Seoul, Incheon, and Gyeonggi, have adopted SCPs. According to the law, the contents of SCPs must include the basic directions, goals, and strategies of smart city construction while taking into consideration the characteristics and current situation of the region. In most regions, citizen participation is actively used for the analysis of local characteristics and developing strategies through surveys, living labs, or other tools. This study targeted those 45 cities that adopted SCPs to analyze what stage of the planning process citizen participation is utilized in SCPs, using contents analysis of SCPs. Additionally, this study conducted thematic analysis through semi-structured interviews with public officers working for smart cities and living labs to derive the barriers and suggestions for future living labs.

3.2. Contents Analysis

Prior to analyzing the detailed contents of SCPs regarding citizen participation, we classified it into three stages: Issue Identification, Problem-Solving, and Implementation and Feedback. For smart cities, citizens can take a role in discovering necessary urban services as democratic participants, and as creators who directly participate in problem-solving with local governments or users who create better services by providing solution execution and feedback (Callahan, 2007; Simonofski et al., 2017, 2019). Considering the role of citizens and active participation in SCPs, we re-organized the five traditional citizen participation stages in urban planning by IAP2 into three stages for SCPs, combining some stages with similar characteristics like "consult" and "involve" or excluding "information" stage that do not show more active participation (Figure 1).
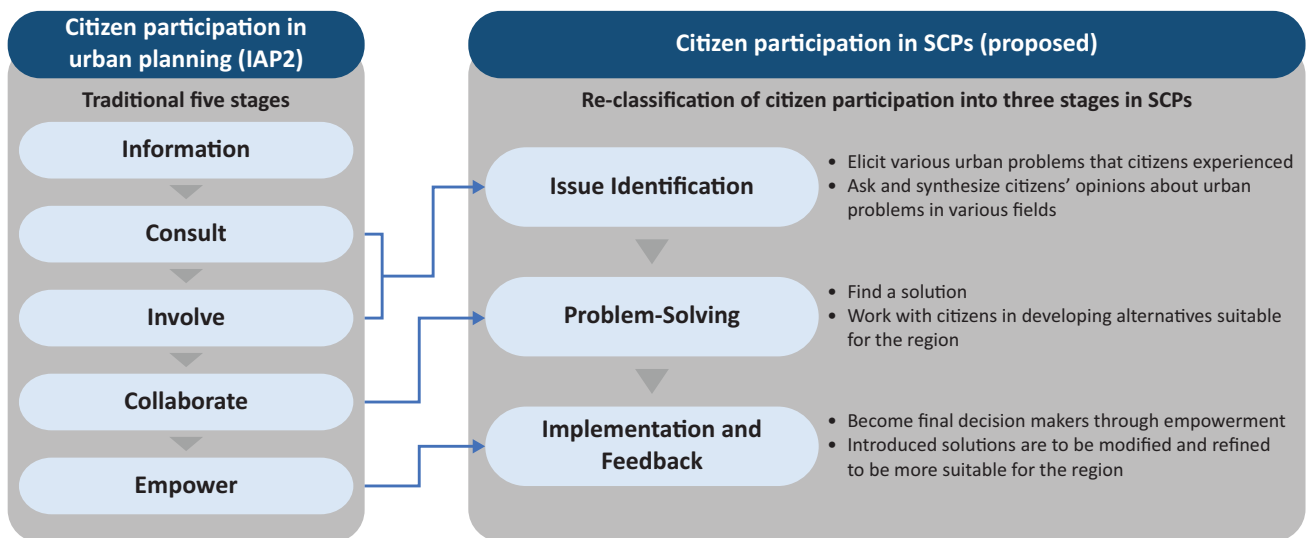
Citizen participation in urban planning (IAP2)	Citizen participation in SCPs (proposed)

Figure 1. A framework of re-organization of citizen participation in SCPs.

First is Issue Identification, which is a process that listens to citizens' opinions and elicits various urban problems. At the beginning of smart city planning, there is a need to ask and synthesize citizens' opinions about regional problems they suffered in various fields. The second stage, Problem-Solving, aims to solve the problems derived through the first stage, going through the process of finding a solution. In this process, citizen participation affects the development of alternatives suitable for the region. In executing the solution in the community, citizens become final decision makers which can be linked to the third stage, Implementation and Feedback. At this stage, the introduced solutions are to be modified and refined to be more suitable for the region. This study classified 45 local SCPs according to the above citizen participation stage presented in each plan, analyzed the citizen participation tools mainly used in each stage, and further reconstructed the local SCPs centering on the stage of citizen participation in which the living lab is used. To this end, we conducted a content analysis of SCPs, including not only citizen participation that had already been implemented in the actual planning process, but also future citizen participation planned in the smart city service solution and monitoring stage.

3.3. Interview Protocol

We used the semi-structured interview to collect data regarding the barriers to living labs for SCPs and suggestions for improvements. Interviews were conducted over the phone or in writing because face-to-face interviews were limited due to the Covid-19 pandemic restrictions. We recruited interview participants considering the type of each SCP depending on the citizen participation stage of the living lab. Five public officials who experienced living lab for SCPs or were in charge of SCPs participated in interviews from August 26, 2022, to September 6, 2022. Four interviewees, whose partici-

pants' codes were from A to D, were each from regions using living labs at the intermediate level of citizen participation. Interviewee E was from a city which did not use a living lab for SCP but had established the SCP five years ago. Interviewee A worked for an SCP, and B was in charge of overall work related to the smart city, including living labs. Interviewee C worked on establishing smart city services, and D was in charge of the smart city challenge project and related works. Using open-ended questions, we asked the interviewees about their experience of using citizen participation in establishing local SCPs, the pre-requisite and barriers to the living lab for SCPs, and some suggestions for future living labs. Lastly, participants answered the effect of living lab and citizen participation for SCPs and the suitable citizen participation stage for living lab in SCPs. Additionally, common questions set in advance were amended or added in response to the respondents' experiences with the living lab and citizen participation. Figure 2 describes the fundamental questions of the interview.

We conducted a thematic analysis based on the interview responses using MAXQDA software which is a qualitative data analysis tool. Thematic analysis is a helpful method for understanding the perspective of different interview participants and emphasizing their similarities or differences (Nowell et al., 2017; Shahab et al., 2021). We first color-coded the responses in accordance with their contents and keywords, with selected sentences and paragraphs serving as each coding segment. Then, we categorized the primary responses (coding segments) into the following seven groups: purpose, prior citizen participation experience, management procedure for the living lab, barriers, outcomes, suggestions, and planned implementation of the living lab. Next, we gathered and structured the responses in accordance with the code to look for patterns and linkages. Finally, we identified four barriers to living labs and provided recommendations for the future.
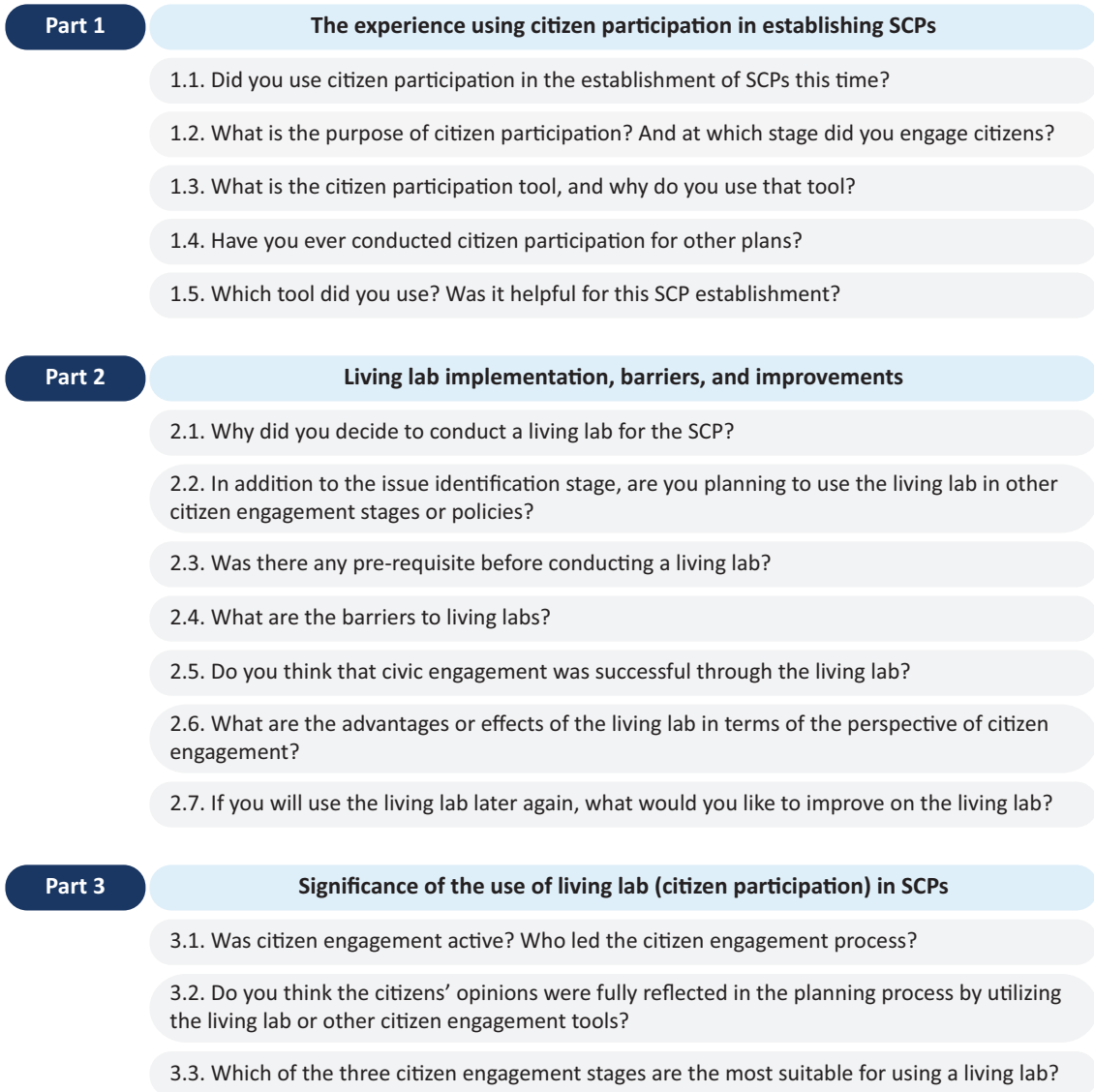
Part 1	The experience using citizen participation in establishing SCPs

1.1. Did you use citizen participation in the establishment of SCPs this time?

1.2. What is the purpose of citizen participation? And at which stage did you engage citizens?

1.3. What is the citizen participation tool, and why do you use that tool?

1.4. Have you ever conducted citizen participation for other plans?

1.5. Which tool did you use? Was it helpful for this SCP establishment?

Part 2	Living lab implementation, barriers, and improvements

2.1. Why did you decide to conduct a living lab for the SCP?

2.2. In addition to the issue identification stage, are you planning to use the living lab in other citizen engagement stages or policies?

2.3. Was there any pre-requisite before conducting a living lab?

2.4. What are the barriers to living labs?

2.5. Do you think that civic engagement was successful through the living lab?

2.6. What are the advantages or effects of the living lab in terms of the perspective of citizen engagement?

2.7. If you will use the living lab later again, what would you like to improve on the living lab?

Part 3	Significance of the use of living lab (citizen participation) in SCPs

3.1. Was citizen engagement active? Who led the citizen engagement process?

3.2. Do you think the citizens' opinions were fully reflected in the planning process by utilizing the living lab or other citizen engagement tools?

3.3. Which of the three citizen engagement stages are the most suitable for using a living lab?

**Figure 2.** Semi-structured interview questions.

4. Analysis

4.1. Citizen Participation in Smart City Plans

The type of citizen participation in most SCPs can be divided into three stages, namely Issue Identification, Problem-Solving, and Implementation And Feedback. Figure 3 describes the percentage of local SCPs using citizen participation.

Issue Identification searches the local problems for a set of visions, goals, objectives, and strategies of SCPs, which many local governments traditionally have used as surveys and public hearings. Overall, six local governments used only surveys in this stage, while living labs were also actively used by 25 local governments in this stage. Problem-Solving is the second stage that prepares alternatives for how to solve the local issues derived from Issue Identification. In this stage, 30 local governments used only living labs and nine governments

used an online platform or digital participation governance including idea competition, advisory, and others. Implementation and Feedback applies the solution derived in the prior two stages to the region and gathers feedback. In this stage, 22 local governments use living labs and only three use civic mapping or online platforms. This indicates that fewer than half of local governments are delegating initiatives to individuals, with local governments still overseeing the majority of planning processes. Many cities employ a variety of techniques to promote citizen participation, but few are used beyond the Issue Identification phase. Living labs, in contrast, are extensively used across all three stages, making them appealing alternatives for allowing citizens to take part in smart city initiatives and have more control over the planning process. Further, we analyzed how the living lab is working as a citizen participation method in SCPs and confirmed whether it is effective to engage citizens in smart city planning in Section 4.2.
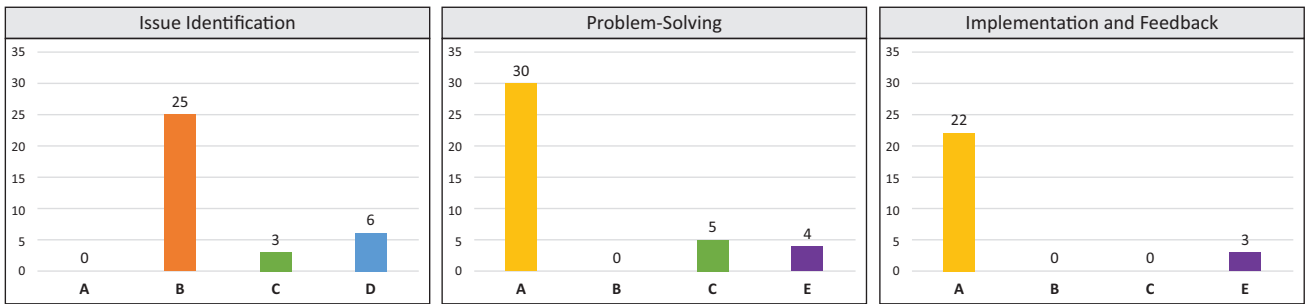
* A: Living lab only, B: Living lab + Survey, C: Living lab + Others, D: Survey only, E: Others (idea competition, advisory online platform, SNS, etc.).

Figure 3. The percentage of local SCPs using citizen participation tools in the three stages. Notes: A—living lab only; B—living lab and survey; C—living lab and others (idea competition, advisory online platform, SNS, etc.); D—survey only; E—others.

4.2. Analysis of the Use of Living Lab in Smart City Plans

Based on the three citizen participation stages, we divided local SCPs into four types in terms of the usage of living labs, as shown in Table 1.

Out of 45 SCPs, five were excluded because they did not follow the common format of SCPs, were not approved by the Ministry of Land, Infrastructure, and Transport, or were established before the relevant law was enacted. Of the remaining 40 local governments, 15% did not use living labs in SCPs, which correspond to Type A. Most of them used surveys to identify the local issues or identify the needs of citizens by analyzing civil complaint data and using digital governors. Type B, on the other hand, utilized living labs and is further subdivided into three sub-types based on the extent of use. Overall, 10% of local governments are classified as Type B1, using living labs only in Issue Identification. They all used surveys and living labs to identify local problems and other tools such as online platforms or digital twins to make a new place to communicate with citizens in the planning process. Type B2 includes 27.5% of local SCPs, which are three metropolitan and six medium-sized cities in two provinces. As they held living labs three to four times, the participants took a pre-education about SCPs and living labs in the first session as they might not know what a smart city and a living lab are. Subsequently, citizens gather to share local problems for the environment, transportation, safety, healthcare, and so on, synthesize similar problems into one theme, and decide how to solve the problems in two or three rounds. Although

Type B2 governments receive ideas from citizens, there is a limit in that it does not give citizens the authority to make detailed decisions or give feedback continuously through monitoring. Type B3 gives citizens more opportunities to solve problems and monitor implementation than Type B2. Type B3 represents 47.5%, with 10 metropolitan cities and many districts in Seoul but only one rural area. They plan to work with citizens to test solutions and evaluate them with the help of citizens as well. Additionally, some local governments like Gangseo-gu in Seoul have partnered with businesses, local stores, and citizens to demonstrate a smart order application that allows visually impaired people to easily visit and place an order. Other governments also make partnerships with universities so that citizens can continue to participate in living labs and testing projects.

4.3. For a Future Living Lab in Smart City Plans: Barriers and Suggestions

Unlike other citizen participation tools, living labs are widely utilized for identifying issues to giving feedback in SCPs, which is a relatively high level of citizen participation like Implementation and Feedback. However, most local governments have hitherto only conducted living labs for Issue Identification and Problem-Solving or do not use them; thus, we looked at why local governments are hesitant to apply living labs as a citizen participation tool in the planning process. To this end, we reveal the barriers to living labs based on the interview responses in terms of participant composition, low smart

Table 1. Type of living labs.

Type		Degree of citizen participation using living labs	Stage of citizen participation using living labs			Number of SCPs (%)
			Issue Identification	Problem-Solving	Implementation and Feedback	
A	A	Very low				6 cities (15%)
B	B1	Low	✓			4 cities (10%)
	B2	Intermediate	✓	✓		11 cities (27.5%)
	B3	High	✓	✓	✓	19 cities (47.5%)

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city awareness, rewards, and the discrepancy between living labs and actual plans. Further, we provide suggestions and improvements for upcoming smart city living labs.

4.3.1. The Gap Between the Opinions From the Living Lab and Actual Smart City Planning Reflection

First of all, the gap in objectives and expectations about SCPs between citizens and local governments can be a barrier in the living lab of the smart city. It is also related to the possibility of reflecting citizens' ideas in the SCPs. In other words, the practical impossibility of realizing the services desired by citizens causes a discrepancy between the demands of citizens and the plans. Regarding this issue, Interviewee C mentioned:

> It is impossible to implement all the policies that citizens want. Even if solutions are necessary for real life, it takes a budget from installation to maintenance and monitoring, so we cannot do everything in the region, and it takes much time to coordinate them.

In fact, the gaps might be attributed to the tendency of citizens to prioritize personal interests over the public goods of SCPs—let us suppose that only policies that are technically impossible to implement or that take forever to realize are presented for establishing plans; further, if the contents of plans represent the interests of particular classes or citizens. There is a risk that citizens' ideas will not be sufficiently adopted in the plans. Even if it is adopted, the plan may turn into a plan to pursue specific interests rather than a plan for the public interest of citizens.

4.3.2. Lack of Knowledge and Awareness

Regarding the above issues, some interviewees noted the reason is that living lab participants lack knowledge and have low awareness about smart cities and living labs. Unlike in recent years when discussions on smart cities have been relatively active, there was insufficient discussion or publicity about smart cities at the time SCPs were established. One of the interviewees mentioned that "more than 90% of citizens who responded to surveys about smart cities said they do not know the smart city." The concept is difficult to understand and vague and is challenging for citizens to recognize the smart city since any outcomes or visible effects are insignificant. Furthermore, the lack of knowledge about the smart city harms implementing living labs and finding local issues or in-need policies. According to Interviewees A and E, "citizens typically chose services they desire even if they are unrelated to a smart city, focusing mainly on the 'field' of policies like transportation, healthcare, and safety." Additionally, Interviewee D said it was hard to decide on a smart city service solution due to the lack of knowledge about smart cities.

In this regard, utilizing pre-education or seminars on the smart city and living labs would be helpful to improve the level of awareness and knowledge of citizens. Interviewee A responded that providing basic education about smart cities and living labs is needed. Interviewee B also mentioned that facilitators and experts should play an important role in delivering relevant information and recognizing the smart city concept when operating a living lab. Further, Interviewee A suggested that an online platform can be useful in inducing more citizens' participation in the living lab of SCPs because it can eliminate the spatial constraint of participation. Therefore, it will be effective to develop online content via YouTube, including the general contents of the smart city and living lab, in order to enhance knowledge and awareness. Alternatively, public officials and planners can conduct pre-living labs with facilitators and experts to set basic directions and goals for living labs before implementing multiple living labs with citizens.

4.3.3. Limitation of Participant Composition and Recruitment

It is challenging to recruit living lab participants, and there is not enough diversity in the composition of participants. The number of citizens who can participate in living labs is limited, therefore the number of participants who represent the region is significant for determining the validity and reliability of using the outcomes of living labs for planning and policymaking. In fact, some citizens prioritize personal interests over public goods. For example, Interviewee B mentioned:

> The living lab seems effective only when people from various classes or backgrounds participate. Otherwise, if residents already live in the same neighborhood and know each other well, it will be difficult to coordinate and control a conflict of interest among them. So, the living lab will likely fail or be delayed.

Another issue is that because of time and space limitations, the participants' makeup does not reflect the region's population. Interviewee B said:

> Considering the personnel of public officials and consulting companies who operate it, most living labs are operated during the daytime on weekdays, and therefore the number of citizens who can participate is inevitably limited. Further, overall recruiting living lab participants did not go well.

Therefore, the diversity and representation of living lab participants must be guaranteed to obtain high-quality living lab results.

To overcome the issue of participant composition and recruitment, living lab organizers can consider recruiting experts with knowledge in the smart city service field or living lab. Interviewee B responded:

Let's suppose residents, experts, and other stakeholders such as business operators, public officials, and planners are involved together in the living lab. In that case, the living lab can proceed in a way that can solve problems or conflict factors that may arise within the living lab.

Moreover, it is necessary to expand opportunities so that more diverse residents can participate in living labs without time and space limitations by utilizing various ICT technologies such as smartphone applications or online platforms.

4.3.4. Lack of Sustainability of Rewarding System for Citizen Participation

Planners and local governments also confront the issue of rewards for participating in the planning process. Although local governments recognize the importance of rewards for living lab participants, there is insufficient legal evidence to provide incentives to participants, and there is not enough budget to execute them. According to Interviewee A, "it is often difficult for public institutions to give cash to the public, and the legal basis for a reward for those who participate in a planning and decision-making process like the living lab is still insufficient." Such a restriction of rewards may not be proper for the citizens who participate in living labs, even if the whole objective of their participation is not about money. Moreover, the behavior of local governments encouraging citizen participation by depending on non-repudiable rewards such as money may not be sustainable for SCPs.

Therefore, planners and local governments have to provide various types of rewards based on legal standards for incentivizing the participants in the planning process. Regarding this, Interviewee C mentioned that "reward systems such as management of an innovative technology project or project leaders are being considered, in addition to providing local gift cards." Alternatively, it is also possible to grant qualifications such as project manager or committee for the entire process of planning, implementation, and monitoring of the proposed smart city projects through living labs, or rewards such as certificates and awards from local governments. For a suitable living lab, the active participation of citizens from various backgrounds and demographic characteristics should be prioritized. However, considering the time and effort required for a living lab, there will be few citizens participating in a living lab with a strong will to solve local problems. Therefore, citizens should receive reasonable rewards for participating in the living lab by establishing appropriate legal and institutional grounds, such as local ordinances accompanied by local governments.

5. Conclusions

According to the results of this study, most cities in South Korea use living labs for citizen participation in the plan-

ning process and local governments are aware that living labs for inducing citizen participation in SCPs are better than other measures. Nevertheless, most cities still only use living labs for the Issue Identification stage and are planning to expand to the Problem-Solving and Implementation and Feedback stages. For this reason, we identified what discourages them from applying living lab in the planning process of SCPs and what factors would improve the living lab environment. First, the gap between the results collected through citizen participation and the actual contents of the SCP can hinder sustainable citizen participation. However, from the local government's viewpoint, some citizens' demands tend to be personal or unnecessary to SCP, and those tend to be impossible to implement in the city. Despite this, gaps exist in the planning process and both the planners and local governments need to address them, because as the gaps deepen, citizens may lose their motivation to participate. Second, there was little awareness of the concept of "smart city," so there is a limit to inducing citizens to participate in SCPs. As a result, the organizers of living labs for SCPs can influence the results of citizen participation in the planning process. Third, public officers find it difficult to identify diverse members of living labs in each region because there are not enough residents who can participate in living labs. According to their experience, if diverse members participate, the results tend to be in the public interest; however, if a particular group or a small number of participants participate in living labs, the results tend to be biased toward personal issues not related to the smart city. Lastly, regarding economic feasibility, living labs can face cost problems that the skeptics pointed out (Barnes et al., 2003; Michels & De Graaf, 2010). Public officers shared concerns that encouraging citizen participation based on living labs would be less efficient in the process of SCPs.

Although barriers and limitations exist, there are solutions as well. First, not only citizens but also experts with expertise in smart cities should be included as indispensable members. Experts can suggest the correct directions for a smart city and play a role in coordinating decision-making among members of a living lab so that the results are in the public interest. Improving citizens' knowledge related to smart cities can also be the base for inducing citizen participation in SCPs. Second, local governments should improve residents' awareness about smart cities and living labs through various policies such as education, campaign, and public hearing, and actively utilize online platforms such as YouTube and Instagram to improve awareness among the younger generation about urban planning. As a result, planners will easily organize living labs and gather more diverse opinions through more participation of citizens who are interested in smart cities. Finally, despite the economic skepticism regarding citizen participation in SCPs, planners should provide incentives for participants to be swayed, such as a legal basis to support compensation for participants. In other words, reasonable reward standards for

time spent and costs incurred by citizens must be prepared according to local governments' financial conditions. However, planners and local governments should move away from the attitude of simply relying on only incentives or rewards for citizen participation to improve the sustainability of participation in the planning process. Living labs are a clear way to provide solutions for urban problems and have powerful advantages that can connect the local government and citizens. Additionally, it can be effective in harmonizing the traditional top-down planning structure and grassroots planning bottom-up structure of SCPs (Baccarne et al., 2014). Therefore, it is necessary that local governments efficiently address barriers to maximize the above advantages of citizen participation using living labs. We can ensure that inclusive SCPs may be possible when such limitations are effectively addressed, and SCPs utilize citizen participation suitable to local circumstances.

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Conflict of Interests

The authors declare no conflict of interests.

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