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Research Briefs

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**Reshaping the planning process
for Inclusive City in the era of
Climate Change : Designing
for-and-with vulnerable people**

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Research Summary

I . Overview

1. Research Background

- Humanity-induced global climate change and its corresponding social and economic damages have captured the attention of the public.
 - Climate change is a by-product of industrialization and urbanization. The natural environment like forests and rivers covered by artificial materials like concrete and asphalt excessively accumulates solar energy and exhaust heat, leading to the urban heat island effect.
- Climate change effects like the urban heat island effect influences all humankind. However, people with high sensitivity and low adaptation capability to adapt to environmental damage are more vulnerable to climate change. They suffer from economic poverty and discrimination and are excluded from various kinds of opportunities.
- To tackle this unfair situation, the international society endeavored to establish the vision of an “inclusive city”. While citizen participation in urban spatial planning is the key to building inclusive cities, city planning has been regarded as an area for selected administrators and experts due to its barriers to understanding. In this context, the purpose of this research is to find ways to help people most vulnerable to climate change participate in city planning.

2. Purpose

- In the course of economic growth and prosperity, a shrinking middle class and

exacerbating polarization socially excludes the marginalized population in urban areas. This research set out from discussions of an ‘inclusive city’ that eliminates social exclusion.

- In this context, this study asks, "for whom", "why", and "how" the goal of enabling an inclusive city can be achieved in the climate change era.
- Chapter 2 reviews the discussions on inclusive cities and climate change vulnerable groups to climate change. Then, it introduces the Planning Support System (PSS) for spatial planning as a tool to help citizens, including the vulnerable groups, participate in spatial planning. Finally, cases of applying the PSS in city planning in the US and Japan are examined.
- Chapter 3 selects Bupyeong-gu, Incheon Metropolitan City as the study area to examine the urban heat island effect, a corresponding effect of climate change that causes heatwave in summer. Camp Market in Bupyeong-gu was a munition factory area during the Japanese colonial period and was later used as a military supply center of the U.S. Army after liberation. Recently, prior to the land's return to Incheon, there have been debates regarding the future use of the area. Two scenarios, (1) using the area as a neighborhood park, and (2) using it as a cultural park, are compared and analyzed, and the urban heat island effect of a nearby old residential area, the company housing of Mitsubishi, is analyzed. Before the aforementioned content, current conditions are reviewed to explain the reason for conducting a case study and selecting the study area, and ENVI-MET (4.0), a microclimate analysis tool applied in the study, is introduced.
- Based on the theoretical review and empirical analysis, the final chapter suggests a measure to apply the PSS to the climate change governance of the local government as a tool to promote the participation of the climate change vulnerable groups in spatial planning. The Chapter analyzes the current status of the Bupyeong-gu Sustainable Development Committee based on the standards of inclusive cities examined in Chapter 2. Resultingly, this research outlines a direction for improvement and suggests a new participation model for the climate change vulnerable group, to achieve inclusive urban governance.

II. Theoretical review of related cases in Korea and abroad

1. Inclusive cities

- The concept of “inclusive growth”, which emerged from reflective questions about the nature of economic growth, led to the idea of an “inclusive city”.
- The dictionary definition of inclusiveness (in Korean), “to embrace or accept others generously”, is closer to “inclusion” than generosity or forgiveness.
- Hence, under the premise that spatial characteristics affect opportunity structures in the area, inclusive cities can be defined as cities that lessen adverse conditions and guarantee equal participation for citizens to create “Cities for All”.
- There are two major strategies for inclusive cities.
 - 1. Improve accessibility: In a spatial perspective, equal access to main infrastructures and effective public services is imperative to realizing the vision of inclusive growth.
 - 2. Guarantee fair and equal participation: Inclusive cities need to guarantee fair opportunities to participate in urban decision-making processes that aim to restore democratic processes.
- The 24th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP24) announced the Silesia Declaration on “Just Transition” to indicate that “relative conditions” differ in the course of climate change response, and emphasize the need to embrace individuals and their respective communities excluded from the transition process.
- Fair transition at the city-level means (1) guarantee of fair opportunities and (2) expansion of climate-resilient city infrastructure.

2. Climate change vulnerable groups

- Although the impact and intensity of climate change may vary across

socio-economic groups and geographic scopes, there is an underlying fundamental unfairness within the social system in which people who contribute least to climate change suffer most from it.

- In such context, the characteristics of the populations most affected by climate change appear to be (1) children and (2) the elderly by age, (3) female by gender, and (4) the poor by income level.

3. Planning Support Systems (PSS) for spatial planning

- Planning Support Systems collect information for decision-makers and support their reasonable decision making by combining various analysis models as much as necessary to establish the required solutions (Denshan, 1991).
- City planners define urban problems, set policy goals accordingly, design the plans to achieve targets, and conduct modeling to build various scenarios.
- PSS is designed to visualize the expected outcomes of various scenarios, helping non-expert residents understand. It is a useful tool for problem-solving processes and negotiations, which helps experts persuade residents regarding sensitive local issues.

4. Good practices of PSS usage

1) Sapporo, Japan

- The City of Sapporo uses TRANUS, a PSS for land use and transportation planning.
- The policymakers suppose there are five scenarios, including status-quo and scenarios of new transportation policy alternatives. Scenario plans are created in conformity with the goals and implementation strategies of each detailed policy and forecast the interaction between land-use changes and transportation.

2) Charlottesville-Albemarle, Virginia, The U.S.

- The Hampton Roads Transportation Planning Organization (HRTPO) of Virginia devises transportation plans under the “Environmental Justice Act”.
- The essence of environmental justice (EJ) is to guarantee every citizen’s participation in the development and implementation of policies regardless of race, nationality, or income level through environmental laws. The Environmental Justice Index specifically defines and protects the environmental vulnerable population.

III. Empirical Analysis

1. Status of the studied areas

1) General situations of Bupyeong-gu

- The study area, Bupyeong-gu, locates at the northeast of Incheon Metropolitan City, neighboring Gyeyang-gu in the north, Nam-gu, and Namdong-gu in the south, Gyeonggi-do Province and Bucheon City in the east, and Seo-gu in the west.
- The total area of Bupyeong-gu is 32 km², 3.01% of the total area of Incheon.

- As of 2016, the population of Bupyeong-gu is 549,716 (17% of the total population of Incheon).
- Based on the standards of the climate change vulnerable population in chapter two, subchapter two, the current status of Bupyeong-gu are as follows:
 - **(Gender)** As of 2018, the male population is about 260,000, and the female population about 264,000. The gender imbalance has increased to exceed 4,000.
 - **(Age)** The Aging Index of Bupyeong-gu has increased from 2015(79.9%) to 2018 (101.5%). Bupyeong-gu also has the second largest elderly population aged 100 or more in Incheon (136 females, 36 males).
 - **(Income)** Since standards for low-income class differ by societies, the socio-economic characteristics of Korea were taken into consideration to examine national basic livelihood security recipients and low-income, single-parent families as alternative indexes to the income level. Results showed that of all districts in Incheon Metropolitan City, the largest number of national basic livelihood security recipients who earn less than the 50% of the median income reside in Bupyeong-gu.¹⁾ As of low-income, single-parent families, it was found that 42 families(164 members) and 41 families(149 members) reside in Bupyeong 2-dong and Sangok 3-dong, respectively.

2) Main study area 1: Camp Market, a former U.S. Army camp in Bupyeong

- The Camp Market area was used as a site for the Japanese army's munition factory during the Japanese colonial period, built to prepare for the Sino-Japanese War. After liberation, from August 1945 to June 30th, 1973, the area was used as a United States Army Support Command (ASCOM) City, a multi-purpose complex supporting the US Armed Forces in Korea. There are currently 35 buildings of historic value in the area.

1) National Basic Living Security System is a foundation of social safety net in Korea. The system guarantees a basic level of living for the people suffering from absolute poverty by providing benefits for livelihood, medical care, housing, education, funeral, and childbirth; it also provides systematic self-sufficiency benefit services for self-support and self-reliance to people who have abilities to work.

- Prior to the return of the Camp Market, the type of the park to be built in the area changed from a neighborhood park (building coverage ratio: less than 10%) to a cultural park (building coverage ratio: less than 20%).

3) Main study area 2: former company housing of Mitsubishi

- Samneung Village, the second study area, is Bupyeong 2-dong, where the boarding house of middle- or low-income Koreans who worked for Japanese factories of war supplies was at during the Japanese colonial period. Bupyeong 2-dong is appropriate for an analysis of the vulnerable population as it is concentrated with old and low-rise houses.

3. Analysis tool and hypotheses

1) ENVI-met simulation model

- The ENVI-met model is a microclimate model that considers interactions between four systems (soil, vegetation, atmosphere, and buildings). Micro-level weather patterns are useful for the simulation.

2) Hypotheses for research

- Based on the status analysis in subchapter two above, the following two hypotheses are stated:

► **Hypothesis 1.** The temperature of the **Camp Market Area** will always be higher if a ① neighborhood park (building coverage ratio: less than 10 %, removing some modern buildings) is built, as opposed to the case in which a ② cultural park (building coverage ratio: less than 20 %, maintaining all buildings) is built.

- [Background Theory] The factors escalating the urban heat island effect are the land-to-artificial sheath ratio, spaces between buildings, and the height allocation of buildings.²⁾

► **Hypothesis 2.** Camp Market(① & ②), former company housing of Mitsubishi(③) The urban heat island effect in the summer will peak at night (11 pm) rather than in the morning (6 am) or daytime (2 pm).³⁾

- [Background Theory] Urban heat island effect occurs when waste heat accumulates in the artificial sheaths of urban areas and releases radiant heat during the summertime, and the effect takes place two to three hours after sunset and escalates during the nighttime.

3) Data used for the simulation

- A 24-hour simulation was conducted over the morning, day, and night on August 1st, when the tropical night phenomenon frequently occurs.
 - Hour of the day's lowest temperature recorded: 6 am
 - Hour of the day's highest recorded temperature: 2 pm
 - Hour of the tropical night analysis was conducted: 11 pm
- To analyze the urban heat island effect on ① a U.S. army garrison (Camp Market) and ② a former company housing of Mitsubishi, surrounded by apartment buildings over 15 stories, values were entered for the surrounding

2) An Seung Man et al. (2016) "Prospect of Urban Microclimate Management", KRIHS Policy briefs No.583, p.2

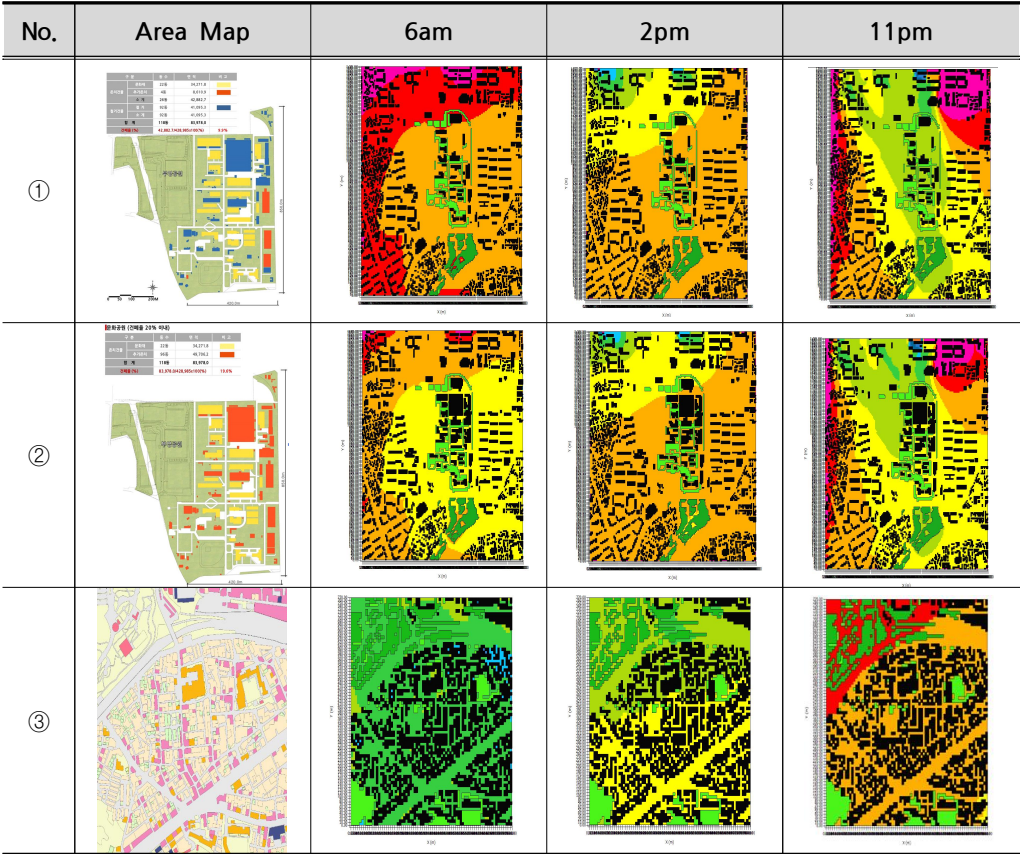
3) August 1st was chosen based on research by Choi Gwang Yong and Kwon Won Tae (2005) on the daily occurrence of the tropical night in summer. According to the research, which analyzed data collected from 61 weather stations over 32 years (1973~2004), tropical night used to start occurring in early summer, and most frequently occurred in early August.

buildings' building typology and height, and green spaces as they affect wind fields, and land-use ratio as it affects temperature.

4) Results of the study on the heat island effect

- This study tested two hypotheses.
- The first hypothesis assumed the heat island effect would worsen in the case of building a cultural park (building coverage ratio: less than 20 %, maintaining almost all buildings to preserve their historic values), than the case of building a neighborhood park (building coverage ratio: less than 10%, removing old buildings in the Camp Market), because the spaces between the buildings were closer in the former case.
 - According to results, the temperature maps of the two cases are similar in spatial distribution but differ in the hourly analysis.
 - In the early morning (6 am), the temperature of the residential area concentrated with high-rise apartment buildings, north to Camp Market, was 0.5~1°C higher in the neighborhood park scenario than the cultural park scenario.
 - At night (11 pm), the temperature of two-thirds of the southern area within the Camp Market was about 1°C higher in the neighborhood park scenario than the cultural park scenario.
- The second hypothesis tested whether generally, during the urban heat island effect, the solar energy accumulates in the artificial sheaths of urban areas during the summertime and occurs two to three hours after sunset and escalates during the nighttime.
 - Results found that in the case of the neighborhood park scenario, the heat island effect intensified in the order of day (2 pm), night (11 pm) and morning (6 am).
 - In the cultural park scenario, there was the greatest number of areas that recorded the highest temperature at night (11 pm), but heat distribution was highest in the northwest area in the morning (6 am).
 - In the case of the Mitsubishi area located to the south of Camp Market, the heat island effect peaked in the order of morning (6 am), day (2 pm) and night (11

pm).



<Figure 1> Scenario drawn in ENVI-met and its output

5) Research Limitation

- The ENVI-MET (4.0) simulation is suited for a micro-level analysis of the urban area but is systematically limited to conduct a macro-level analysis. Therefore, a more detailed analysis like the effect of the northwestern hills in Bupyeong-gu on the heat island effect remains a task for future studies.
- According to the 24-hour simulation conducted to analyze the tropical night phenomenon on August 1st, the temperature was higher in the early morning than at night. However, given the summer temperature distribution from June to August, the temperature may have been on its rise on August 1st. Analysis of other dates is necessary for even more accurate results but was left for future studies due to the time constraint of this study.

IV. Conclusion: Uses of environmental modeling for-and-with climate change vulnerable groups for inclusive urban management

1. Bupyeong-gu's citizen participatory governance model

1) Inclusive city analysis tool

- Chapter two, subchapter two introduced the definition of an 'Inclusive City', the overall idea of city inclusiveness, and related strategies. The meaning of climate change vulnerability and climate change vulnerable groups were also explained. Key components of inclusive cities are as follows:

- ① There is no social exclusion
- ② There are no social, spatial, and economic vulnerabilities
- ③ (During city planning) Participating in spatial planning is easy

2) Results and implications of current status analysis

- Possibility of participation by a non-expert citizen group
 - The aforementioned standards for inclusive cities assume that a city's inclusiveness decreases with high possibilities of social exclusion.
 - While the governance ordinance of the Sustainable Development Committee of Bupyeong-gu is a leading exemplary case in Korea, it still falls short of the standards of inclusive cities.
 - The ordinance implies an absence of prior knowledge or experience in sustainable development (past and present), and possibilities of non-expert local citizens and climate change vulnerable populations being excluded in important decision-making processes (future).
- There is a possibility that non-expert citizens are excluded from the opinion gathering processes, as the ordinance describes,
 - “① The council can collect public opinions through public hearing, public debate,

and survey whenever necessary for the given tasks. ② The council can collect opinions of related organizations to efficiently promote sustainable development projects of Bupyeong-gu.”

- Collectively gathering opinions from sporadic demands implies that possibilities of exclusion exist.

- Index for Climate change Vulnerable population

- To facilitate Bupyeong-gu's inclusive city management, research on domestic and foreign studies and its residents, development of an index in line with Bupyeong-gu's present situations based on the standards of the climate-vulnerable group are necessary. The existing index particularly has to be complemented from a climate change perspective by closely cooperating with the Social Welfare Committee.

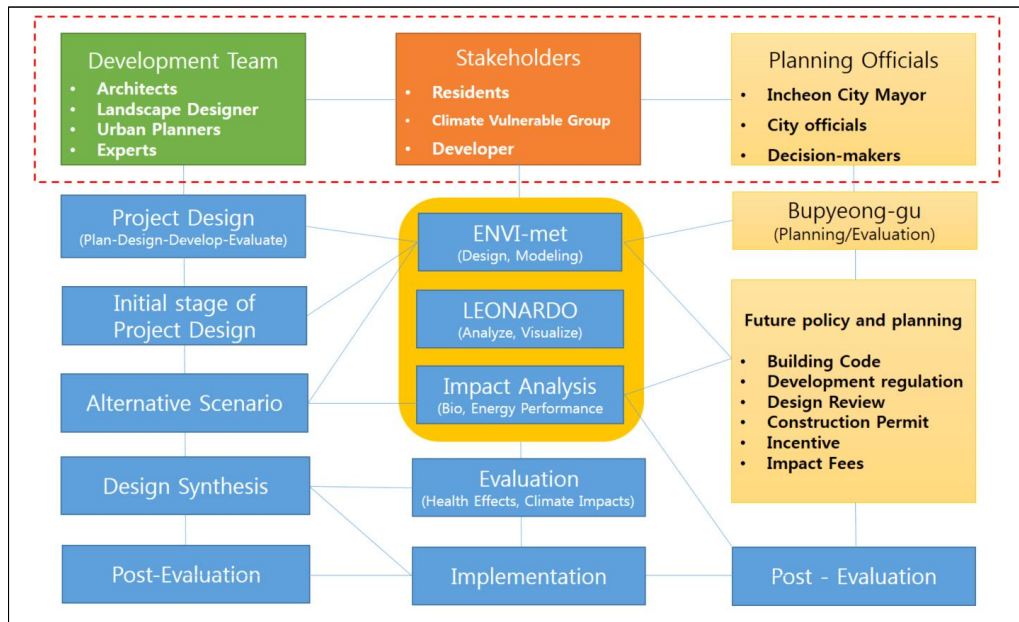
- Simplicity for citizen participation in the planning processes

- To make citizen participation simple in an inclusive city, the use of PSS can be taken into consideration, as it lowers the entry barrier by helping non-experts understand the potential results of the plan.
- To analyze the heat island effect at a microclimate-level, the ENVI-MET simulation used in chapter three can be used. Results that are visually organized by each hour can enhance the understanding of participants.
- However, every modeling tool has its limits and it is impossible to replicate the complex real-world. Therefore, support from experts who well-understand the advantages and disadvantages of the tools is needed.

2. Participation model of climate change vulnerable groups for inclusive urban management

- The following factors need to be considered in constructing the governance structure:
 - An overriding consideration of climate-vulnerable groups, and establishment of a citizen participatory governance

- Defining of roles of each stakeholder for cooperative spatial planning
- Scenario planning through the PSS: the PSS can be used to discover the changes in transportation, buildings, and forests, understand the impact of climate change and broaden the public's interests from economic gain and social convenience to include climate change and environmental problems.



<Figure 2> ENVI-met applied in designing Inclusive City governance model
Data (source): Authors

3. Future goals

- Suggestions to use of the PSS for an inclusive city and climate change response
 - City inclusiveness is an imperative agenda for future urban policies of international organizations in their quest for sustainable development. Since spatial planning for climate-vulnerable groups will be further emphasized in the future, follow-up studies have to be conducted continuously.
- Establishment of strategies to advance international projects
 - New projects with international organizations such as the United Nations Office for Sustainable Development (UNOSD) and the Green Climate Fund (GCF)

require a detailed demarcation of roles such as project planning, project management, performance management and project evaluation since the early stages, and cooperation plans that organize the implementation system are needed.

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