기본연구보고서 2017-11

신 기후체제 대비 건축물 분야 기후변화 취약성 진단 연구

A Research of the Vulnerability Diagnosis Method
for Buildings on the New International Climate Change Agenda

이은석 Lee, Eunseok
고영호 Ko, Youngho
박성남 Park, Sungnam

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SUMMARY

Chapter 1: Introduction

For the long time we have prepared social, physical and institutional measures for climate disasters. When a disaster occurs, people try to find a safe place. In the urban area, the built environment including the typical buildings becomes the refuge. Indoor space is especially expected to be safe. The climate disasters, however, frequently exceeds the expectations of those measures and the limits been prepared for the past. This means that built environment such as buildings and facilities is no longer considered as safe space.

After the Paris Agreement of 2015, Korea signed the Paris Agreement on Climate Change on April 22, 2016 with 168 participant countries. This means that Korea needs to follow the direction of the next climate change policy of the international community. Korea also has to establish a national target and an operating system that is practicable for local governments.

Climate change policy needs to include requirements for cities and buildings

separately. However, Korean policies and measures to deal with climate change do not consider with buildings and the urban environment.

The research questions of this study are as follows: First, this research identifies characteristics of the buildings that are repeatedly affected by specific natural disaster. Second, after the explanatory characteristics of an individual building are identified, this research reveals how buildings with similar characteristics are distributed in the surrounding area.

Chapter 2: The Trend of Climate Change Adaptation Policy and Research

In the climate change adaptation policy, the overall climate change vulnerability diagnosis for buildings does not represent significant difference from other subjects' climate change vulnerability diagnosis except for differences in the types of climate change adaptation strategies for primary industries such as agriculture and fisheries.

Major overseas adaptation policies have provided detailed strategies in terms of increasing resilience, partnerships between governments and regions, utilization of scientific technologies and data, and enhancing community sustainability. In Korea, the risk of residential areas to flooding and coastal structures has been assessed. Climate change impact and vulnerability assessment systems for large industrial complexes have also been prepared.

Assuming the disaster caused by climate change as an event and the buildings as the social space, the social complexity and the physical, natural, and built environment are necessarily considered with the minimization of the risks and damages.

The climate change vulnerability diagnosis methods currently applied for domestic climate change adaptation policy use the administrative district for their spatial range. Actual impact and effect of climate change, however, cross the range of the administrative area so to be limited to have effective diagnosis results. Assessment of the vulnerability, therefore, necessarily considers the minimization of the basic analysis unit, understanding the social condition of the analysis unit. The climate change vulnerability diagnostic modeling for buildings is to explain the

exposure, sensitivity, social response and resilience, identifying the social elements buildings represent.

Chapter 3: Establishment of Climate Change Vulnerability Analysis System

Spatial vulnerability diagnosis with a high resolution can be accomplished not by considering the administrative district as a spatial unit but by taking a facility, a parcel or a building where citizens actually live as a spatial reference unit. When this spatial reference units are distributed in a certain area, it represents a climate change vulnerable area. As a result, this type of vulnerability diagnosis takes a bottom-up approach.

This research takes heavy rainfall as the subject phenomenon of climate change vulnerability diagnosis for buildings. Among various weather phenomena caused by climate change in Korea heavy rainfall accompanies many casualties such as deaths and life damages. The subject of vulnerability diagnosis applied to this study is, therefore, flooding due to heavy rainfall. Residential and non-residential buildings, where most people spend their time for habitation and production activities, are the main spatial extent of this research. This research also focuses on the buildings in the damaged areas that have experienced repeated floods due to heavy rainfall.

The basic concept of surface water flood building analysis is to find the spatial distribution of building that is characterized through the standardized explanatory variables of buildings in the flooded area. In case of several buildings in a parcel, this research apply the characteristics of the main building of a parcel to that parcel in order to have effective modeling to diagnose the influence of the surface water flood on buildings.

Among the least degree of missing information in the building register, this research selected indicators applicable to climate exposure, sensitivity, and adaptive capacity. An explanatory indicator of building location environment for flooding is included. The surface water density, adjacent manhole density, and elevation of the average sea level are included to represent the influence of surface water flood in urban areas. The officially assessed individual land price is also added as a social indicator related to adaptation capacity.

Chapter 4: Analysis of Risk and Vulnerability of Buildings

A basic database was constructed for Seoul Metropolitan Government. A basic database consists of the building register, social data, and geographical data to consider explanatory information of climate change vulnerability such as climate exposure, sensitivity, and adaptation capacity.

Characteristics of the buildings in flooded areas affected by climate exposure are extracted through spatial regression analysis. The spatial regression model uses the OLS(Ordinary Least Square) method.

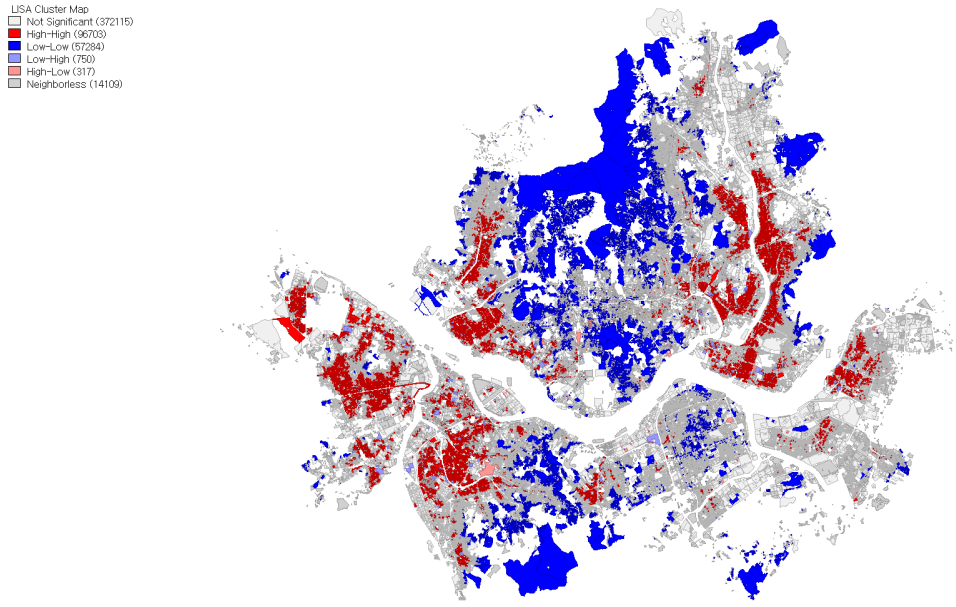
The spatial regression analysis based on the relationship between building information reveals that buildings located in Seoul with high risk of repetitive flooding damage have greater climate change vulnerability when the building coverage ratio is higher, the floor area ratio is lower, the number of households is larger, the number of floors is lower, the number of underground floors is larger, the period of building use is shorter, the official land price is lower, the adjacent manhole density is higher, the surface water concentration is higher, and the average sea level of parcels is lower.

Buildings are complex combination of physical, economic, social, institutional, and environmental factors. The type of climate change vulnerability diagnosis and assessment model to deal with buildings, therefore, should select the social vulnerability model. The social vulnerability model suggests that the general public can analyze and utilize climate change vulnerability maps more easily using GIS. Since the spatial information based on a certain spatial unit includes various socioeconomic information and its distribution can be identified, it is very useful for analyzing the vulnerability by enabling spatial statistical processing through sharing of spatial information.

Buildings in the parcel with high vulnerability should have the ability to secure resilience through the form and composition of the building, considering the elements of climate change ‘adaptation’ and the minimization of ‘loss and damage’ by exposure. The climate change vulnerability diagnosis model of this research has the advantage in selecting parcels where vulnerable buildings to heavy rainfall and

at the same time in deriving safe parcels. Since the diagnosis results based on the parcel unit and the high spatial resolution, the policy utilization by local governments can be various.

The policy related to the vulnerability diagnosis model of this research can be the urban planning and the detailed planning for the climate change adaptation when they focus on climate change vulnerability, and can be the low impact development project and the water circulation improvement project for climate change prevention when they focus on derived safe areas.



[The vulnerable area(red: HH) and safe area(blue: LL) as the result of LISA analysis]

Keywords

Repetitive disaster risk by climate change, big data related to buildings, spatial regression modeling, climate change adaptation policy, GIS