# A Study on the Policy of Disaster Prevention for Housing Welfare Based on Mobile Environment

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## Abstract

*Korean government has recently constructed the integrated database for disaster prevention under the participation of relevant agencies. But the government project has been delayed because local governments have not properly provided basic data necessary to construct the database. And to formulate an effective disaster prevention policy, it is necessary to analyze the acceptable level of disaster by region through the analysis of the association between the degree of disaster and the disaster prevention facility within the region. Finally, it is thought that it is possible to take the preventive measure for minimizing the damage resulting from natural disasters by providing disaster-related information for local residents on a real-time basis through the construction of the mobile system.*

*Keywords: Disaster prevention, Big data, DB linkage council, Mobile System*

## 1. Introduction

In Korea, the housing policy has been implemented with a focus on housing supply until the end of the 1990s as it has been urgent to resolve the quantitative problem of housing due to rapid economic development since the 1970s. People have taken an interest in the qualitative improvement of housing as the improvement project of old houses in the 2000s. But preparation for disaster prevention has been neglected such as heavy rain, earthquake and the like as the qualitative improvement of housing has been made with a focus on the aspect of physical facilities. Neighboring countries such as China and Japan have alerted people to earthquake as large-scale earthquake damage has occurred. Interests have been mounting in the disaster prevention policy for residential welfare as damage from unprecedented heavy rain has continually occurred in Korea every year. The Korean disaster prevention policy has had some limitation in preventive response to disasters as information transmission has not smoothly occurred between relevant agencies for the years. Accordingly, to implement the effective disaster prevention policy, it is necessary to construct the integrated information system for agencies related to disaster prevention, national government and local government to share information on disasters and on disaster prevention and infrastructures on a real-time basis. The construction of the integrated information system related to disaster information makes it possible to analyze vulnerable districts beforehand and come up with an effective counterplan and to evacuate residents to a safe place by eliciting an dangerous area at the point in time when a disaster occurs. Accordingly, this study attempts to investigate the realities of disasters such as damage from storm and flood and earthquake recently occurring in Korea and present the proper disaster prevention policy and the implementation plan through the analysis of big data. And it presents the

scheme for transmission of disaster information using the mobile system for it to be effectively transmitted to residents.

## 2. Theoretical Investigation and Previous Studies

### 2.1. The Concept of Disaster Prevention

The general concept of disaster prevention can be divided into the broad-sense concept and the narrow-sense concept. The narrow-sense concept is defined as one stage of the procedures for emergency management related to disasters. In general, the procedure for emergency management can be divided into preparation, response, restoration, disaster prevention and the like. In a broad sense, disaster prevention includes prior vulnerability assessment with the types of disasters and all measures for preventing vulnerability.

### 2.2. Previous Studies Relating to Disaster and Mobile

Koh Jae-kyung and Choi Choong-Ik and Kim Hee-Sun(2010) identified the vulnerability of 31 cities and counties in Gyeonggi-do with a focus on natural disaster damage and presented that the disaster prevention policy of local government still uniformly determined by national government should need to differentiate regional characteristics. Choi Choong-Ik(2003) presented that the disaster prevention policy considering the possibility of disaster at the time of urban planning would be needed as natural disaster damage is influenced primarily by the natural element but considerably much by the physical element of urban land use. As for the use of database, Kim Chi-Yeon(2012) conducted a study of the method of range query using the index in the large-scale database system. As for the use of database related to disasters, Hwang Eui-Ho and Lee Geun Sang and Ko Deuk-Koo(2007) presented a need for the disaster prevention policy linking GIS with the mobile by presenting the scheme for Korean river map service based on the mobile.

## 3. The Recent Realities of Korean Natural Disasters

In Korea, as large cities have been formed with economic development and the In the period when agriculture was the basic industry in the past, crops damage due to typhoon, heavy rain and the like was the most typical disaster damage in Korea. But as large cities have been formed with economic development and the phenomenon of dwelling concentration has emerged, houses have flooded due to heavy rain and large-scale victims have occurred. For this reason, large disaster damage has occurred in the urban area. Especially, flood damage has recently occurred at the central area of Seoul due to localized torrential downpour in summertime. An investigation of the trends of accumulated precipitation and localized torrential downpour in summertime in Korea for recent 30 years showed that they continually increased as shown in Figure 1. Especially, the number of days with the heavy rain of more than 100mm a day exceeded 100 days in 2011.

### Table 1. Accumulated Precipitation and Severe Rain Storm of Summer

| division | Average accumulated precipitation | severe rain storm | |
|---|---|---|---|
| | | over 100mm/day | over 40mm/day |
| 2011year | 1048mm | 102 | 69 |
| 2000s | 767mm | 54 | 37 |
| 1990s | 714mm | 49 | 29 |
| 1980s | 695mm | 43 | 26 |

source : NEMA(National Emergency Management Agency).

It is known that in relation to earthquake, Korea is comparatively safe compared to countries located at circum-Pacific earthquake belt as it is located at the tip of east of the Eurasian Plate including China, Russia and the like. But people's attention to earthquake is mounting as damage due to large-scale earthquake is continually occurring in neighboring countries such as the large earthquake occurring in the Sichuan Province, China, in 2008 and the large earthquake of East Japan in 2011. And according to the recent research, the frequency of earthquake occurrence is gradually rising within Korea.

The annual average frequency of earthquake occurrence was found to account for 43 times in the 2000s, the almost twofold increase compared to the first half of the 1990s. Accordingly, there is an increasing need to throw away the awareness that Korea is safe to earthquake and take preemptive disaster prevention measures.

### Table 2. Earthquake Status of Korea

| division | 1979 - 1985 | 1986 - 1990 | 1991 - 1995 | 1996 - 2000 | 2001 - 2010 |
|---|---|---|---|---|---|
| total frequency | 137 | 63 | 111 | 158 | 431 |
| annual average | 17 | 13 | 22 | 32 | 43 |

source : NEMA(National Emergency Management Agency).

## 4. The Recent Realities of Korean Natural Disasters

### 4.1. The Scheme to Construct the Integrated System for Disaster Prevention

Currently, Korea is improving the national land use information system and constructing the Urban Planning Information System(UPIS) as part of the government 3.0 implementation scheme promoted by new government. It is the method of integrating and using currently generated information related to real estate, it is thought that the following development process is needed: First, it is necessary to integrate data related to real estate. The real estate-related information system is currently scattered in the Korea Land Information System(KLIS), the e-Architectural Information System(e-AIS), and the Urban Planning Statistic System(UPSS). Accordingly, the big data system can be constructed by collecting the data of each field, connecting them to the existing managed real estate space information system and the real estate attribute information system and finally integrating space information and attribute information. If big data constructed this way are made the information proper to the purpose of the user through diverse analytic methods, it is thought that the goal of the urban planning information system could successfully be attained.
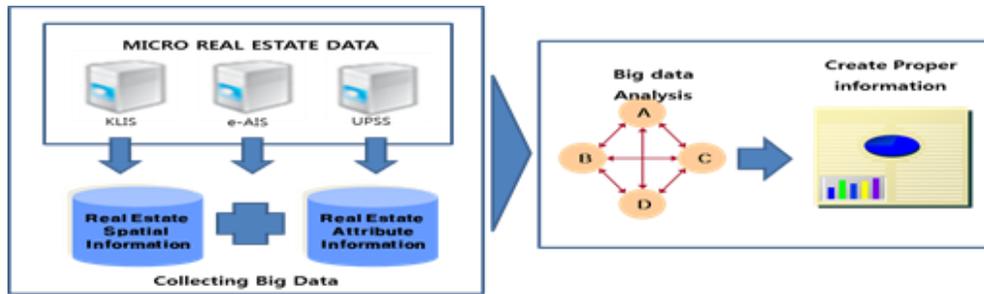
**Figure 1. Process of Building UPIS**

It is thought that the construction of the urban planning information system can become the scheme to resolve the problem of the disaster prevention policy presented earlier. It is expected that it will be possible to use the urban planning information system to prevent disaster damage and respond to the occurrence of the disaster by linking all sorts of disaster information on landslide and earthquake danger, flood danger and the like with each other. For this purpose, the process of integrating information on relevant fields into UPIS is needed. Information related to the infrastructure for disaster prevention is currently managed by the Ministry of Land, Infrastructure and Transport(MOLIT), information on landslide and so on is managed by Korea Forrest Service(KFS) and information on overall disasters such as flood damage is managed by National Emergency Management Agency(NEMA). It is necessary to analyze the association between data on several disaster-related fields to achieve efficient disaster management

Especially, it is necessary to make a real-time analysis of vulnerable districts with anticipated climate changes by linking all sorts of disaster-related data with the urban planning information system and integrating information on disasters and information relating to the degree of housing deterioration, the infrastructure of the district and the like. Then it is possible to establish the urban plan to minimize the damage of the realized disaster in a short-term period and secure a strong ability to respond disasters in a long-term period.

### 4.2. The Scheme to Use the Mobile System for Effective Disaster Prevention

The earlier presented development of disaster prevention and management is carrying into practice the basic work for effective disaster prevention policy. In case the disaster actually occurs, how fast its relevant information can be delivered to residents is indispensable to minimize the disaster-induced damage. And it is possible to induce residents to participate in voluntary prevention by enabling them to usually notify the possibility of disaster occurrence in their residential area beforehand. Much time and cost were required to acquire information on the disaster, analyze its danger and deliver it to residents in the past, resulting in the failure of effective disaster prevention in many cases. But it is possible to provide diverse information for people on a real-time basis because of the reduction of information processing costs and the supply of smart phones, which is thought to make it possible to implement a little more effective disaster prevention policy.

In introducing the disaster prevention through the mobile, it is first necessary to analyze how far the damage caused by the heavy rain, earthquake and the like geographically spreads and how much the anticipated damage is. For this purpose, it is

necessary to establish the system that can elicit the acceptable size of the disaster, such as the disaster prevention facility currently installed by region, based on past data. To attain this goal, it is necessary to develop the prediction model with the use of the neural network model and the regression model based on the earlier constructed big data. The disaster-induced damage can be minimized by delivering this elicited information to residents on a real-time basis through the smart phone. And it is expected that people's interests in disaster prevention can usually be enhanced by enabling people to confirm disaster-related information in advance through the application.



**Figure 2. The Concept Map of Mobile Information System**

## 5. Conclusion

Interests in the resolution of the disaster prevention problem within the residential area are mounting due to the damage of natural disaster such as the recently rapidly-increasing precipitation in Korea and the damage of the earthquake occurring in neighboring countries. But the present situation of Korea is that preparation for natural disaster is very poor as water and sewage facilities are not installed based on the past data and most of the old houses have no earthquake-resistant facility. Accordingly, it is urgent to construct the disaster prevention system corresponding to the changing environment in terms of residential welfare as well as disaster prevention.

Government has currently carried forward with the selection of disaster-vulnerable district and the revitalization of the urban renewal project. But it is confronted with a difficult problem due to the poverty of constructed data and the depression of the housing market. To resolve this problem, government is currently constructing the system that integrates and manages disaster information and real estate information. So it is expected to greatly reduce the time and cost required to achieve efficient disaster prevention management in a long-term period. But it is thought that it is necessary that government should provide budget support for data integration a little more actively as data construction is delayed because of basic data by region insufficiently stored up to now. And to achieve efficient disaster prevention by delivering constructed data to residents, it is necessary to elicit the possibility of disaster occurrence by region through the analysis of the association between disaster information and infrastructure. Especially, it is possible to induce residents to make a voluntary anticipation of the disaster by enabling them to confirm information relating to all sorts of disasters through the smart phone.

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