

The assessment of Fire Risk in Goyang city and Evaluation of regional economic impacts in case of fire in dangerous buildings

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ABSTRACT

The purpose of this study is to estimate the fire risk in the Goyang city by using the spatial data of buildings and to evaluate the economic damage by the industry in accordance with the possibility of fire in this area.

Based on the database about integrated building information providing by the government, the possibility of fire occurrence is derived by utilizing the density and usage of building in Goyang city for evaluating the fire risk. And the level of fire service for each building was compared using the location of a fire station.

To be specific, using the above-mentioned database, the total floor area and the building area of the individual buildings in Goyang City were used to calculate the density of the buildings and to consider the spatial distribution of these. Then, the statistical data such as the number of fire accidents, the damage of people, the amount of property damage according to the usage of the building were used to derive the grade of fire risk for each building. The level of the fire service was given a grade according to the radius from the location of the fire station considering the variables such as the road width and the traffic congestion time zone.

Each fire risk factor is divided into weight factor and reduction factor. By overlapping it, the relative density of space between individual buildings is standardized to 7 classes using ArcGIS Hotspot analysis.

Based on the fire risk, the economic damages of the Goyang city were calculated by using the sales data of the major industrial class in Korea, and the economic damage effect was calculated assuming the fire occurrence probability according to each fire risk grade.

In this study, the regional I-O model for Goyang city was created by matching with 30 national industry classification and 20 regional industry classification of Goyang city. Based on the supply model, the effects of the fire risk in Goyang City were analyzed based on the scenario of 6 months of non - production and business loss due to fire.

As a result of the analysis, East-Ilsan suffered the most economic damage and Deokyang suffered the least damage among the 3 regions, West-Ilsan, East-Ilsan, and Deokyang. By industry, "Electricity, Gas, Steam, and Water supply" showed the

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greatest losses.

INTRODUCTION

Recently, global climate change has increased the risk of disasters and has become larger in scale. As a result, threats to human security such as food, water and energy resources are increasing. In the case of Korea, from 1971 to 2011, natural disaster damage amounted to 8.6 times more property damage. The estimated cost of damages due to climate change is estimated to increase from KRW 3.6 trillion (0.31% of GDP) in 2020 to KRW 6.9 trillion (0.59% of GDP) in 2050 according to the Ministry of Environment.

In preparation for an increase in social problems caused by disasters, the Ministry of Public Administration and Security is promoting the project to establish integrated disaster safety information system from 2015, and focuses on information sharing and linkage between central ministries.

In this study, the final objective is to evaluate the risk of each type of technologies for fire prevention and mitigation and to evaluate the technological value considering the social and economic effects of fire reduction technology.

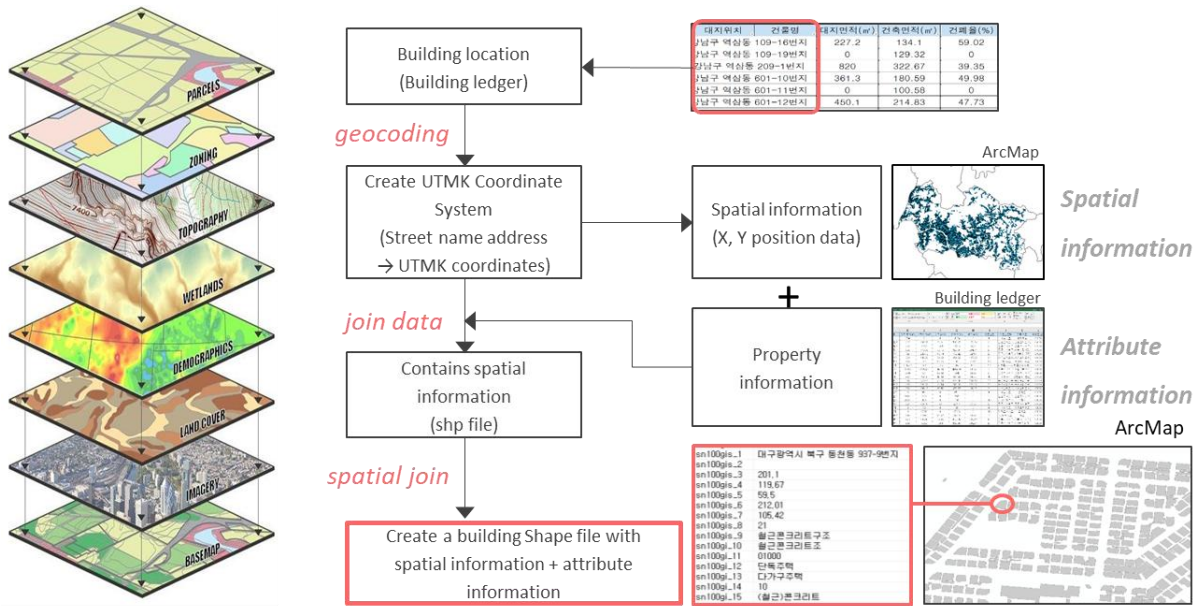
METHODOLOGIES & DATA

Establishing a list of risks creates a list of fire risks based on existing research and statutory standards. Based on Likelihood and Impact, the regional risk list can be cataloged as very high risk, high risk, moderate risk, and low risk.

Based on the cataloging, the method of analyzing the fire risk and the stepwise flow are shown in the following figure 1 & 2.

Step	DB construction and status investigation	Damage Analysis of Fire Status	Set step by application	Fire risk analysis
Method	Standard of Enforcement Decree of the Building Act	Status and damage of fire by application	Natural distinction (GiZscore)	Risk Matrix
Content	- Classification criteria for building use - Fire classification	- Status & frequency of fire occurrence by usage - Damage due to fire	- Classification of fire frequency - Fire damage industrial classification	- Fire Hazard Hotspots

Figure 1 Fire risk analysis method and flow



Source : Kim(2018)

Figure 2 Fire risk analysis method and flow

The fire risk resulting from the step-by-step DB construction and risk analysis process goes through the economic damaging process according to the probability of fire risk. The process of estimating the economic damage caused by the fire risk is shown in the following figure 3.

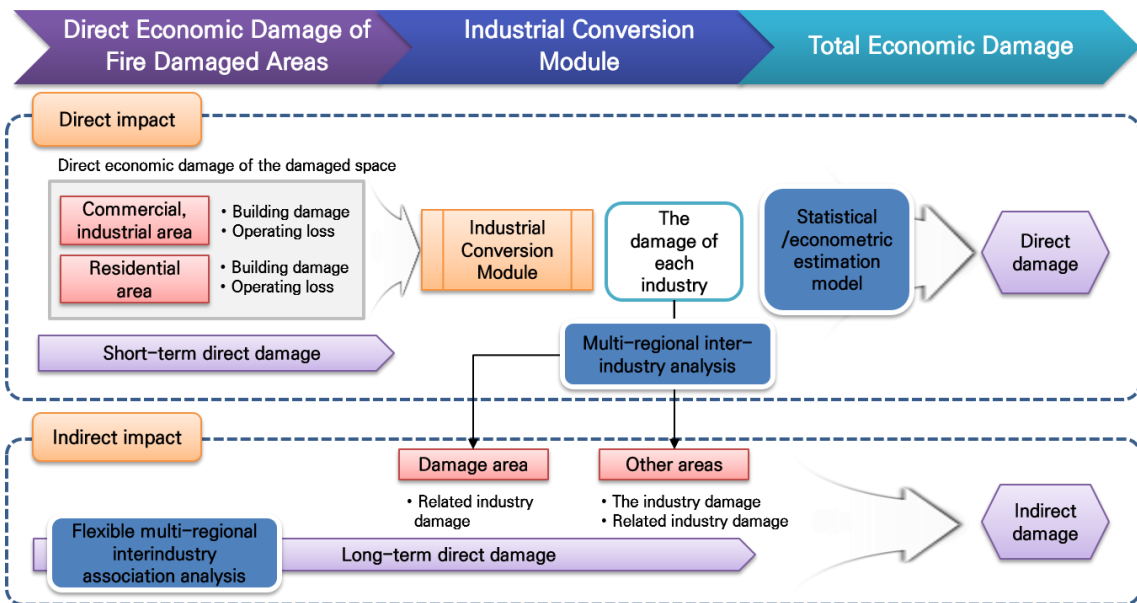


Figure 3. Economic Impacts and Estimation Methods of Disaster Damage

RESULT

In this study, the regional I-O model for Goyang city was created by matching with 30 national industry classification and 20 regional industry classification of Goyang city. Based on the supply model, the effects of the fire risk in Goyang City were analyzed based on the scenario of 6 months of non - production and business loss due to fire.

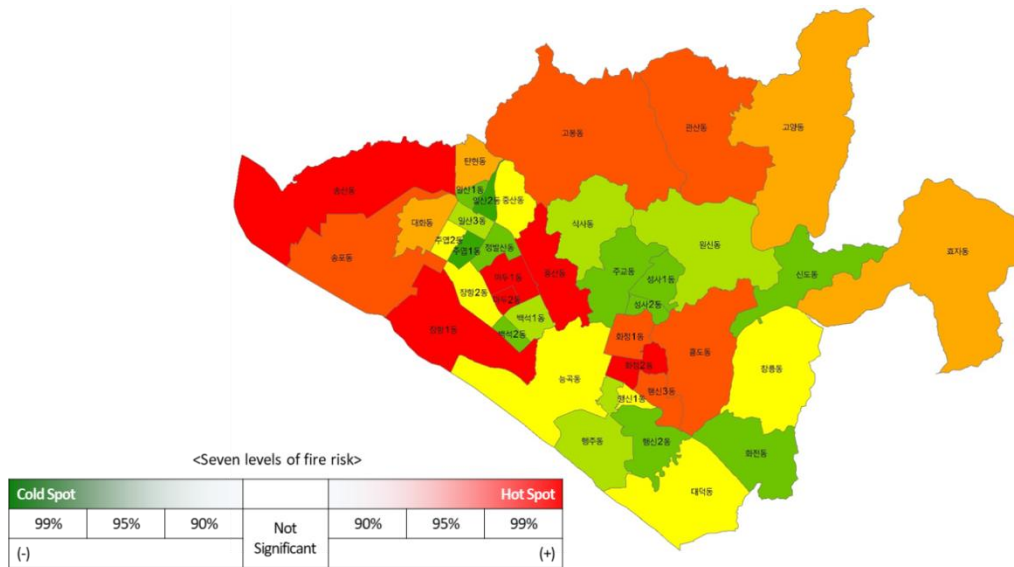


Figure 4 Hot-spot analysis of fire risk in Goyang city

As a result of the analysis, East-Ilsan suffered the most economic damage and Deogyang suffered the least damage among the 3 regions, West-Ilsan, East-Ilsan, and Deogyang. By industry, "Electricity, Gas, Steam, and Water supply" showed the greatest losses.

Table 1 Economic Impact Analysis Results

Industry	West-Ilsan	East-Ilsan	Deogyang
Construction	236.52	1,234.07	1,054.93
Public administration, defence and social security	922.23	5,215.17	6,394.60
Educational services	148.07	217.07	208.68
Financial and insurance activities	1,067.12	14,238.58	2,283.18
Agriculture, Forestry and Fishery	0.06	0.00	0.00
Wholesale and Retail business	214.51	1,089.32	545.37
Health and social welfare services	176.96	343.39	409.00
Real estate and leasing business	180.59	698.92	482.90

Facilities Management and Business Support Services	275.26	1,661.96	521.29
Accommodation and restaurant business	103.21	381.60	328.03
Arts, sports and leisure services	136.39	535.46	346.49
Transportation	116.52	230.36	435.15
Electricity, gas, steam and water supply business	4,072.95	66,960.86	62,822.18
Professional, scientific and technical services	297.55	4,351.71	791.59
manufacturing	167.58	3,914.37	996.19
Publishing, Video, Broadcasting Communication and Information Service	457.08	6,606.73	724.61
Sewage, waste treatment, raw material recycling and environmental restoration business	207.90	798.95	1,674.82
Associations and organizations, repair and other personal services	71.91	223.54	211.44

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