

# Evaluation on R&D projects in Korea to predict and reduce natural disaster

Lee Kangguk<sup>1,\*</sup>, Wonhwa Hong<sup>2</sup> and Kim Su-Young<sup>3</sup>

<sup>1</sup>Disaster and Safety Management Institute, Kyungpook National University, Korea

<sup>2</sup>School of Architectural, Civil, Environmental and Energy Engineering Kyungpook National University, Korea

<sup>3</sup>Disaster and Safety Management Institute, Kyungpook National University, Korea

\*Email: ggyi@naver.com

**Abstract.** This study is intended to evaluate and analyze R&D projects for natural disaster prediction and reduction that have been conducted from 2003 up to 2016 in Korea and use it as foundational material for future R&D projects for disaster prevention technology in Korea. In consideration of essentiality about the characteristics of Korea's natural disaster prediction and reduction R&D projects and achievement of project goals, scientific, technological, and social performances are arising. Concerning "technical performance", in 2016, there were 4 patents registered receiving over 80 points (out of 100) (50%), so in the future, technology level is expected to rise greatly. Moreover, a lot of research results are being applied practically to the affair of Ministry of Public Safety and Security.

## 1. Introduction

In Korea, natural disaster prediction and reduction R&D projects have been carried out in order to establish and promote scientific technology promotion policy in the area of disaster and safety management and encourage R&D associated with disaster prevention technology and disaster prevention industry to protect people's life, properties, and major facilities [1]. This study is intended to evaluate and analyze R&D projects for natural disaster prediction and reduction that have been conducted from 2003 up to 2016 in Korea and use it as foundational material for future R&D projects for disaster prevention technology in Korea.

## 2. The contents of R&D projects for natural disaster prediction and reduction in Korea & the management system

### 2.1. The promotional process and contents of the projects

Until 2003, development projects for natural disaster prevention technology in Korea had been transferred to national R&D projects, and according to 'pan-ministry flood prevention measures', the area of flood disaster came to be separated as projects to develop flood disaster prevention technology from 2004. Since then, revisions have been repeatedly made according to the reorganization of Korea's government agencies and directions of government policy [2]. It is mainly about devising mid- and long-term plans for the 10-year R&D project for natural disaster reduction and building up disaster prevention infrastructure to realize a safe nation with no concern for disasters like flood or landslides [3]. According to the designation of sunset industry in 2016, continuous tasks were completed, and



then, the project ended. This study classifies R&D projects for natural disaster prediction and reduction that are being carried out in Korea (table 1).

**Table 1.** Classification on Korea's natural disaster prediction and reduction R&D projects.

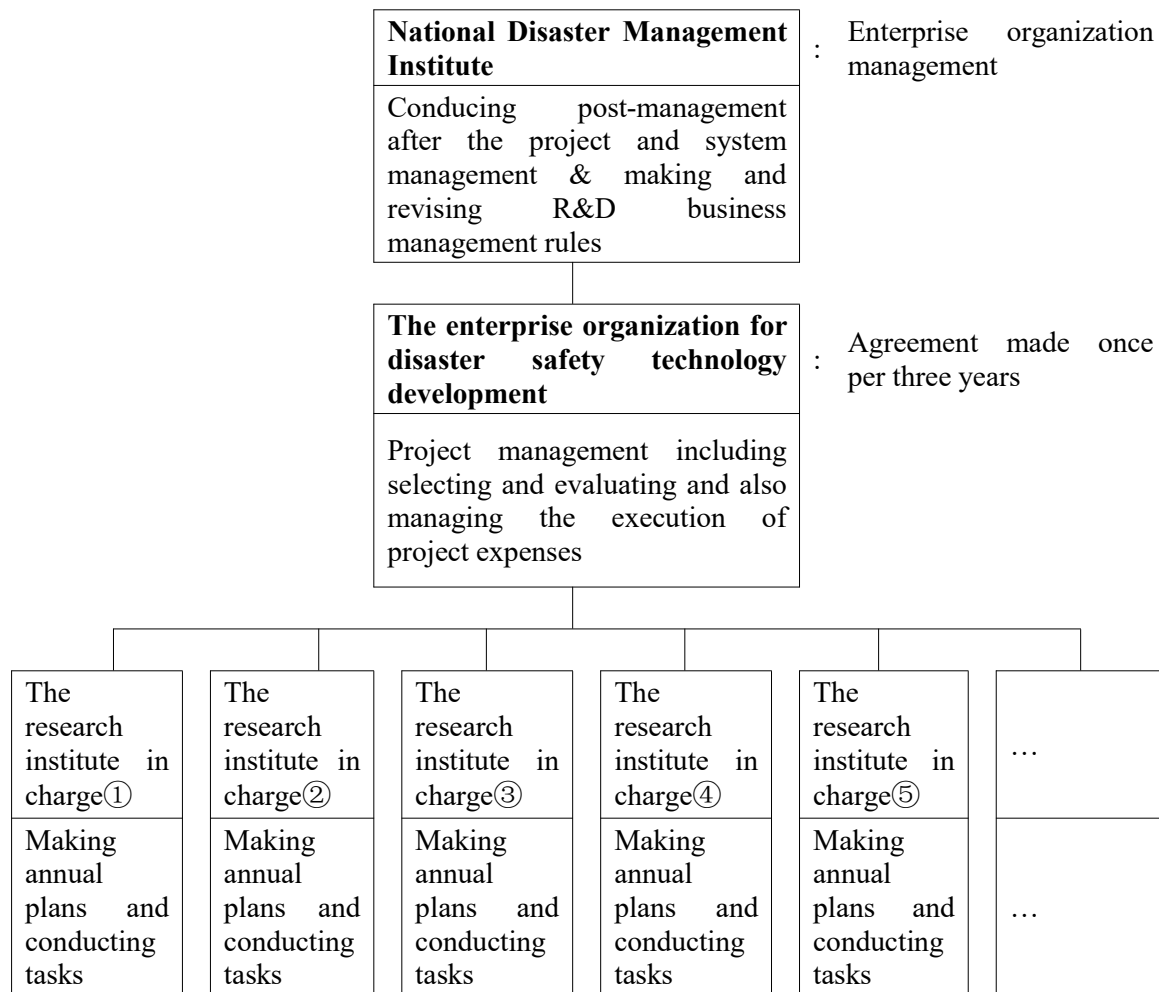
Division	Contents
Evaluating the risk of natural disaster, predicting damage, & developing prevention technology	<ul style="list-style-type: none"> <li>- Analyzing and evaluating disaster vulnerability and risk to prevent damages to facilities and minimize the impact and building up strategies to prevent, prepare for, and cope with disasters by developing technology to predict damage</li> <li>- Developing technology to build up a high-efficiency • high-performance prediction • warning system using ICT convergence technology and smart technology in order to establish a prompt and accurate prediction • warning system</li> </ul>
Developing technology to enhance capabilities to prepare for and also cope with natural disaster	<ul style="list-style-type: none"> <li>- Developing disaster management technology to cope with the increase of risk caused by climatic changes and technology to improve disaster-preventing competence to cope with disaster for less damage</li> <li>- Predicting volcanic disaster promptly, developing analysis technology to minimize damage and cope with it systematically, and building up an international cooperation network for collaborative coping</li> </ul>
Technology to support victims from disasters to help them return to normal life	<ul style="list-style-type: none"> <li>- Studying ways for efficient restoration about large-scale complex damaged area and establishing work continuance management technology to cope with earthquake or tsunami</li> </ul>
Collaboratively planned multi-ministry social problem-solving projects (Disaster safety service)	<ul style="list-style-type: none"> <li>- Devising a social agreement about the level of national disaster relief policies or services corresponding to the national status and developing technology to optimize disaster relief and budget operation</li> </ul>

## 2.2. The project management system

In 2016, Korea's natural disaster prediction and reduction R&D projects were managed and operated by Kyungpook National University's enterprise organization for disaster safety technology development [4]. The enterprise organization is generally overseeing R&D project planning, selection, evaluation, progress management, and adjustment, performing evaluation on selecting research projects, mid-progress report sessions, annual evaluation, and final evaluation, conducting research on demands from all the industrial and academic links to discover new research projects continuously, and also managing and supporting researches conducted by research institutes. The project management system is shown as below (figure 1).

<b>Ministry of Public Safety and Security (current Ministry of Public Administration and Security)</b>
Setting the basic direction, securing and supporting with budgets, and making promotional plans, etc.

With the reformation of government organizations in July, 2017, it was changed to be the Ministry of Public Administration and Security.



**Figure 1.** The management system for Korea's natural disaster prediction and reduction R&D projects.

### 3. The performance plans and performance achievement of Korea's natural disaster prediction and reduction R&D projects

#### 3.1. The performance plans of Korea's natural disaster prediction and reduction R&D projects

The ultimate performance goal of Korea's natural disaster prediction and reduction R&D projects is to build up customized coping technology R&D and local disaster prevention infrastructure based on scientific technology to predict natural disaster that can occur from future climatic changes and reduce damage, realize people's safety, and establish a local disaster safety system by securing 77% of the 「Natural Disaster Monitoring • Prediction • Coping Technology」 level compared to that of advanced countries.

#### 3.2. The performance achievement of Korea's natural disaster prediction and reduction R&D projects

Korea's natural disaster prediction and reduction R&D projects are integrated with social disaster safety technology development projects in 2017 and reorganized as disaster prediction and reduction R&D projects [5]. Therefore, in 2016, at the time of setting up performance goal indexes with the institution in charge of evaluation on government contribution specialized in investigating, analyzing, and evaluating Korea's national R&D projects in Korea Institute of Science & Technology Evaluation and Planning, only 2016 goals were established. In 2017, based on the reorganized projects,

performance goal indexes will be set up again. Also, with the designation of sunset industry, budgets and tasks are reducing continuously (table 2).

**Table 2.** The performance goals of Korea's natural disaster prediction and reduction R&D projects in steps and the score provision of performance indexes.

Performance indexes ①	Index weight ②	The target ③	Achieved value ④	Achievement rate ⑤	Performance index weight ⑥	Scores by indexes ⑦	The final score ⑧
Growth engine creation	0.1	20	28	100%	1.0	3	28.9
Policy use	0.3	4	7	100%	1.0	9	
Academic performance	0.29	52.44	47.65	90.87%	1.0	7.9	
Academic performance(2) (Multi-ministry indexes)	0.01	52.44	0	0	1.0	0	
Technological value	0.3	5	5.1	100%	1.0	9	
Sum	1						

#### 4. The performance validity and performance evaluation of Korea's natural disaster prediction and reduction R&D projects

##### 4.1. The performance validity of Korea's natural disaster prediction and reduction R&D projects

In consideration of the characteristics of Korea's natural disaster prediction and reduction R&D projects and essentiality about the achievement of project goals, scientific, technological, and social performances are arising, and the grounds of performance are presented as follows (table 3).

**Table 3.** The performance validity of Korea's natural disaster prediction and reduction R&D projects.

Performance type	Allotting of marks	Superiority of performance	Connectivity and essentiality	Validity of sources
Scientific	5	<ul style="list-style-type: none"> <li>The performance of this project is constantly increasing. But the level of Korea's disaster safety technology is still low as 73%, so journals that can reach the level of advanced countries' technology have not yet produced results.</li> </ul>	<ul style="list-style-type: none"> <li>The result of this project is practically associated with reducing natural disaster. SCI or journals published are quantitatively increasing, and superiority of their quality is also shown.</li> </ul>	<ul style="list-style-type: none"> <li>Performance information has been entered to NTIS (National Science &amp; Technology Information Service), and the performance has been examined by KISTEP.</li> </ul>

<b>Technologica I</b>	5	<ul style="list-style-type: none"> <li>The result of this project is only the registration of Korean patent, and it can be applied industrially.</li> </ul>	<ul style="list-style-type: none"> <li>The result of this project is practically associated with reducing natural disaster. The quality of patent is also higher than 'B', so its technological superiority is thought to be shown.</li> </ul>	<ul style="list-style-type: none"> <li>Performance information has been entered to NTIS, and the performance has been examined by KISTEP.</li> </ul>
<b>Social</b>	20	<ul style="list-style-type: none"> <li>The social performance of this project is constantly growing. Regarding political application corresponding to core performance, academic and social contribution is thought to be favorable.</li> </ul>	<ul style="list-style-type: none"> <li>The study result is associated with the affairs of Ministry of Public Safety and Security (current Ministry of Public Administration and Security) and applied politically. The performance system is provided for free and is used to cope with disaster or victims practically.</li> </ul>	<ul style="list-style-type: none"> <li>'Superiority to cope with climatic change and 10 items selected' and DB building performance and performance to publicize for the utility of study results are thought to be valid.</li> </ul>

#### 4.2. The performance evaluation of Korea's natural disaster prediction and reduction R&D projects

##### 4.2.1. Scientific performance

Regarding Korea's natural disaster prediction and reduction R&D projects, among total 233 theses, SCI thesis are total 44 and KCI (Korea Citation Index) theses are total 189, and for the last three years, the mean mrnIF (Modified Rank Normalized Impact Factor) of SCI theses is found to be 53.59, so qualitative superiority is fairly high. Also, the mrnIF of international journals of disaster risk reduction exceeds 31.32, and about scientific performance, a large number of theses are being published, so constant performance rise is expected.

##### 4.2.2. Technological performance

Regarding the patent application and registered patent performance of Korea's natural disaster prediction and reduction R&D projects, there are recently 47 cases for the last three years, and among them, patents registered are 11 cases. This project's patent performance per 1 billion is 1.34, so it is higher than 1.23, the mean of disaster safety R&D. Concerning "technical performance" to evaluate technological power in registered patents' K-PEG (Korea - Patent Evaluation & Grading), in 2016, there were 4 patents registered receiving over 80 points (out of 100) (50%), so in the future, technology level is expected to rise greatly.

#### 4.2.3. Social performance

Regarding constant growth in the policy use performance of Korea's natural disaster prediction and reduction R&D projects, multilateral publicity activities are being conducted including exhibitions to increase interest in disaster safety and improve recognition, societies • associations, books and videos, discussion sessions, and articles. Most of the research projects are accompanied with systems and sample products developed and delivered for free to Ministry of Public Safety and Security (current Ministry of Public Administration and Security) and research institutions for national disaster safety. Accordingly, from 2012 property and life loss from natural disaster have been continuously reducing. This is thought to be the indirect effect of this project closely associated with the affairs of Ministry of Public Safety and Security (current Ministry of Public Administration and Security).

### 5. Conclusion

The purpose of this study is to conduct evaluation and analysis on Korea's natural disaster prediction and reduction R&D projects conducted from 2003 up to 2016 and provide foundational material for Korea's disaster prevention technology R&D projects to be carried out afterwards. The conclusions of this study are as written below:

1. Korea's natural disaster prediction and reduction R&D projects are being carried out in the aspects of developing technology to evaluate the risk of natural disaster and predict and prevent damage, developing technology to enhance competence to prepare for and cope with natural disaster, developing technology to support overcoming from disaster to help return to normal life, and carrying out social problem-solving pan-ministry collaborative planning projects (disaster safety service).

2. In consideration of essentiality about the characteristics of Korea's natural disaster prediction and reduction R&D projects and achievement of project goals, scientific, technological, and social performances are arising.

3. Regarding the scientific performance of Korea's natural disaster prediction and reduction R&D projects, a large number of excellent theses are being presented, so the performance is expected to rise constantly. Concerning "technical performance", in 2016, there were 4 patents registered receiving over 80 points (out of 100) (50%), so in the future, technology level is expected to rise greatly. Moreover, a lot of research results are being applied practically to the affair of Ministry of Public Safety and Security (current Ministry of Public Administration and Security).

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