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A Development on Conceptual Prototype Design for Efficient Operation of Disaster Management Resources

Joon Ha Kim+, Tae Jung Song, Jong Bin Kim

Research Planning Division, KITValley Co.,Ltd., #1901-1910, DaeRung-post-tower 5th, 68 Digital-9-gil, Geumcheon-gu, Seoul, Korea
+ Correspondence: kimjoonha0522@gmail.ac.kr; Tel.: +82-2-2624-3555

A B S T R A C T

In this paper, we were to study the system to support the disaster response and recovery by providing the disaster management resources such as the Disaster Resource Sharing System(DRSS) in the republic of Korea, the WebEOC in US, and Social Emergency Management Alliance(SEMA) in Japan, etc. Based on the case-study of operation and management the system of disaster management resources, this paper is to suggest the conceptual prototype for efficient operating system of disaster management resources in case of disaster.In order to design the conceptual prototye system, we studied the operating case and guideline of the disaster management resources supporting system in case of disaster. Forthemore, through the best practices and latest technology trends, we suggested the reasonable techniques of the disaster management resources operation and management to assist the disaster response and recovery in case of disaster.The conceptual system is to show the standard equation to stock up the disaster management recources according to disaster cases, to suggest the best path to provide the disaster management resources in the golden time, and to provide the information of disaster vulnerable areas and the placement information of temporary portable base-equipment, etc. As a result, the system can effectively support the decision-making information for the disaster response and recovery to the disaster managers or government officials.In the future, we expect to contribute the stocking and providing policy of disaster management resources at the Ministry of the Interior and Safety in the republic of Korea if usig the advanced system to thepolicy business which is "Digital-Based the Integrated System for the Disaster management Resources(2020-2022)".

keyword : Disaster management resources; disaster response and recovery; DRSS(Disaster Resources Sharing System)

1. Introduction

Recently, as climate change accelerates around the world, extreme weather events are occurring one after another. The damage by natural disasters is also gradually complicated and diversified due to social development such as urbanization, population density, and industrial advancement(Lee et al., 2013; Hong et al., 2017).

When occurring disasters such as flood, earthquake, and pandemic, the government has to consider the efficient disaster response to minimize the human damage, infrastructure damage, and property damage to provide the disaster management resources such as materials, equipment, and manpower to the disaster site.

Since 2014, the Korea Government(the Ministry of the Interior and Safety) has built a DRSS(Disaster Resources Sharing System) and is currently operating it. Through this system, disaster management resources are registered. Especially, by figuring out the current stock of goods or materials, it can effective provide the disaster management resources for the disaster response and recovery in case of any disaster.

Nevertheless, the central and local government is difficult to stock up the goods and materials for disaster management because we are hard to calculate an appropriate amount of disaster management resources. Sometimes, it is expensive to retain the disaster management resources when we hold too much. Conversely, it is difficult to provide the dis-

aster resources in the right time and place. As a result, we hard to control disasters because it does not provide resources.

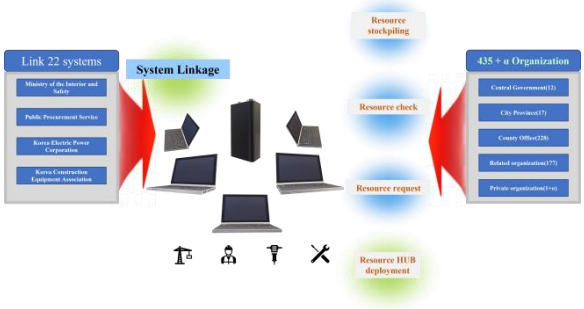
For the reason, currently an uniformly criteria is being applied to stock up the goods and materials for disaster management as a desperate measure(Kim et al., 2019; Lee et al., 2013; Park et al., 2012). 2012).

Therefore, it needs to review and analyze the operating standards the disaster resources sharing according to the regional characteristics and disaster types. But there is a lack of the research and paper on this theme(Kim et al., 2019).

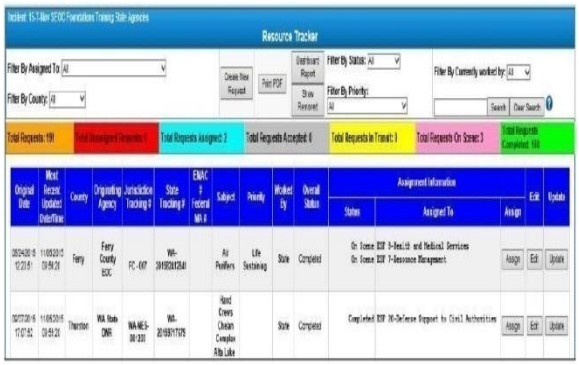
This study is to investigate the disaster management resources operating and managing system and to study the system operation cases and guideline for disaster management resource operation and management in the event of a disaster.

Through the best practices and latest technology trends, we suggested the reasonable techniques of the disaster management resources operation and management to assist the disaster response and recovery in case of disaster.

As a result, we tried to design a prototype for the efficient operation of disaster management resources by deriving an improvement plan for operation and management of disaster management resources.



<Fig 1> DRSS Operational diagram (MOIS, 2019)



<Fig 2> WebEOC operation screen (MDMI, 2020)

2. Materials and Methods

2.1. Investigation of the related system for Disaster management resource

In this study, in order to analyze the related system for operation and management of the disaster management resource, we investigated the system operation cases and guidelines for disaster management resource operation and management in the event of a disaster. Through case studies such as FEMA(Federal Emergency Management Agency), NIMS(National Incident Management System), SEMA(Social Emergency Management Alliance), improvement measures for disaster management resource operation and management were derived.

We applied the derived results to the prototype design system for disaster management resources.

2.2. Prototype Design System of the Disaster Management Resource Operation and Management

In this study, it designed the prototype system for disaster management resources using the analysis results of the related system. In particular, the prototype function design was considered for the following two items.

First of all, it is suggest the criteria for stockpile of disaster management resources based on disaster type to overcome the resources shortage problem caused by lack of awareness of necessary resources and the inability to mobilize resources due to lack of special and advanced equipment.

Second, it suggested the information to provide the disaster management resources in a golden time and the data to provide the information of disaster vulnerable areas.

It also showed the placement information of temporary portable base-equipment in order to improve resource utilization problems caused by inappropriate resource input and allocation in the event of a disaster.

As a result, we designed the prototype system and will apply the design to the disaster management resource operation system development.

3. Results

3.1. Analysis of the Operation and Management System of Disaster Management Resources in domestic

The Korea Government(Ministry of the interior and Safety) developed the DRSS(Disaster Resources Sharing System) in 2014, and implemented the integrated management of disaster management resources in cities, towns and villages nationwide in 2015.

The primary functions of DRSS are to support the searching and registration of disaster management resources, the request and approval of resource support, the synchronizing of disaster management resources for each institution and the supply of other resource-related statistics.

Currently, it has to obtain the authority to use the DRSS after applying for permission. But the management rights are all different for cities·provinces, cities·counties·districts, central ministries, related agencies, and private organizations. Especially, the officials who want to obtain the permission have to apply the authority according to each user position. Nevertheless, if the takeover of the acquisition is insufficient, there are cases of application indiscriminately.

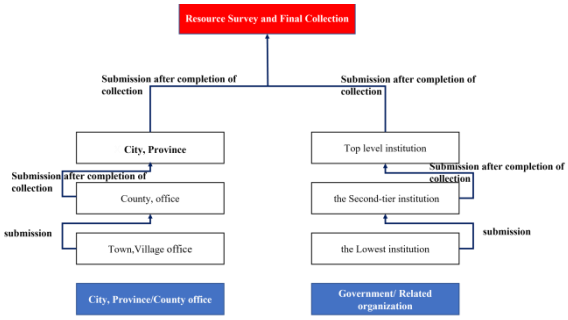
No.	system	Authority name	State	Organization name	Claimant
19	Disaster management	Disaster management officer	Application	county office	
18	Disaster management resources	Disaster management officer	Application	county office	
17	Disaster management resources	Disaster management officer	Application	county office	
16	Disaster management resources	Disaster management officer	Application	county office	
15	Disaster management resources	Disaster management officer	Application	county office	
14	Disaster management resources	Disaster management officer	Application	county office	
13	Disaster management resources	Disaster management officer	Application	county office	

Random application

<Fig 3> DRSS system user-specific permission application case (MOIS, 2020)

In addition, disaster management resource stockpiling and management resource surveys for maintaining DRSS can be reported in Eup, Myeon, and Dong (lowest organization / department). After that, it is submitted to the city / road (highest organization) again, gathered and finally reported.

In this way, the time and manpower may be excessively consumed if the relevant person in charge is overloaded or the handover is insufficient, so it is judged that an efficient disaster management resource operation and management plan with a horizontal structure is needed.



<Fig4> Current Disaster Management Resource Stockpiling and Management Resource Survey Reporting System (MOIS, 2020)

3.2. Analysis of the Operation and Management System of Disaster Management Resources in overseas

The U.S. manages the disaster management resources using FEMA Document 508, (Incident Resource Inventory System), IAB SEL(The Interagency Board for Emergency Preparedness and Response, Standard Equipment List), WebEOC (web-based emergency management information system), and EMAC(Emergency Management Assistance Compact). FEMA uses FEMA Document 508 to define and categorize disaster management resources.

The characteristic of this document is that the material resources and the operating human resources are grouped together for each stage and function of disaster management. Resource types are largely divided into two types, NIMS-Typed resources and other standardized resources.

In the case of the federal government, the IRIS (Incident Resource Inventory System) supports each disaster management organization to frequently register and update the stockpiling status of NIMS-type resources and to share resource information using the intranet. 'The Interagency Board for Emergency Preparedness and Response (IAB)', a group of disaster management experts Standard Equipment List is provided by 21 fields.

In particular, it can be said that the most characteristic part is that the necessary resources for each function are presented in detail in the disaster response process, and the personal protective equipment field is separately formed to secure the safety of the disaster manager at the site.

In Japan, through the Disaster Management Resource Procurement and Transportation Support System, in the event of a disaster, relevant ministries and public organizations in the Disaster Response Headquarters support the procurement and transportation of support materials.

Unlike Korea and the United States, Japan mainly operates a system for identifying the status of relief supplies and mobilizing them, not a system

for supporting equipment held by the central government and local governments, and organizes and operates disaster management resources with a total of 139 items in 14 categories.

In Japan, reference is made to the NIMS of the United States to secure the necessary linkages with organizations related to disaster prevention for all disasters, regardless of the type and scale of the disaster.

The SEMA, which was launched in August 2016 after the 2016 Kumamoto earthquakes, was designed to respond to emergencies such as traffic paralysis due to disasters by updating real-time network information.

In particular, SEMA overcomes the limitations of the government support system by utilizing the supply chain of private companies and provides benefits to participating companies by organizing private/non-profit responses to quickly respond to disasters, enabling information sharing and linkage.

3.3 Implications

As a result of analyzing the current status of the disaster management resource operation and management system, it was found that DRSS used in Korea was somewhat insufficient due to the heavy work of the person in charge.

In particular, after the separation and integration of the "section" or "department" in charge of disaster management resources, the lack of takeover of related personnel appears as the biggest cause, and most disaster management resource personnel actually do so. Disaster management resources The actual situation is that the focus is on the synchronization of the DRSS rather than grasping the current situation.

Therefore, it is required to improve the performance so that public and private sector information on future supply and demand of disaster management resources, warehousing / delivery, inventory management, storage and transportation management can be input and corrected in real time in DRSS, and the utilization of users is improved. In order to improve it, it is necessary to improve the detailed functions such as simplifying the functions of the system and improving the accessibility of the system for private companies.

In addition, regular system utilization training for all users is essential after the expansion and improvement of DRSS capabilities.

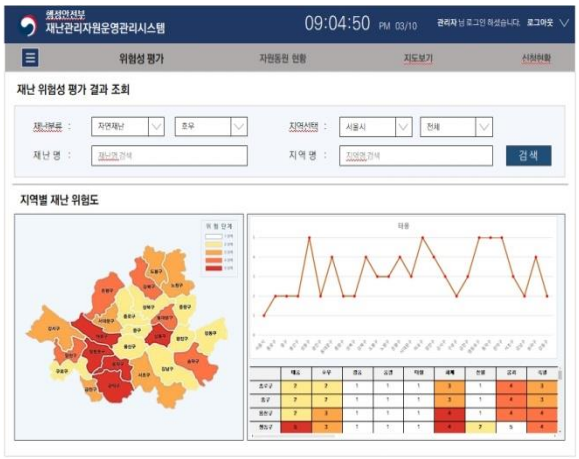
4. Prototype Design for the Disaster Management Resource Operation and Management System

The main screen of the disaster management resource prototype is shown in <Fig 5>. The main screen consists of the current time, login/logout, all menu open buttons, menu movement buttons, and shortcut buttons. The main menu is divided into risk assessment, resource mobilization status, map view, and application status.

<Fig 5> Disaster Management Resource Prototype Main Screen

As a result of the disaster risk assessment, the inquiry screen is the same as <Fig. 6>. Cities·provinces, cities·counties·districts Natural disasters (heavy rain, typhoon, strong wind, storm, heavy snow) and social disasters (fire, mountain fire, collapse, explosion, marine vessel accident, environmental pollution accident, marine pollution accident, livestock infection, infectious disease) risk assessment results can be categorized and visualized, and risk grades can be expressed in the form of tables or graphs according to the type of disaster.

In particular, according to the results of the disaster risk in the search area, the types of disaster management resources necessary and the amount of reserves accordingly were identified.

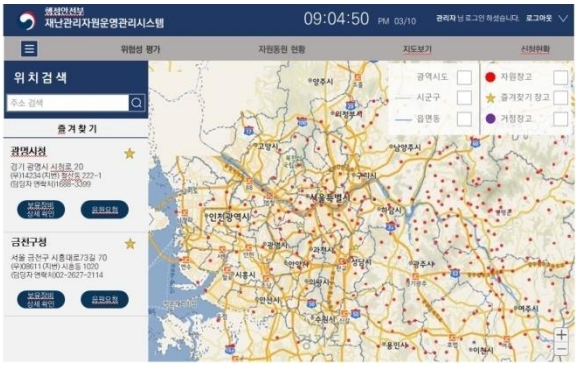


<Fig 6> Disaster risk assessment result inquiry screen

The resource mobilization status inquiry screen is shown in <Fig 7>. It is possible to search for disaster management resources according to resource classification or disaster type, and in the case of 'appropriate stockpiles', it is expressed based on a calculation algorithm to improve resource shortage problems caused by not securing disaster management resources. 'Current location' displays the current location as an address, and when the address is clicked, it is displayed in the form of a pop-up, and when the 'Request for Support' button is clicked, the request form is opened in the form of a double pop-up.

<Fig 7> resource mobilization status inquiry screen

The map display screen is shown in <Figure 8>. It is possible to search for the location of the support warehouse, favorite warehouse, and base warehouse within the map view screen. Considering the golden time, it is also considering whether disaster management resources can be reached, and the expression of information on the placement of disaster vulnerable areas and mobile base equipment.



<Fig 8>Map View Display Screen

5. Conclusions

The conclusions obtained through this study are as follows.

1. As a result of reviewing the disaster resource management system at home and abroad, the current situation was somewhat insufficient due to excessive work of domestic DRSS practitioners, and the biggest reason was the lack of handover of related workers after the separation and integration of disaster management resources.
For this reason, most disaster management resource managers are focusing on the synchronization of DRSS. Therefore, in order to improve these problems, education on DRSS and best practice education on disaster management resource operation is urgently needed, and it is judged that systematic management of stockpiles using disaster prevention personnel is necessary.

2. In the case of disaster resource management systems in advanced countries, when a disaster area occurs, the optimal amount of disaster management resources is predicted in advance according to the scale of damage and effective support is provided during actual mobilization. It is judged that reasonable operation and response will be somewhat limited as the management departments in charge are different according to the characteristics of each location.
Therefore, in order to solve these problems, administrative standards for crisis management and legal and institutional standards within government departments should be supported in the level of resolving the national crisis, and it can be said that the currentization of disaster management resources using the currently established DRSS is most urgent.

3. To develop an efficient disaster management resource prototype, the disaster management resource prototype was designed using the results of the system status analysis.
The main menu consists of risk assessment, resource mobilization, map view, and application status.
In particular, when using DRSS in consideration of calculation of stockpiling standards for disaster management resources by type of disaster, reachability of disaster management resources in consideration of golden time, provision of information on disaster-prone areas and mobile base equipment arrangement It has been improved/complemented so that the heavy work of the staff in charge can be somewhat lessened.

The disaster management resource prototype developed through this study can be used in connection with the "Digital-Based the Integrated System for the Disaster management Resources(2020-

2022)" of Ministry of the Interior and Safety later, and the Ministry of the Interior and Safety establishes a disaster management resource stockpile plan It is considered that it can be used as a reference material.

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Profile

Joon Ha Kim+ (kimjoonha0522@gmail.com)

Senior Research Engineer, Ph.D / Research Planning Division / KITValley Co.,Ltd. / #1901-1910, DaeRung-post-tower 5th, 68 Digital-9-gil, Geumcheon-gu, Seoul, Korea

Tae Jung Song (tjsong73@gmail.com)

Division Director, Ph.D / Research Planning Division / KITValley Co.,Ltd. / #1901-1910, DaeRung-post-tower 5th, 68 Digital-9-gil, Geumcheon-gu, Seoul, Korea

Jong Bin Kim (mces2809@gmail.com)

Senior Researcher / Research Planning Division / KITValley Co.,Ltd. / #1901-1910, DaeRung-post-tower 5th, 68 Digital-9-gil, Geumcheon-gu, Seoul, Korea