

# The necessity of F-NDMS based on Digital Twin.

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**Abstract**—As the years go by, human and property damage due to abnormal climates such as typhoons and local heavy rains increases. Republic of Korea introduces NDMS(National Disaster Management System) and shares disaster information from the department in charge to ministries across the country. The disaster control tower-NDMS- is operated to reduce damage such as natural disasters and personnel accidents. However, the budget is still focused on post- damage recovery. It is necessary to prepare an advanced model to prevent related disasters by introducing a digital twin system at the pan-ministerial level.

**Keywords**—digital twin technology, digital twin model, national disaster, disaster response

## I. INTRODUCTION

Digital twin technology for disaster safety has already been mentioned in many fields. The digital twin, designed for disaster safety, enables cyclical management such as prediction-prevention-response-recovery, according to ‘Digital Twin Technology Report’(2021)’.[1]

Due to typhoon, named *Hinamno*, the government ordered a flood response using advanced digital technology on April, 2023. Related ministries and local governments have launched a "digital twin-based urban flooding smart response system." [2] The Ministry of Environment provides precipitation prediction data and actual measurement data for flood risk areas. A multi-purpose observatory is established based on the high-precision spatial information of the local government. IoT sensor stores rainfall, database in real time. The digital twin system derives areas expected to be damaged by flooding.

## II. WHAT IS NDMS

Since 1996 in South Korea, NDMS(National Disaster Management System)[2] has been responding to crisis situations that threaten the safety of the people, such as natural and social disasters. In the early days of development, it was mainly operated by natural disasters such as flooding, drought and heavy rain.

Because the scope of the disaster expands, the system also has taken care of social disasters. Currently, It consists of three types: Disaster Management Service Portal, National Disaster Safety Portal ([www.safekorea.go.kr](http://www.safekorea.go.kr)), and Disaster

Management Smart App. [3] In the event of a disaster, the system determines the response system in four stages: attention, crisis, alert, and seriousness, according to FRAMEWORK ACT ON THE MANAGEMENT OF DISASTERS AND SAFETY(Article 38 Issuance of Crisis Alerts).[3]

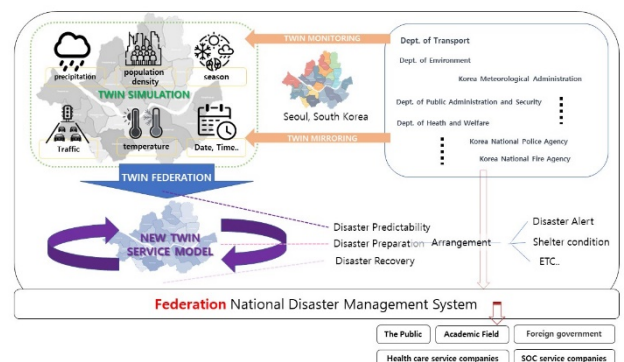
However, It was also pointed out in previous studies that the focus is on recovery rather than disaster prevention.[4]

## III. F-NDMS BASED ON DIGITAL TWIN

There are many combinations of social and natural disasters. It is related to traffic volume, population delivery, season, temperature, and humidity. We propose the new NDMS based on digital twin technology, **F-NDMS**(Federation-National Disaster Management System).

The departments in charge monitor the information and provide the information to be mirrored by applying it to the twins. Twin models are simulated to derive the result value. Finally, federating each digital twin model creates one information-intensive digital twin system. By repeating this process, we create twin AUTONOMATION in which the digital twin repeats the experiment autonomously.[5]

Table 1. F-NDMS Model.



For example, we make the date that humidity, temperature, population density, and last year's forest fire information in Seoul, South Korea, are simulated in twins. It is predicted the density of the population passing through the section where wildfires frequently occur for the **F-NDMS**. The system could catch the possibility when wildfires will occur. The department

saves the cost of human lives, property damage, and personnel input. Automation Digital Twin Model is able to make Disaster Predictability, Disaster preparation and Disaster Recovery.

The government predicts disasters in advance. If you know when a disaster comes and how big a disaster is, you could prepare that as the most efficient policy. The information provided by F-NDMS allows the public to protect safety and life. In academia, it is study-able data for disaster preparation methods. Global SOC companies and foreign governments would be interested in digital twin system.

#### IV. AS A RESULT

The frequency of natural disasters has increased and related damage has become more complex. Advanced disaster response system should give us the chance to make not only recovery policy but also disaster preventive one.

This should be required continuous budgeting and providing data for progressed safety and life. It is necessary to raise the level of digital twins so that a lot of data can be simulated and federated.

Overcoming a new type of disaster by integrated control tower is our challenge. The government must consider countermeasures with the predicted values derived through the twin system. All ministries should actively utilize countermeasures together made by F-NDMS.

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