Development of National Disaster Management Information Platform for Research and Decision-support Applications in Taiwan

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ABSTRACT

Taiwan’s Executive Yuan Program on Applying Science and Technology for Disaster Reduction is an important large-scale integrative program planned and promoted by the Ministry of Science and Technology together with other related government departments. After considering the environmental characteristics and the progress of disaster prevention efforts in Taiwan, this program incorporates the concept of disaster management and integrates the resources of disaster prevention-related government sectors to develop a disaster management information platform to facilitate disaster reduction related researches and their applications to practice. The platform is designed for monitoring and improving the overall effectiveness and efficiency of coordination and realization of disaster prevention efforts among government departments. With the underlying support of advanced information technologies (including hardware and software), the platform employs a three-levels disaster information management framework, namely data, model, and management, to collect and integrate disaster-prevention related data from various sources for research and testing of different analysis, simulation and prediction models for disaster reduction, and to provide various visualization and management tools for decision-support application on disaster prevention and reduction. This paper overviews the background and objective of the program and reports the current status of the development of the disaster management information platform. In addition, some discussions will be provided on the challenges and prospects of the promotion and application of the platform.

Introduction

In order to consolidate disaster reduction technology from different agencies in Taiwan, in 2009 the Ministry of Science and Technology completed planning work for the “National Disaster Management Platform.” The plan was submitted for approval to the National Disaster Reduction Committee in October 2009. However, in the aftermath of Typhoon Morakot that year, the

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government’s need for disaster reduction technology became more pressing. As a result, the National Disaster Management Platform was promoted to a higher level within the government organization, and the Ministry of Science and Technology (MOST) was charged with its roll out in order to ensure the availability of resources and coordination across government agencies. In response, MOST, which has a key role in the development of science and technology in Taiwan, proposed “The MOST Program on Applying Science and Technology for Disaster Reduction (ASTDR).” It was hoped that the new program could effectively consolidate upstream and downstream disaster reduction technology to ensure that technological innovations can be quickly applied to practical disaster reduction work (Chen, 2009).

Current Disaster Reduction Information Systems in Taiwan

Overall, various government agencies in Taiwan have devoted different levels of efforts in recent years to developing their own mission-oriented disaster reduction information systems with little coordination and collaboration across these efforts. As a result, duplicated investment of research manpower and funding may occur. An inventory of the current disaster reduction information systems shows that: (1) Disaster reduction databases require a unified architecture, ensuring that disaster response operations, agencies, and staff at different levels can make more effective use of the data; (2) The integration of real-time monitoring data requires further strengthening; (3) Standards for the exchange of map data for disaster reduction should be implemented to strengthen the acquisition and application of information; (4) Disaster reduction information systems should be designed around the tasks of related government agencies, and must consider overall needs at each stage of disaster management; and (5) Effective information management tools are required to integrate different management tasks and provide communication platforms. Looking at the issues above, we find that disaster reduction work in Taiwan urgently requires a common platform for cooperation and information exchange. The integration of disaster reduction information systems for each government agency together with the establishment of an information-sharing system will enable the integration and sharing of disaster reduction information between different agencies, thereby enhancing the effectiveness of disaster reduction (Yu et al., 2009). Since many agencies are involved in disaster reduction, each with complex and overlapping disaster reduction systems, establishing the Disaster Management Information Platform for Research and Decision-support Applications (DMIPRDA) has become an urgent task.

Establishing the Disaster Management Information Platform for Research and Decision-support Applications

In order to ensure that each government agency has access to accurate, comprehensive, and timely disaster reduction information, the MOST office for the ASTDR program, the National Science and Technology Center for Disaster Reduction (NCDR), and the National Center for High-Performance Computing (NCHC) have collaborated to develop an information sharing platform, referred to as the DMIPRDA. The aim is to establish a disaster prevention cloud-based laboratory, providing a comprehensive cloud environment for disaster prevention research, which can offer the data storage and computing resources required for research applications, and deliver more effective disaster reduction decision-support applications. At present, the DMIPRDA includes the following main system environments. In terms of data, the primary
focus is on “establishing an environment for the collection, integration, value-adding, and sharing of data,” providing data queries, access, and value-added analysis, and a sharing environment for disaster reduction data. In terms of models, the primary focus is on “establishing a computing environment for multimodal integration.” Multimodal data integration can link multiple databases with models in an integrated system environment. In terms of disaster management, the focus is on “establishing a disaster management visualization interface,” providing disaster indicators and warning signals. The content of the platform is based on the results of actual research on disaster reduction technology, combined with an information exchange mechanism, enabling government agencies involved in the MOST Program on ASTDR to easily exchange data for disaster reduction, increasing the effectiveness of disaster relief through the exchange and sharing of useful information. The implementation of these focus issues and the establishment of the Platform for the Research and Decision-support Applications of Disaster Management Information and the technology integration & application process are shown in Figure 1.

Figure 1. The Establishment of the Disaster Management Information Platform for Research and Decision-support Applications and Technology Integration & Application Processes

**Progress on Disaster Management Information Platform for Research and Decision-support Applications**

The DMIPRDA platform is currently at the active stage of development. Outcomes at the current stage are illustrated using the fifth issue, earthquake disaster prevention technology. Using risk analysis and disaster simulation to integrate monitoring data and analysis results, a query function for historical seismic events, as shown in Figure 2, has been provided by the platform to estimate possible disaster impacts and affected areas. Investigation of the features of each simulated severe earthquake events provides a reference for earthquake disaster mitigation.
The future platform development will continue to expand platform data, models, and management modules for improving the overall effectiveness of disaster operations, and also for responding to the ever-changing technologies of the future, ensuring that the platform delivers greater benefits. The focus of future disaster reduction work will be on the following tasks: (1) efficient and intelligent massive data processing and management; (2) development of more efficient and accurate simulation and prediction models to enhance operational effectiveness of disaster reduction; (3) establishment of information exchange and integration standards; (4) establishment of a more stable and reliable disaster reduction information delivery network.

![Schematic Map of Risk from simulated Seismic Events (Seismic Intensity)](image)

**Figure 2.** Schematic Map of Risk from simulated Seismic Events (Seismic Intensity)

**Conclusions**

The platform for the research and decision-support applications of disaster management information is being established for cross-disciplinary and cross-departmental work. It has had a major impact on the outcome and implementation of disaster reduction research and decision-support applications in Taiwan. Work on the platform is continuing according to current planning goals. With the support of the Ministry of Science and Technology and relevant agencies, and the joint efforts of colleagues involved in the platform, it is hoped to integrate and add values to disaster reduction research produced by government agencies in Taiwan with application of advanced scientific methods and technology to improve the overall effectiveness of disaster reduction work.

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