Developing a Web-based Platform to Share Disaster Risk Reduction Technology

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ABSTRACT :

This paper introduces a technology sharing platform for the global network on climate change adaptation (CCA) and disaster risk reduction (DRR). The platform defines a foundation that provides various products or services and its objective is to allow demanders, suppliers and experts to share DRR technology.

The platform is divided into architecture and governance. The fundamental component of architecture relies on detailed technology information which includes structured technology such as technology, systems, tools, analytical models, and non-structured technology such as standards, codes, process, and consulting. The architecture also includes a case study of the application and evaluation for the DRR technology to determine its performance level. Finally, architecture will include a function that enables stakeholders to provide their opinions, experience, and judgements related to the case study.

The primary function of the platform's governance is to exchange the opinions and prepare incentives for sharing information among demanders like the UN organizations and Asia-Pacific nations, as well as suppliers of private sectors and institutions. In addition, subject matter experts can provide input on DRR technology as gatekeepers and participate in the community by presenting their opinions to technology applications

The platform is currently being developed based on the Korean e-Government standard framework and will support both Web and mobile services. This project has been conducted by the financial support from the Korean NEMA as one of the follow up activities of Incheon Declaration and REMAP for DRR through CCA adopted at the 4th Asian Ministerial Conference on DRR, which was held in Oct. 2010 in Incheon, Republic of Korea.

KEYWORDS :

DRR, Technology Sharing, Platform, Architecture, Governance

1. INTRODUCTION

As most natural disasters occur repeatedly, the damage can be reduced by sharing and utilizing prevention information and analytical data based on past disasters. The United Nations has made various efforts, including the International Decade for Natural Disaster Reduction (IDNDR) to reduce the occurrence of natural disasters internationally through scientific and technological solutions. In fact, it has established the International Strategy for Disaster Reduction (ISDR) solely for this issue as a follow-up action, and the institution has been in active operation since 1999. In addition, the Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR) has been held since 2010 to allow engagement of high-level government officials on disaster management and other stakeholders including parliamentarians and science and technology groups.

At the 4th AMCDRR held in Incheon, Korea in October 2010, Incheon declaration and REMAP for DRR through CCA were adopted by ministers and high-level officials from 53 countries in Asia and the Pacific through several multi-stakeholder consultations including UN institutions and NGOs. The key issues of the 4th AMCDRR were as follows: "strengthening capacities for DRR and CCA," "sharing technology and information" and "integrating of DRR and CCA into development." Of particular importance, agreements were reached about plans to organize education and training programs on climate change adaptation(CCA) and disaster risk reduction(DRR) for government officials and other stakeholder groups. In addition, design plans for establishing a web-based platform for collecting dispersed data and technology on climate change and disaster risk reduction were developed [7].

According to agreements made at the 4th AMCDRR, it will implement the platform which disaster risk reduction technologies and education about the technologies will be shared. This paper introduces the platform methodology for the architecture, or managing DRR technology, and outlines the governance, or the operation strategy. This project will allow advanced disaster risk reduction technology to be shared with the common goal of strengthening each country's disaster prevention capacity. Furthermore, active exchanges between and overseas business expansions among the participating countries are expected to lead to greater advancement in disaster risk reduction technology.

2. PREVIOUS STUDY

The contents of 195 websites operated by international, Asian, America, and EU organizations containing information related to overseas disaster technology and information platforms were investigated. Research showed that these websites contain information on meteorology, hydrology, geology, spatial information, disaster information, climate change, etc[9]. More notably, the contents of these websites are limited in scope to presenting tools, solutions, and software products related to: research and expert evaluation, project information, disaster data and statistics information, and real-life case studies. It was discovered that a few of websites on disaster technology products in the DRR field have been developed.

According to the literature review conducted on technology information platform ([1][2][3][4][5][6][10]), a platform will serve as a basis used for creating various products or services. The basic structure of a platform is divided into two components: architecture and governance. Architecture is the overall structure of a computer-based system and defines the principles and guidelines about the design and alteration of the system. Governance signifies the structure of opportunities and authorities among the participants of a business ecosystem and the system of incentive provision.

Architecture consists of several elements including key mechanism, supplement and gatekeeper etc[1]. The key mechanism is the central part that implements tasks through the hardware according to the user's demands. An interface is the touch point between the user and the user application. The key mechanism with an interface is a module that is reused while the entire system remains unchanged. The second element of the architecture is the basic and un-reusable module supplements. The third elements necessary to transform the architecture into a platform are the gatekeeper, and the connector and interface.

The gatekeeper, who implements a decisive role in providing key values, is an element that qualitatively changes the information content by filtering, selecting, scaling, processing, and packaging. The connector and interface are elements that help businesses and customers to create value; the connector is an execution path for the mutual interaction between two or more components, and the interface is an application touch point for user applications.

Lastly, the link element serves as a transfer path to connect many products and services for the sustained growth of the platform. In summary, it is of paramount importance to form a new value complex architecture that uses the assests of a business's own products and technology as a platform and attracts users for the new architecture.

Governance will function as a tool that will provide oppportunities of new group in participating the platform and in creating new value. Governance requires three strategies([2][6]): The first strategy combines exposing and managing techonology products in such a way that the quality of effort is maintained above a certain level; The second strategy is to inspire participation by providing benefits and incentives to participants. An appropriate incentive system secures profit by charging usage fees to the user; The third strategy maintains and strengthens status through constructing monopolistic cooperation, setting subscriber standards, internalizing key capacities, and securing patent acquisition. In summary, governance is the appropriate construction and management of opportunities, authorities, and profit distribution system among the business ecosystem participants.

3. RESEARCH DESIGN

3.1. Platform Domain

Incheon REMAP is a plan to fulfill disaster prevention needs in response to the increasing number of natural disasters due to climate changes. The basis of the plan emphasizes cooperative management. The platform targets climate change adaptation, and sharing disaster management related information, technology, and lessons. Topic 2 is subdivided into information/technology sharing, disaster risk reduction technology, case studies and lessons. Accordingly, the scope for the disaster risk reduction(DRR) technology information platform design is determined so as to construct a platform that includes all the specific topics.

3.2. Disaster Types Shown by the Platform

The statistics for climate-related disasters between 1980 and 2012 reveal that in Asia, flood/inundation and typhoon related disasters occurred most frequently, followed by those related to drought and temperature abnormality. Therefore, Asia-Pacific countries will share technology information related to storms, floods, drought and extreme temperature through an information sharing platform.

3.3. DRR Technology Information Classification

UN ISDR and AMCDRR focus on topics regarding disaster risk reduction rather than disaster response and recovery. The following sections will introduce a decision making process which emphasizes gathering and sharing information, assessing and forecasting situations, planning, decision making and sharing according to the ISO22320 (Emergency Management Requirements) published by ISO/TC223. Based on this process, disaster technologies related to DRR will be classified into structured technology which includes technology, systems, tools and analytical models, and non structured technology which illustrates standards, codes, process, and consulting etc.

Technology as a component refers to sensor, radar, CCTV, location information technology, SNS, and DMB etc. Systems as integration include risk assessment, disaster-induced damage analysis, flood/inundation prediction, evacuation, early warning, and decision-making system etc. Tools as a kit are classified into planning, risk financing, risk transfer, and training etc. Analytical models indicate inundation prediction, water level measuring, weather analysis, rainfall prediction, and big data analysis etc.

4. RESEARCH MODEL

The proposed platform module for DRR technology information sharing is based on the literature review of IT platform as shown in Figure 1. This model contains the platform architecture and governance.

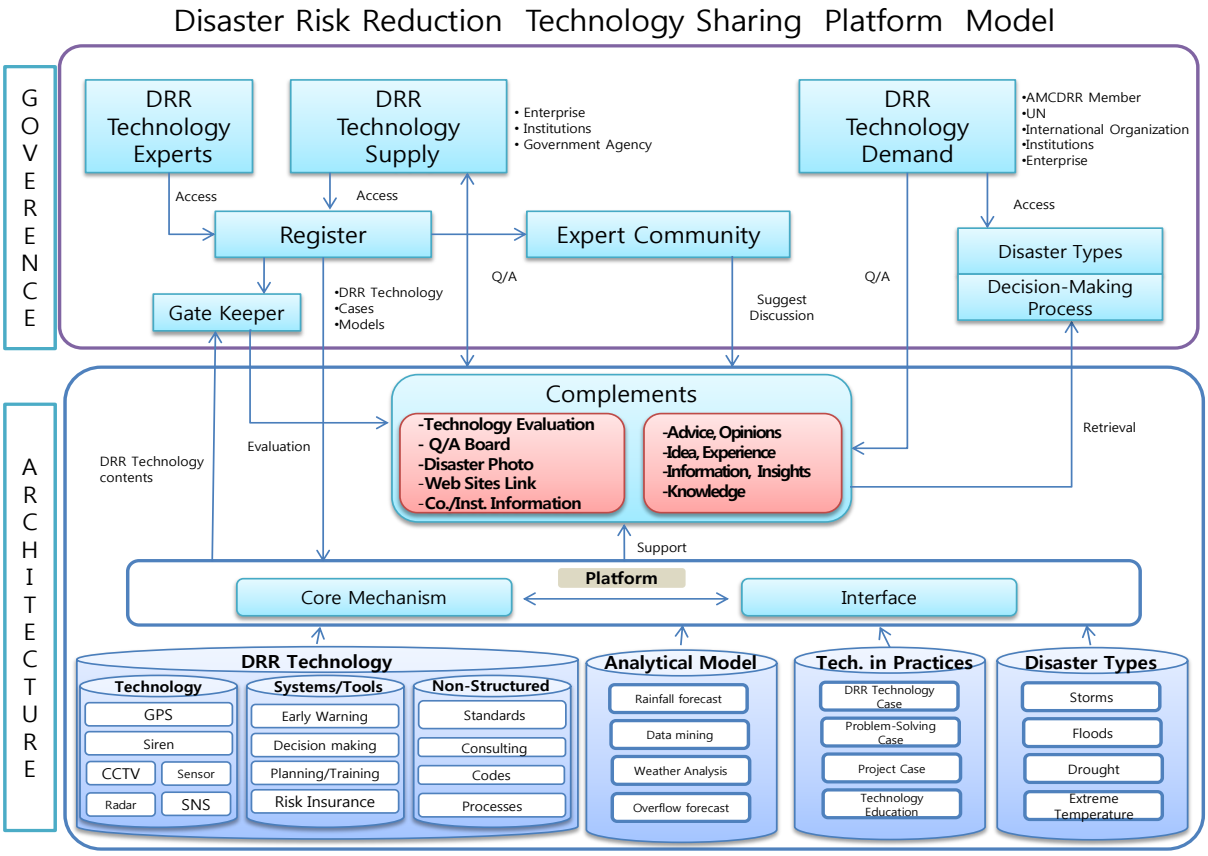


Figure 1. DRR Technology Information Sharing Platform Model

4.1. Platform Architecture

The platform architecture is comprised of a key mechanism, interface, and supplements. DRR technologies, analytical models and technology in practices are selected as the key mechanism. The key mechanism includes DRR technology information that shows technologies, systems, tools, non-structured technologies as well as an analytical model that examples rainfall and inundation prediction model, and climate analysis model, etc. DRR technology information is organized into technology summary and details. The analytical model information is also represented by summary and details format. The key mechanism also includes technology in practices which is comprised of the technology case, the project case, and the problem-solving case. The case studies' formats are prepared and educational content derived from technology in practices will be delivered.

The interface is an important component for the supplier's value creation, and is divided into two types. The first type of interface signifies the touch point between the user and user application. An interface needs to be able to easily register DRR technology, analytical models, quality evaluation, and technology in practices. Moreover, an interface is needed that will enable DRR technology users or experts to present their questions, evaluations, problems, and opinions easily. The second type of interface will signify the execution path for the retrieval according to disaster types with decision-making process. It will also allow for SNS to upload photos of disaster sites or allow access by mobile phones, etc.

Supplements signify a basic module that is not reusable. Various advice, opinions, ideas, experiences, insights, and knowledge surrounding case studies where DRR technology is used will be presented as examples for

supplements. The supplements also show technology evaluation, photos of disaster sites, supplier's information, and disaster-related website links.

4.2. Platform Governance

The platform formation stage is divided[6] into three stages: introduction, rooting, and growth. This research will focus on the introduction and rooting stages as governance. At the core of platform operation strategy is considering the influential factors related to the platform.

Platform regulations are essential during the introduction stage. Regulations consist of participation domain confirmation and regulation method determination. In a disaster technology platform, participants such as DRR technology experts, suppliers, and demanders hold the authority of access, usage and activities, and the final producers (DRR technology suppliers) participate. Suppliers are entities such as business, research centers and state-run agencies. The participation ecosystem provides a platform for sharing to take place directly among the supplier, the expert and end consumer. The end consumer refers to the AMCDRR member countries, international organizations, research centers and businesses. In the regulation method, autonomy is given to businesses without relation or restrictions by the platform operator.

The rooting stage establishes a scope for the early platform stages. This stage seeks to secure more than the critical value of participants necessary for the growth and operation of an effective cycle. The tasks during the rooting stage are to acquire participants and to provide appropriate incentives for the participants. When the consumer group has a sizeable indirect network and the main goal of the incentives is to secure several participants, one-time, short-term incentives are effective. These incentives could include low pricing, technology training, problem-solving, expert's judgment, or providing information etc.

In summary, regulation methods are a key during the platform introduction stage, while open participation is essential during the rooting stage. Utilizing this platform as a DRR technology community is recommended, and this would be accomplished by developing strategies for sharing questions, evaluations, problems, and opinions related to DRR technology among experts, demanders and suppliers.

5. MODEL IN PRACTICE

5.1. DRR Technology

See Figure 2, and Figure 3. General information of the technology includes its name, a brief introduction giving a short product description, specifications, its use, etc. Additional information show price, period off delivery, A/S, the supplier information, classified type, etc. It also notes information related to performance results, certification, patent, etc.

Name of the product	Name of the product	Urban storm water simulation
	Model type	SWMM MODEL(Public domain, USA, EPA)
	Code (Clearance, KRISS)	
Description (functions)	- use throughout the world for planning, analysis and design related to Storm water runoff, combined and sanitary sewers, and other drainage systems in urban areas. - time-varying rainfall, evaporation of standing surface water, snow accumulation and melting, rainfall interception from depression storage, infiltration of rainfall into unsaturated soil layers, percolation of infiltrated water into groundwater layers, interflow between groundwater and the drainage system, nonlinear reservoir routing of overland flow, and runoff reduction via Low Impact Development (LID) controls	

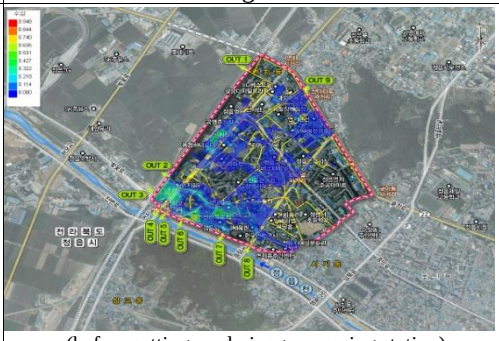
Photo(Shape)				
Standard	Size		weight	
Specifications	- design of storm detention facility project in Jeongup-si, Jeonlabu-do - project objective : reduction of frequent inundation area when urban Storm water is occurred. planning for measure of flood inundation as investigation drainage basin, runoff and drainage Facilities			
Use	- consulting and analysis for design alternatives of storm detention facility - planning for measure of flood inundation as investigation drainage basin, runoff and drainage facilities			
Images of installation process	 (before setting up drainage pumping station)	 (after setting up drainage pumping station)		
Keyword	SWMM, Design consulting, storm detention facility			

Figure 2. DRR Technology General Information

Price	normal price : USD 50,000			
Efficiency				
Period for delivery	8 weeks			
A/S (Warranty)	1 year			
Supplier	Company	HECOREA Inc.		
	Website	www.hecorea.com	Contact	+82 2 572 4320
	Address	405, Woorim venture town2, Seoul, KOREA		
	A person in charge	Name	LEE, Jinyoung	
		Contact	+82 2 572 4320	
		E-mail	Ljy@hecorea.co.kr	
Manufacturer	Country	USA, EPA	Company	
	Website		Contact	
	Address			

Record	Jeongup-si, Jeonlabuck-do			
License	storm detention facility project in YeonJi-District, Jeongup-si, Jeonlabuck-do			
DDR Technology	Technology	Sensor( ) Radar( ) CCTV( ) GPS(●) Siren( ) Light Bar( ) Electronic Board( ) SNS( ) DMB( ) Broadcast( ) FAX( ) Telephone( ) Speaker( ) Broadcasting Device( ) etc.( )		
	Systems	Risk Assessment( ) Damage Analysis(●) Flood Prediction( ) Inundation Prediction( ) Evacuation System( ) Early Warning System( ) etc.( )		
	Tools	Planning( ) Risk Financing( ) Risk Transfer( ) Training( ) etc.( )		
	Non-Structured Tech	Standards( ) Codes( ) Process( ) Consulting( ) etc.( )		
Decision-Making Process	Gathering and sharing information( )	Assessing and forecasting situation(●)	Planning( )	Decision making and sharing( )

Figure 3. Additional Information of DRR Technology

5.2. Expert Judgment and Recommendation

Expert judgment and recommendation together execute a decisive role in providing the platform's core values as a gatekeeper. By filtering, storing, processing and packaging information, they qualitatively change the information content. In May 2013 at the GAR15 conference held by UN ISDR, three categories –Technology Usable, Technology Used, Technology Useful– were presented as technology evaluation elements and indicators were designed. Figure 4 shows an example of an expert evaluator who assigned a grade after making a judgment.

Technology Usable: How do you judge the level of the reviewed DRR technology's on-site usage possibility and extent?	■ Very possible (100%) □ Generally possible (70%) □ Somewhat possible (40%) □ Impossible to use (0%) (Opinion: The device satisfies the users' demands as its use of the DMB communication network gives it the advantage of generating no usage expenses for equipment construction and communication circuit usage)
Technology Used: Are you aware of the reviewed DRR technology's past application cases?	■ Yes □ No Please describe the application case (Overview: Disaster risk regions, major institution situation rooms, densely populated areas such as high-rise buildings, etc)

Technology Useful: If the DRR technology is usable, how useful is it for protecting against inundation, flooding, etc. presently or in the future?	■ Very useful (100%) □ Generally useful □ Somewhat useful □ Not useful (Opinion: A product has strong combined disaster-resistant characteristics against traffic congestion, circuit disconnection, etc., by using DMB data transmission)
Technology Evaluation Grade: Please evaluate the reviewed DRR technology?	□ ☆☆☆☆☆(A^+) ■ ☆☆☆☆(A^0) □ ☆☆☆(B^+) □ ☆☆(B^0) □ ☆(C)

Figure 1. Expert Judgment of DRR Technology

5.3. Case Study

Technology in practices illustrates use of DRR technology through case studies, which are mainly operated by the suppliers. This includes the technology, the project, and the problem-solving case studies. Experts of the technology would provide input such as ideas, advice and insights based on the case studies. Figure 5 shows a technology case study as an example answers the following questions in three paragraphs. The study questions ask: First, please explain what type of technology has been installed by your company with respect to its location, place and situation (focus: overview). Second, please explain the background for the technology's installation. Third, what were the effects of building the technology according to the user's requirements?

Title : Disaster Alarm Broadcasting(Independent/Interconnected) System
1. Please explain what type of technology has been installed by your company with respect to its location, place and situation (focus: overview). ① Installation location: Rivers/seawalls/disaster risk regions in island areas, city·province·county disaster situation rooms, major institution situation rooms, densely populated areas such as high-rise buildings/apartment buildings/villages/schools, etc. ② Description of installed technology: • Rivers/seawalls/ disaster risk regions in island areas : independent disaster alarm device • Major institution situation rooms, densely populated areas such as high-rise buildings/apartment buildings/villages/schools, etc.: interconnected disaster alarm device

2. Please explain the background for the technology's installation.

① User's requirements:

- Disaster broadcasting proprietary firmware development and special terminal production

② Reason for building the technology:

Send disaster information to over 50 million DMB cell phones and navigation devices that have been distributed domestically for quick communication.

③ Purpose of the technology:

To protect the precious lives and property of our citizens from disaster by providing actively engaging disaster information in real-time whenever, wherever, through the DMB broadcasting medium.

3. What were the effects of building technology according to the user's requirements?

① What alternatives did you suggest for the requirements?

- Disaster broadcasting proprietary firmware development and special terminal production

② What were the input/output data for the technology?

No answer

③ What were the effects of building the technology?

- Expansion of application areas through DMB disaster broadcast sending & receiving technology development
- Provide operation management functions from the operator's perspective through real-time system data search functions including alarm announcement/disaster alarm device condition detection and self-test functions

Figure 5. DRR Technology Case Study

A project case study answers the following questions: First, what do we expect to discover from this project? Second, how do you collect information on the technology? Third, what are the features of the technology? Fourth, which types of disaster can the technology be utilized? Fifth, what are the effects of the technology? Sixth, what is the post-management of the technology?

A problem-solving case study answers the following sections: First, the problem-solving case description in terms of ① the case summary (When, Where, What, Why, How) and ② the accompanying case materials (Photos, Videos, Statistics etc). Second, the problem-solving case process organized by the following questions: ① What is the problem of the case and also the cause of it? ② Which techniques (systems, tools etc) were used to analyze the cause? ③ Has the case been recovered? or if it has been delayed, what is the reason for it ④ How did the case influence the economy and society? ⑤ After the incident, have there been any changes in the law or policy?

5.4. Communication

Transfer paths that connect technologies and services for the platform's sustained growth are presented as supplements. They consist of two parts: first, they serve as links to businesses and institutions (public

institutions, research centers, and others) for Q&A on the technology which allow users to connect to the provider's homepage and obtain more detailed information. Secondly, transfer paths allow for browsing disaster information, climate information, climate change information, spatial information, hydrologic information, natural disaster information on typhoon, torrential rain, flood, etc.

5.5. Platform Implementation

The platform implementation develops a framework based on an e-government system. The platform framework plans to adopt the e-Gov Framework [8]. This is an applied technology that builds necessary key functions and architecture in advance for effective development of an information system. Advantages of this framework are as follows: use of advanced information system through open source, guarantee for future expansion by providing a standardized base, and flexible commercialization of platform technology transfer in the future.

The Incheon REMAP Website shown below is being developed based on the technology elements and platform framework. Figure 6 shows the homepage for the platform.

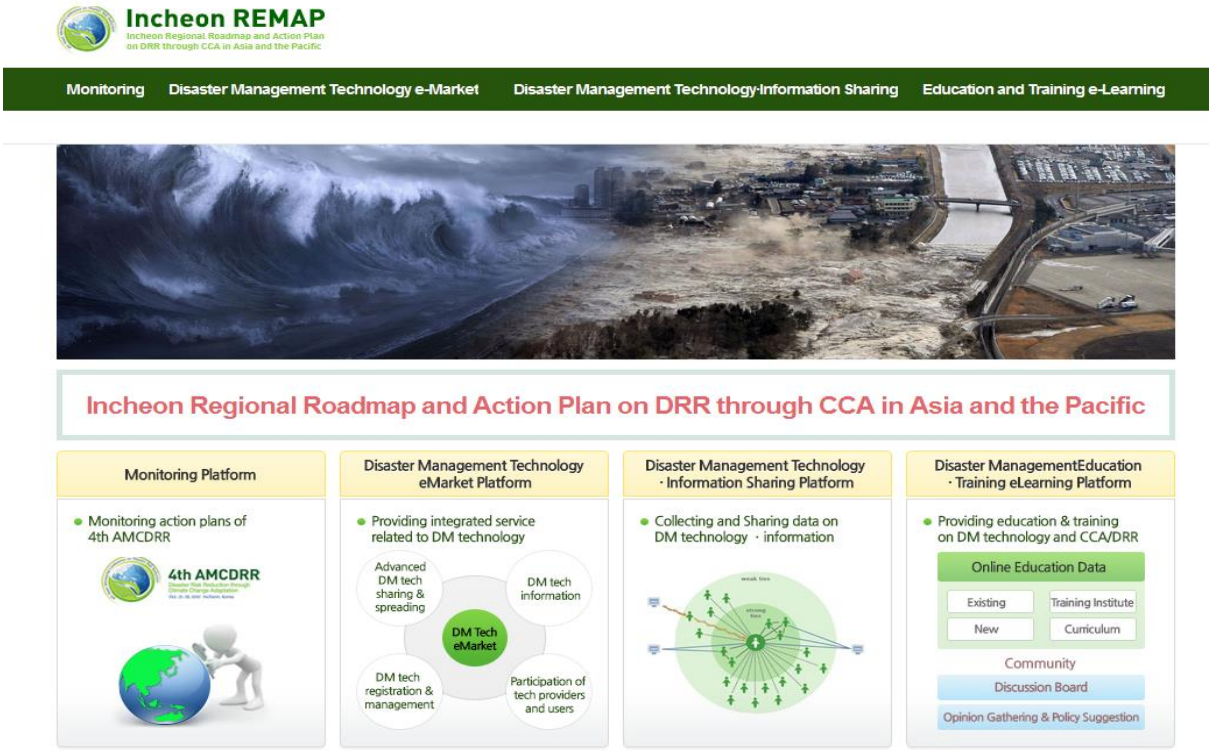


Figure 6. Platform Homepage

6. CONCLUSION

This paper introduces a platform for sharing DRR technology information on DRR technology which includes the content, an analytical model, and technology in practices. In order to enable participation of various stakeholders and experts, the platform is aimed towards generating activity in the community. This involves technology in practices which includes technology, project, and problem-solving case studies. Various international seminars from 2013 through 2015 will be hosted in order to gain greater support and momentum

for successfully implementing this platform. We expect heightened interest and participation levels from states, businesses and organizations by stimulating activities on disaster risk reduction technology and information sharing, which will further strengthen disaster prevention capacity in Asian-Pacific countries.

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