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Establishing a Web-based Platform to Share Technology and Information for Disaster Risk Reduction

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Keywords
Disaster Risk Reduction (DRR), Climate Change Adaptation, Technology Sharing, Platform, Architecture, Governance

Abstract
This paper introduces a technology 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 business customers and suppliers to share DRR technology.

The platform is divided into two components: architecture and governance. The architecture consists of the infrastructure; rather, the technology types or specific data models to be used. It also includes key mechanisms, interface, supplements, etc. Governance is comprised of those who participate in the platform. Accordingly, governance focuses on appropriate incentives for customers and suppliers as well as platform management.

The fundamental component of architecture relies on a detailed technology product which includes monitoring, vigilance, forecasting and warning technologies, and analytical models. The supplement shows a case study of the product/model application. Architecture also includes a gatekeeper. The gatekeeper is an expert who evaluates the product using set criteria to determine the product's performance level. A Q&A board, accessible on suppliers' websites, is created to facilitate dialog between customers and suppliers. Finally, architecture will include a function that enables customers to simulate the analytical model with their own data.

The primary function of the platform's governance is to conduct commercial transactions and prepare incentives for sharing information among customers like the UNDP, GFDRR, ESCAP, and Asia-Pacific nations, as well as suppliers of private sectors and institutions. The primary task of governance is to develop the world's first database which would include various technology products. The database would then be promoted through venues such as conferences, exhibitions, global meetings, etc.

This paper outlines and develops the web-based platform on DRR technology, then builds the platform operation strategy, illustrating how the plan will be executed. 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 National Emergency Management Agency 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.

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 and disaster risk reduction 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 [6].

Since 2011, Natonal Emergency Management Agency, Republic of Korea has supported a study on "Building a Global Networkd for Sharing Disaster Technology and Information." This project will implement the one of the action plans in 4th AMCDRR by establishing a network to enable the sharing of various collected technology information on disaster prevention. The platform will also allow for the development and management of technology-related education programs on climate change and disaster prevention targeted toward government officials and other interest groups.

According to agreements made at the 4th AMCDRR, the platform will be implemented using e-marketing and e-learning strategies through 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.

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. 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][9]), 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. 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: 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.

Platform Design

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 technology information platform design is determined so as to construct a platform that includes all the specific topics.

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 flood/inundation and typhoon through an information sharing platform.

Disaster 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 command and control 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 information, disaster technologies related to DRR will be classified into monitoring technology, analysis and forecast technology, and warning technology.

Monitoring technology is divided into sensor, radar, CCTV, location information technology, and data collection technology. Analysis/forecast technology includes data analysis technology, flood/inundation prediction technology, evacuation and forecast/warning related decision-making technology. Warning technology is classified into media and devices. Media indicates SNS, DMB, broadcasts, FAX, telephone, etc. Devices refer to sirens, light bars, electric bulletin boards, speakers, broadcasting devices, etc.

Platform Model

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

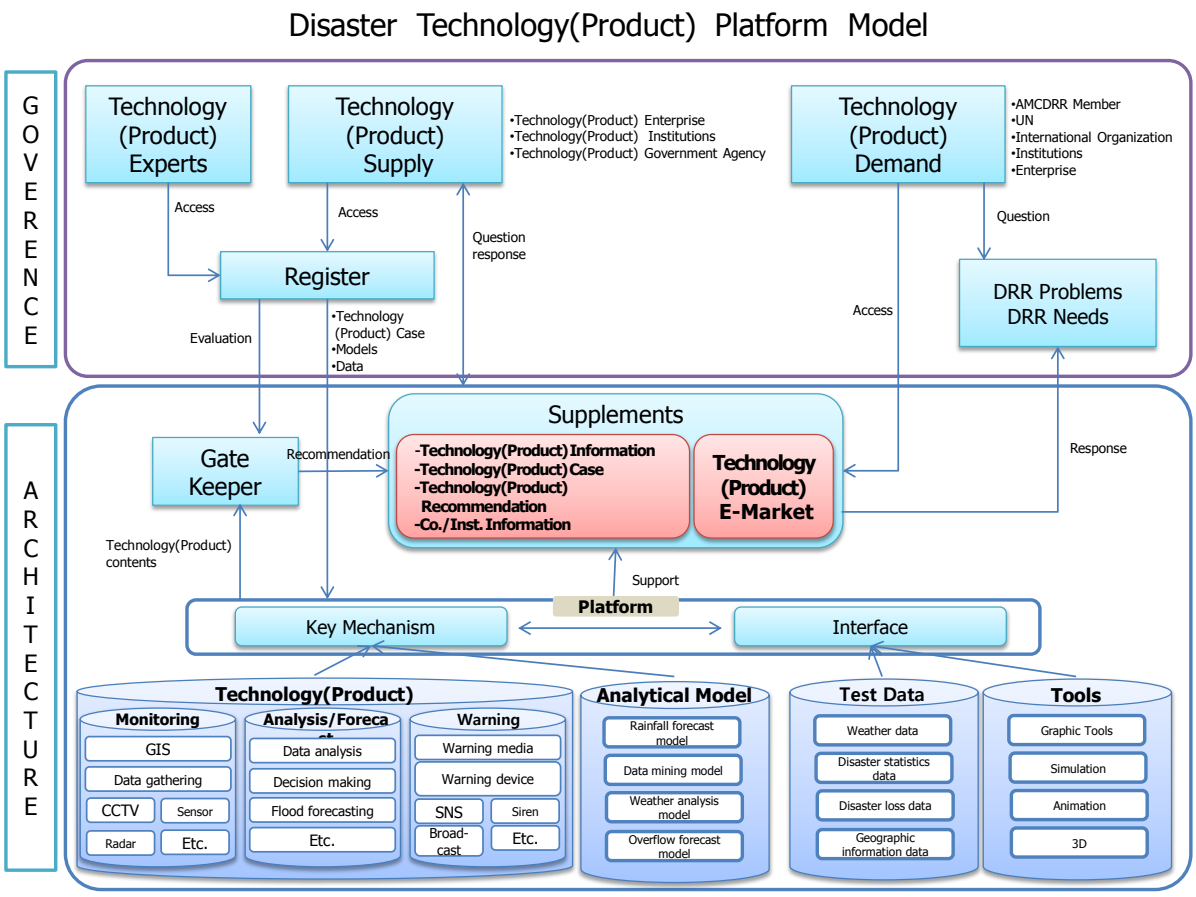

Figure 1 : Disaster Technology (Product) Platform Model

Platform Architecture

The platform architecture is comprised of a key mechanism, interface, supplements, and expert evaluation and recommendation.

Key Mechanism

Disaster related technologies (products), single technology (product) and composite technology (product) are selected as the key mechanism. The key mechanism is comprised of DRR technology information that shows the technologies (products) for monitoring/detection, prediction/analysis, warning, etc., as well as an analytical model that includes rainfall and inundation prediction model and climate analysis model, etc. DRR technology information is organized into technology (product) summary and details. See Figure 2, and Figure 3. A short introduction on the technology (product) includes the name, a brief introduction giving a short product description, classified type, and the supplier information. Disaster technology (product) details show function descriptions, composition, photos, etc. It also notes information related to performance results, certification, patent, etc.

Division		Contents	
Name		Disaster Warning Broadcasting System	
Overview		A system that transmits and provides disaster information to the public in various ways through digital broadcasting media.	
Category	System Health Monitoring	Sensor ( ) Radar ( ) CCTV ( ) GPS Technology ( ) Other Data Collection Method ( )	
	Analysis and Decision-Making	Risk Assessment ( ) Damage Assessment ( ) Flood Forecasting ( ) Inundation Forecasting ( ) Evacuation Command ( ) Forecast/Warning Announcement( )	
	Forecast/Warning Media	SNS ( ) DMB (●) Broadcast ( ) FAX ( ) Telephone (●)	
	Forecast/ Warning Device	Siren ( ) Light Bar ( ) Electronic Board ( ) Speaker ( ) Broadcasting Device ( )	
Provider	Country of Origin	Republic of Korea	
	Company Name	A&D Engineering Co. Ltd	
	Address	336-6 Dangsan-dong 6- ga, Youngdeungpo-gu, Seoul	
	Website Address	http://www.adeng.com	
	CEO	Won-Rak Lee	
	Telephone	02-2163-5200	
	Email		

Table 1 : Disaster Risk Reduction Technology (Product)

Characteristics	Functions	Transmit disaster information that can issue integrated DMB and CBS announcements during a disaster or accident. Disaster information is transmitted to the public through a mobile DMB terminal, DMB navigation, etc.; public broadcasting and private administration broadcasting can be delivered to dedicated receivers for public broadcasting. 1. Control System DMB, CBS integrated announcement system KBS EWS(Emergency Warning System) connection, SBS, MBC, TU-Media, YTN close captioning broadcasting service Graphic User Interface support, Client-Server and Web Announcement support DMB disaster broadcast receiver condition and handicap management, announcement result collection, remote control and program upgrade 2. DMB disaster broadcast receiver Independent village broadcasting amplifier: original program broadcast, ARS broadcast, TTS broadcast, saved message broadcast Disaster situation room announcement details monitoring TTS (Text-to-Speech) broadcast, saved message broadcast, external electric message board connected broadcasting function Alarm broadcast, alarm siren display, repeat, store & play support. Receiver condition management
	Configuration	
	Configuration Design	
	Photo	
Certification, Patent		

Table 2 : Disaster Risk Reduction Technology (Product) Details

Interface

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 (product), product case studies, quality evaluation, analytical models, function and specification, test data, and tools. Moreover, an interface is needed that will enable DRR technology (product) users to present their needs or technical problems easily in the future.

The second type of interface signifies the execution path for the mutual interaction between more than two components (analytical model, test data, tools). A sample interface will be provided where test data is uploaded into an analytical model and processed by tools (graphics, simulation, animation, 3D, etc.) which visualize the results. The disaster related monitoring system construction plan research in Cambodia provides an example where a team led by Professor Hong-Kyu Sohn from Yonsei University, Korea utilized satellite images [8]. A monitoring system for a storm and flood disaster is presented using a remote sensing, water level monitoring system, hydrosphere monitoring system, and deforestation monitoring system. All of these come under the analytical model and results are calculated using test data (e.g., JASON-2 and ENVISAT Radar Altimetry data, MODIS NDWI data, : LANDSAT TM and ETM+images, etc).

Supplements

Supplements signify a basic module that is not reusable. First, a case study where DRR technology (product) is used will be presented as an example for supplements. The case study research answers the following questions in three paragraphs. Figure 4 shows such a technology product case. The research questions ask: First, please explain what type of technology (product) 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 (product) installation. Third, what were the effects of building the technology (product) according to the user's requirements?

Title : <u>Disaster Alarm Broadcasting(Independent/Interconnected) System</u>

1. Please explain what type of technology (product) 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 product:

- 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
- City·province·county disaster situation rooms : disaster alarm device control software
- National Emergency Management Agency: DMB alarm announcement broadcasting software

2. Please explain the background for the technology (product)'s installation.

① User's requirements:

- Disaster broadcasting proprietary firmware development and special terminal production
- Construct a disaster alarm announcement broadcasting system

② Reason for building the technology(product):

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

To send disaster information even during power blackouts or while on the move through disaster-resistant broadcasting media such as the DMB.

③ Purpose of the technology(product):

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 (product) according to the user's requirements?

① What alternatives did you suggest for the requirements?

- Disaster broadcasting proprietary firmware development and special terminal production
- Development of alarm broadcast information reception and handling technology in ordinary private mobile devices (transmission files for broadcasting, terminal UI)
- Development and production of special broadcast receivers that can control multiple equipment such as a village amplifier and private administration broadcasting device
- Construction of a disaster alarm announcement transmission system
- Construction of a transmission system that can send disaster broadcast or disaster alarm broadcast to personal DMB receivers and special receivers

② What were the input/output data for the technology (product)?

No answer

③ What were the effects of building the technology (product)?

- Expansion of application areas through DMB disaster broadcast sending & receiving technology development
- Operation of a stable telecommunication network through the installation of alarm devices that accommodate both cable and wireless technologies(DMB, CDMA)
- Construction of an independent disaster alarm transmission broadcasting network using DMB disaster alarm devices
- Allow convenient operation through touch-based GUI in disaster alarm devices
- 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

Table 3 : Disaster Risk Reduction Technology (Product) Case Study

Transfer paths that connect products 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 products 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.

As outlined in Figure 2, a disaster technology platform will need to be developed as an e-market to allow cyber transactions between users and providers. The e-market platform will provide diverse information on DRR technology including introductory information, manuals, videos, and trial version products in order to promote the product (system, equipment tools, IT device). As the first step in promoting the e-market platform, the National Emergency Management Agency (NEMA), the National Information Society Agency (NIA) Global Cooperation Division, the Korea International Cooperation Agency (KOICA) and others will collaborate to find advanced Korean technologies and transfer them to the Asia-Pacific region. It will further induce the participation of private companies and countries with developed disaster prevention infrastructure so that this platform can develop as a global hub-site for disaster risk reduction technologies.

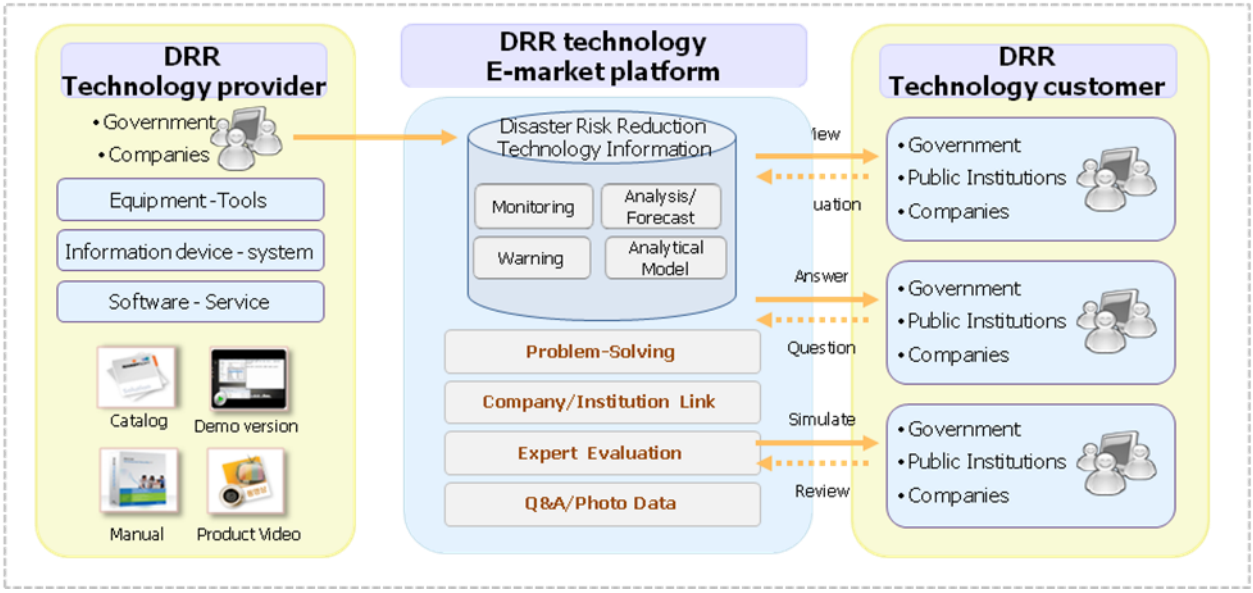

Figure 2 : Disaster Technology e-market Platform

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(Product) Usable, Technology(Product) Used, Technology(Product) Useful– were presented as technology

evaluation elements and indicators were designed. Table 4 shows an example of an expert evaluator who assigned a grade after making a judgment.

Technology(Product) Usable: How do you judge the level of the reviewed DRR technology (product)'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(Product) Used: Are you aware of the reviewed DRR technology (product)'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(Product) Useful: If the DRR technology (product) 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(Product) Evaluation Grade: Please evaluate the reviewed DRR technology (product)?	□ ☆☆☆☆☆(A^+) ■ ☆☆☆☆(A^0) □ ☆☆☆(B^+) □ ☆☆(B^0) □ ☆(C)

Table 4 : Disaster Risk Reduction – Expert Judgment

Strategy for Platform Operation

The platform formation stage is divided [5] into three stages: introduction, rooting, and growth. This research will focus on the introduction and rooting stages. 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 hold the authority of access and usage, and the final producers (disaster technology suppliers) participate. Suppliers are entities such as business,

research centers and state-run agencies. The participation ecosystem provides a platform for transactions to take place directly between the supplier and end consumer, and the most typical form is the open market. The end consumer refers to the AMCDRR member countries, international organizations, research centers and businesses.

Regulation method determination is designed to determine how much regulation should be applied regarding platform usage and supplier activities. Regulation subjects include platform access and usage, determination of technology product price and quality, and compatibility with other platforms. 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 education, or providing tools. By lowering sale prices to below prime costs or providing products for free, the consumer group is increased early on which imposes paid participation on business groups that seek such consumers.

In summary, regulation methods are a key during the platform introduction stage, while open participation is essential during the rooting stage. During the rooting stage, it is advisable to pursue consumer troubleshooting as a separate function, and develop a strategy for providing short-term incentives to consumers and suppliers.

Platform Implementation

The platform implementation develops a framework (See Figure 3) based on an e-government system. The platform framework plans to adopt the e-Gov Framework [7]. 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.

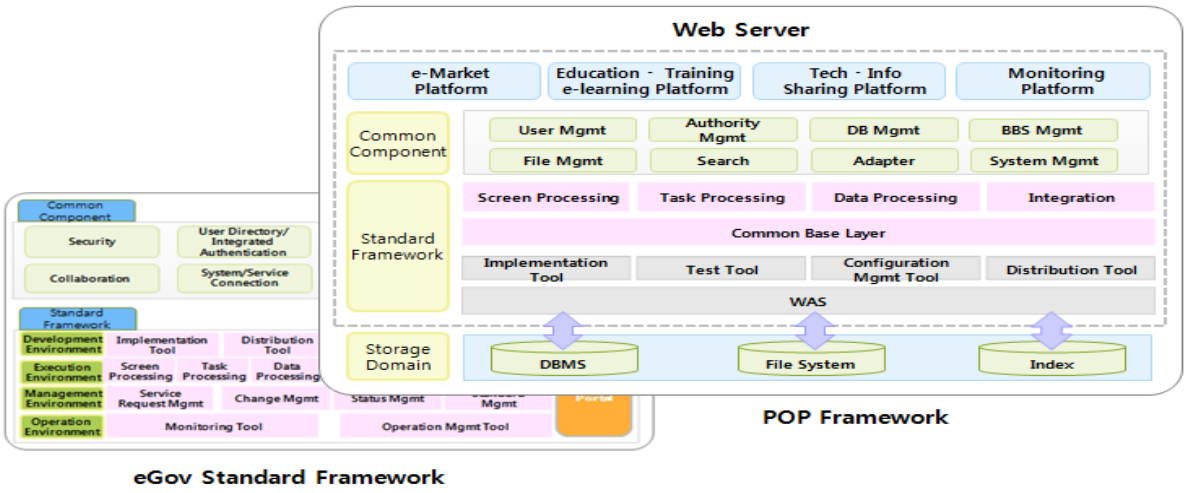

Figure 3 : Platform Framework

The Incheon REMAP Website shown below is being developed based on the technology elements and platform framework. Figure 4 shows the homepage for the platform.

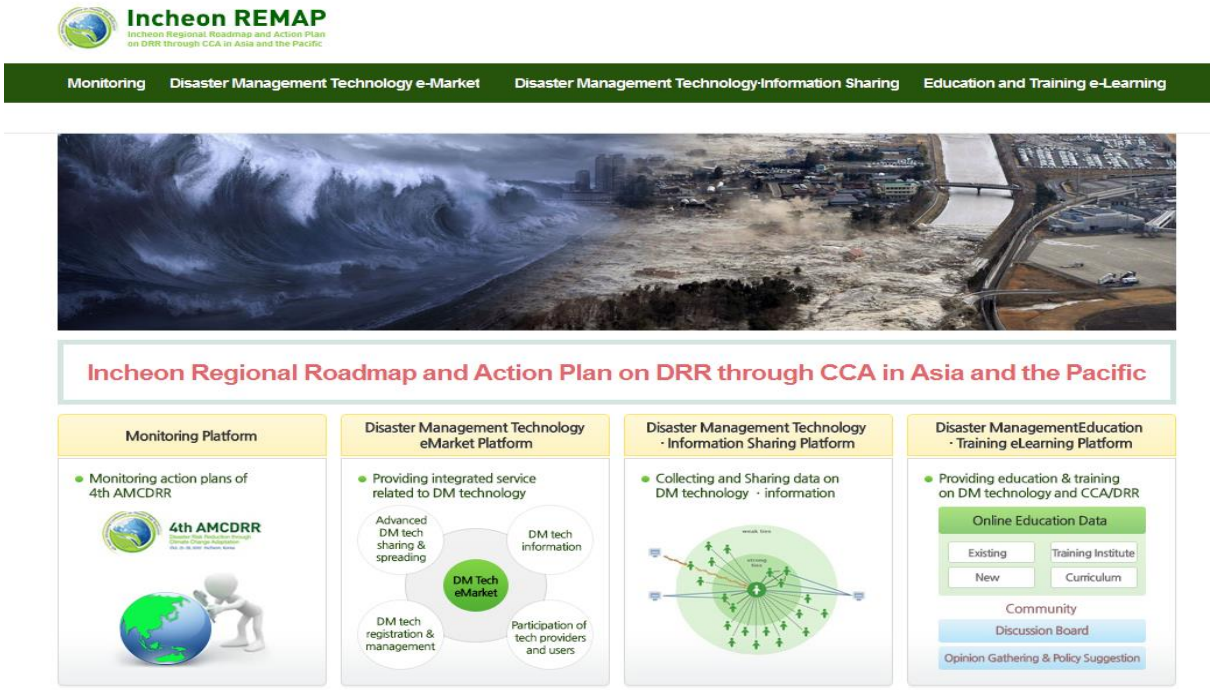

Figure 4 : Platform Homepage

Conclusion

This paper introduces technology (products) contents through case study, expert judgment, and an analytical model of a platform for sharing disaster technology information. Various international seminars related to the 2013-2015 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 through stimulating disaster risk reduction technology and information sharing, which will further strengthen disaster prevention capacity in Asian countries.

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As Director of the Urban Development Task Force in the city of Gwangju, he led initiatives to reduce risk in flood prone areas and engage the private sector in business continuity planning. As Director in the National Emergency Management Agency (NEMA) of Korea, Mr. Kim worked on Disaster Management Legislation and supported capacity building efforts domestically and internationally. His many achievements include organizing the 4th Asian Ministerial Conference on Disaster Risk Reduction, hosted by Government of Republic of Korea.

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