Building Resilient Community by Public Private Partnership – From Science to Action in Developing Countries

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Abstract. The abstract should summarize the contents of the paper in short terms, In order to mitigate possible risks at community level in developing countries, it requires activations of all key stakeholders, especially contributions by public-private partnership. To engage two sides co-working on disaster risk management, there must be clear targets and strategies to gather synergies. Therefore, based on risk maps, social vulnerabilities, investments, tailor-made "smart" disaster risk management could be implemented through regional collaboration. By the definition of "smart risk management", it requires creative and innovative ideas from collecting data to offering better display that should satisfy different situations met by the general public and decision makers. At information ear, according to the base practices in Taiwan, an end-to-end operational model has been operating to produce information intelligence for efficient and effective responses. "Information intelligence" should be the future guidance on value of outputs by information system which must not just be limited in displaying scientific results, but also readable and actionable suggestions to follow. Within the paper, besides introduction on strategic developments, examples of small-scale pilot projects are also illustrated to perform as a pathfinder for setting a new model which meets demands in developing countries. And a systemic approach for developing countries is proposed to enhance capacity and capability of disaster risk management.

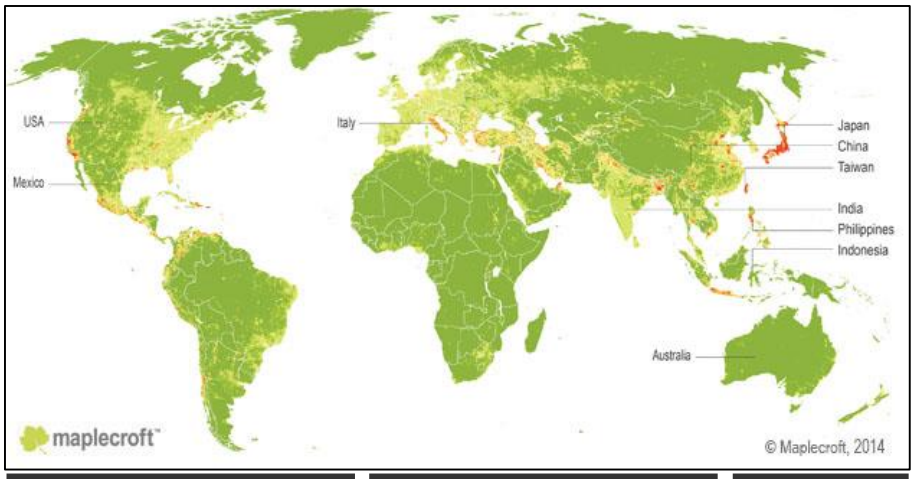
Keywords: smart disaster risk management (Smart DRM), public-private partnership (PPP), information-and-communication technology (ICT)

1 Challenges of Disaster Risk Management in Developing Countries First Section

In 2014, Maplecroft published the Natural Hazards Risk Atlas which states Japan, the United States, Taiwan, China, India, Mexico, the Philippines, Italy, Australia and Indonesia round out the top 10 countries with the highest economic exposure to natural disasters [1]. Figure 1 shows the world-wide evaluation. "Economic exposure" is a common terminology which can sever a vehicle commuting demand and supply of disaster risk management (DRM) between public and private sectors because it highly

addresses societal interests. Major goals of DRM are set to protect lives, reduce losses and enhance resilience. In developing countries, small and medium enterprises (SMEs) occupy most portion of business and are vulnerable to natural hazards compared with global or large enterprises. Among all factors that might be key challenges of DRM in developing countries, the following ones could be essential for improvement:

1. **Inter- and intra- government collaboration**: Nowadays, much more data has been produced by individual agencies which should be important for digitalizing preparedness for emergency response or disaster risk reduction, but due to bureaucracy or inertia reluctancy, low information sharing and exchange among government agencies is a major barrier preventing information integration. It is recommended to have a high-level plan to do inventory surveys on national database and assign clear operational functions to related agencies [2]. By doing so, it is the initial step for building up "smart disaster risk management" (Smart DRM).
2. **Risk maps of physical vulnerabilities**: After collecting basic datasets, production and overlapping of potential maps help to highlight areas with high or multiple risk. Based on the maps, appropriate early warning system and alert messages could be deployed and disseminated accordingly. About equipment of waring warning system and channels to disseminate alerts, possible solutions could be very high-end devices or traditional technology. No matter advanced or old-faction ones, efficiency and reliability decide true performance of the system [3].
3. **Understanding social vulnerabilities**: Evaluation of social vulnerabilities is aimed at measuring the whole society's resilience through identifying the insufficiencies of different aspects such like relevant issues of gender inequity, aging population, risk perception, social status, etc. Being paired with physical vulnerability, social vulnerabilities assist in pinpointing vulnerable minor groups which demand specific cares.
4. **Laws and regulations to enable environment for collaboration**: A well-established environment to regulate rights and obligation of all DRM stakeholders requires legal ground to implement a framework to follow. Laws of DRM can guide direction for inter- and intra- government collaboration.
5. **Setting up all-hazards approach for emergency preparedness and emergency response:** Considering limited capital and human resources in developing countries, an appropriate setup for operations during emergency is a keystone to succeed DRM agenda. Especially, emergency operation could be the most direct way to win credits from top decision makers and the general public. Therefore, a system which can offer operational information intelligence is highly requested is s shortcut to connect scientific community with decision body.
6. **Establish a high-level think-tank for consultancy**: Science-based or evidence-based DRM is a global trend and several best practices of Taiwan and Japan proved it helps quality decisions and saves lives [4] [5] [6] [7] [8]. To make the most use of science and technology is much beyond capability of bureaucratic officers who are used to following superior's instructions, instead of creation. However to cope with dynamic and evolving situations of disaster that highly relies on scientific suggestions. An independent and neutral institution with full support of decision body will play a critical role at all phases of DRM.



Rank	Country	Category
1	Japan	Extreme
2	USA	Extreme
3	Taiwan	Extreme
4	China	Extreme
5	India	Extreme

Rank	Country	Category
6	Mexico	High
7	Philippines	High
8	Italy	High
9	Australia	High
10	Indonesia	Medium

Legend
Extreme
High
Medium
Low
No data

Fig. 1. Maplecroft Absolute Economic Exposure Index 2014 [1]

2 Mission-oriented Design of Investment in Science and Technology for DRM

Investment in science and technology will make a direct link between research community and government administration. Though pure researches do help to accumulate scientific knowledge by publishing papers or journals, but usually these papers can't be directly applied for practical implementation, if without certain procedures to make them feasible. On contract to pure researches, mission-oriented investment first requires clear goals – "improvement" to specify what could be improved, changed or upgraded though filling up gaps, as shown in Fig 2.

For example, to achieve the scheduled milestone of improving Earthquake Early Warning System (EEWS), before real investment, clear targets, like enhancement of accuracy or efficiency, need dialogues among all stakeholders to exchange ideas in developing measure of co-design, co-work and co-implementation. Other jobs required to be done include pre-disaster preparedness plan which will offer guidelines for both emergency responders and citizens to follow just in case of large-scale earthquake; and impacts assessment system provides scientific evidences for exploring vulnerabilities to mitigate in advance or identifying disaster hotspots after a major shock.

All ingredients to make an improvement-oriented investment on DRM are composed of:

1. Innovation: To revitalize existing technology or develop new one for filling gaps at real operations or satisfying people's demands is the ultimate purpose to introduce science and technology for DRM.
2. Information: To enhance collections and coverage of DRM information is aimed at better risk understanding. As mentioned previously, unselfish information sharing is the solid foundation to build up an information backbone for DRM.
3. Interaction: To routinely call meetings or discussions helps to form consensus through open-minded dialogues. Participation to the meetings should be not limited to any single background. Diversity at meetings, such members from government, scientific community, NGO and NPO, assists in broadening DRM scopes to cover end users' demands.
4. Integration: To integrate all stakeholder as a team, addition to information integration, that supports operations for mitigation, preparedness, response and recovery. And resources, capacity and social network of NGOs or NPOs should be considered, but with full communication first.
5. Implementation: To make good things happen for DRM, it demands real implementation of DRM science and technology to finds out both advantages and disadvantages.

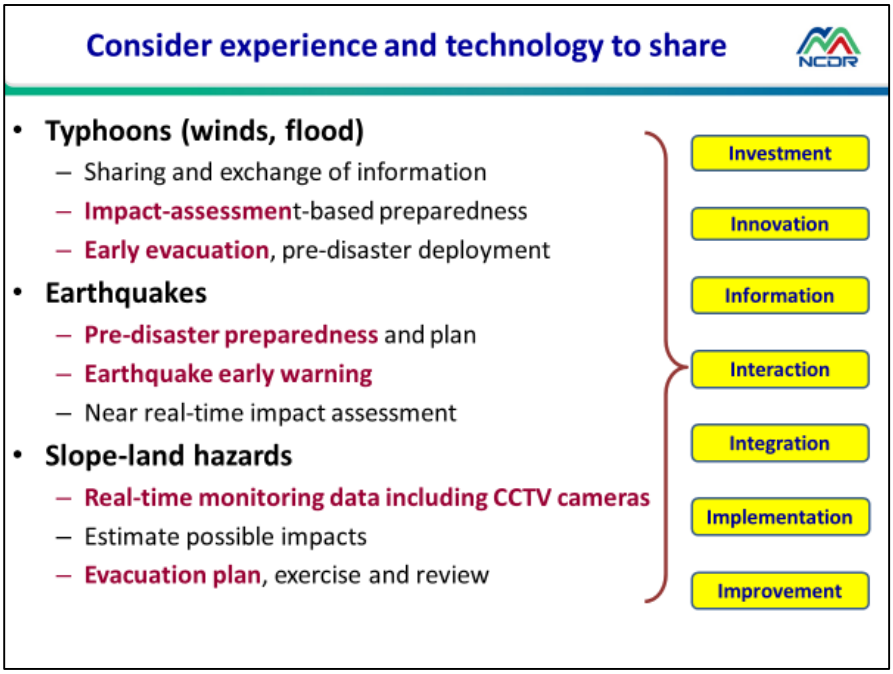


Fig. 2. Improvement-oriented investment on DRM

3 Characteristics of a Project Designed for Developing Countries

In developing countries to deliver a project focusing on Smart DRM, a well-organized plan with a comprehensive capacity survey is a must-be for success. Among all qualifications, no doubts, quality and speed of Internet access will directly decide performance and functions of Smart DRM. Because data collection, transmission, warehousing, sharing or display, every part of Smart DRM heavily replies on the Internet. Elements for Smart DRM might include the following items:

1. Smart sensor network: For collecting data or readings in areas with potential risk, different kinds of sensors are designed to measure specific parameters which help to depict situations on sites. By rapid development of sensors, more options can be easily applied for filed observations. However, much different than decades ago, the Internet connects sensors as network and gives a chance to improve the way to conduct near real-time measurement on physical changes. Fig. 3 is an Internet-connected accelerometer to measure seismic waves, P-Alter, which is designed for detecting P-wave to estimate S-wave and issue warnings. Through the Internet connections, certain number of individual P-Alerts can function as a local seismic network.

- To use IoT to collect real-time data: Internet of Things (IoT) is reshaping the way of real-time measurement on physical vulnerabilities. By applying IoT, the amount of data is increasing at exponential rate that demands new approaches to deal with.
- To collect and analyze basic data for pilot site: It is realistic to choose a pilot site for a small-scale deployment of sensors. Besides testing stability of Internet connection, the pilot project also can offer inputs before large-scale installation.
- To enable a disaster-resilient foundation for a smart city: Now most cities are doing their best efforts for becoming a smart city. Disaster risk management is an index for disaster-prone cites to achieve. So Smart DRM will be emphasized by both officials of central and local levels.

2. Cloud-based decision supporting system: Traditionally, central server at computer room is a typical setup for decision supporting system. But considering redundancy and readiness of the system, cloud technology provides ideal solutions to developing countries. Reasons to embrace cloud-based system: 1) The configuration can reduce loading to establish facilities for high-performance computing and storage; 2) The technology also offers easy assesses to all end users; 3) The environment is mature for cross-platform operation.

- To offer easy access for all users: Since the system can be applied for difference platform, Windows, macOS, IOS or Android, most of users can execute the system anywhere.
- To enhance system's readiness and redundancy: Compared with traditional setups, no matter public or private clouds are able to maintain very stable operation that meet the demands of emergency operation.

– To provide a platform connecting offsite stakeholders: In case of emergency operation, users might access the system anywhere by difference devices. Therefore, decision supporting system operated by cloud technology will also connect users operating at emergency operation centers or on sites.

3. Capacity building for information intelligence: Training qualified personnel to produce and interpret scientific information is an essential part of capacity building in developing countries. With appropriate and understandable interpretation, it will help both decision makers and the general public to take right actions.

– To co-produce tailor-made information for specific users- citizens, decision makers and private sectors: To meet demands of diverse end users, trainees must clearly identify right and in-time information.
– To engage more resources through public-private partnership: Nowadays, private sector also owns and produces big dada which is valuable for DRM. For example, social media and mobile companies can provide informative data, but all application must strictly follow personal privacy.

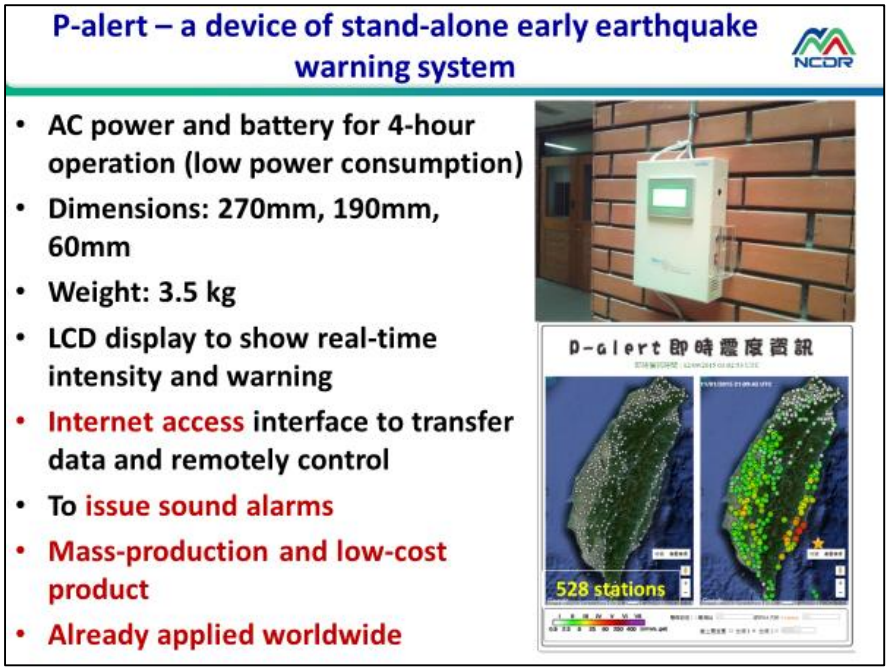


Fig. 3. An Internet-connected accelerometer to measure seismic waves, P-Alter

4 Conclusions

1. To have good teamwork by integrating government, research community, NGOs and NPOs, it needs linkages like mission-oriented projects which focus on demand and supply and encourages constant dialogues among stakeholders.
2. To establish a knowledge-and-technology center, that should function as a facilitator and coordinator and provide professional consultancy
3. To build network between the knowledge-and-technology Center and local universities, through the process, it will both empower local governments and fill information gaps.

References

1. Maplecroft Homepage, https://www.maplecroft.com/insights/analysis/uks-economic-exposure-to-flooding-among-worlds-highest/, announced 2014/02/20.
2. Hsieh, S.H.: Achievements and Outputs of the Program on Applying Science and Technology for Disaster Reduction, 2011-2014, (2015).
3. Tasy, C.Y.: From Academic Research to Policy Making - A Case of Taiwan Effort in Disaster Reduction (2009).
4. Chen, L.C., Yen, C.L., Loh, C.H., Wei, L.Y., Lee W.C., and Ho, H.Y.: Development and Implementation of Disaster Reduction Technology in Taiwan. Natural Hazards 37(1), (2006).
5. Chen, L.C., Liu Y.C., and Chan, K.C: Integrated Community-Based Disaster Management Program in Taiwan: A Case Study of Shang-An Village. Natural Hazards 37(1), (2006)
6. Yen, C.L, Loh, C.H., Chen, L.C., Wei, L.Y., Lee W.C., and Ho, H.Y.: Development and Implementation of Disaster Reduction Technology in Taiwan. Natural Hazards 37(1), (2006)
7. Hsu, H.H, Chou, C., Wu, Y.C., Lu, M.M., Chen C.T., and Chen, Y.M.: Climate Change in Taiwan: Scientific Report 2011 (Summary). National Science Council (2001).
8. Morakot Post-Disaster Reconstruction Council, Rebuilding a Sustainable Homeland with Innovation and United Efforts, Executive Yuan, Taiwan (2011).