SOLVING THE PUZZLE

EXECUTIVE SUMMARY

Innovating to Reduce Risk

This publication is driven by input provided by the disaster risk community. The Global Facility of Disaster Risk and Recovery facilitated the development of the report, with funding from the UK Department of International Development.

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Collaborators

Overview

The starting point for improved disaster preparedness and resilience is to better understand risk. Over the past ten years, there has been a marked improvement in the availability of risk information, but many of the poorest and most vulnerable countries have been left behind. The demand for more robust, accessible, high-resolution and trusted risk data and analyses in these countries is rising. What are the priorities going forwards?

This initiative aims to provide a community perspective on the priorities for future collaboration and investment in the development and use of disaster risk information. It recognizes that while some of the remaining challenges can be addressed through individual initiatives, on others the most progress can be made through acting together as a community. It considers for example, the rationale for a new global risk platform, as well as investments in hazard, vulnerability and exposure information, models, risk communication and capacity building. This report provides the findings of a broad review and consultation aimed at identifying those priority areas of future collaboration and investment.

The consultation was led by the Global Facility for Disaster Reduction and Recovery (GFDRR) on behalf of the UK Department for International Development (DFID). However, we do not see this as a GFDRR or DFID initiative. More than 100 organisations across the user community, academia, NGOs and government have contributed to this initiative. Our aim is to facilitate a wider consensus across the community, which the community itself can take forward to deliver.

The intended outcome of this report is twofold. The first, that through the community speaking as one voice on the priorities for disaster risk information, we can encourage greater and additional investment in the areas highlighted as priorities. The second is that the consensus embodied in the report will initiate the formation of the strong coalition of partners and active collaboration needed to deliver the recommendations.

The next phase of this initiative is to provide seed funding, through the GFDRR-DFID Challenge Fund, to facilitate collaboration and progress in delivering the priorities.

Motivation

There is a great need and a growing demand for disaster risk management (DRM). The need is motivated by the increasing trend in the number of disasters and the resultant growth in losses and fatalities. While disaster losses are significant in all regions of the world, they have a disproportionate impact on developing countries. For example, in 2013 Super Typhoon Haiyan affected nearly 13 million people in the Philippines, approximately 13% of the country's population and nearly 90% of homes were lost in the hardest hit areas[1]. The economic impacts of disasters on developing countries can be staggering: the 2010 earthquake in Haiti caused direct and indirect losses that were equivalent to ~120% of Haiti's GDP[2].

According to a report by Overseas Development Institute (ODI) and GFDRR[3], implementing DRM strategies offers a "triple dividend" by:

- Avoiding or minimizing loss when disasters strike
- Unlocking development potential due to reduced "background risk"
- Producing co-benefits from investments to reduce risk

Reducing the number of disasters and their impacts and increasing resilience to disasters will help maintain growth trends in developing countries. In addition, improved disaster resilience should reduce the demand on relief and humanitarian aid, which have been under considerable pressure in recent years.

Identifying and understanding disaster risk using a disaster risk assessment is a critical step toward implementing an effective DRM strategy, as is evidenced by Priority 1: "Understanding disaster risk" of the Sendai Framework for Disaster Risk Reduction[4]:

Disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be used for risk assessment, prevention, mitigation, preparedness and response.

Using risk assessments to implement DRM strategies, requires a broad range of efforts and the expertise of multiple disciplines. This is the focus of this initiative. The report reviews the status of risk assessments and the priorities going forward, drawing upon experts across these many disciplines.

[1] http://www.mercycorps.org/articles/philippines/quick-facts-what-you-need-know-about-super-typhoon-haiyan
[2] http://www.worldbank.org/en/country/haiti
[3] http://www.mercycorps.org/articles/philippines/quick-facts-what-you-need-know-about-super-typhoon-haiyan

Approach

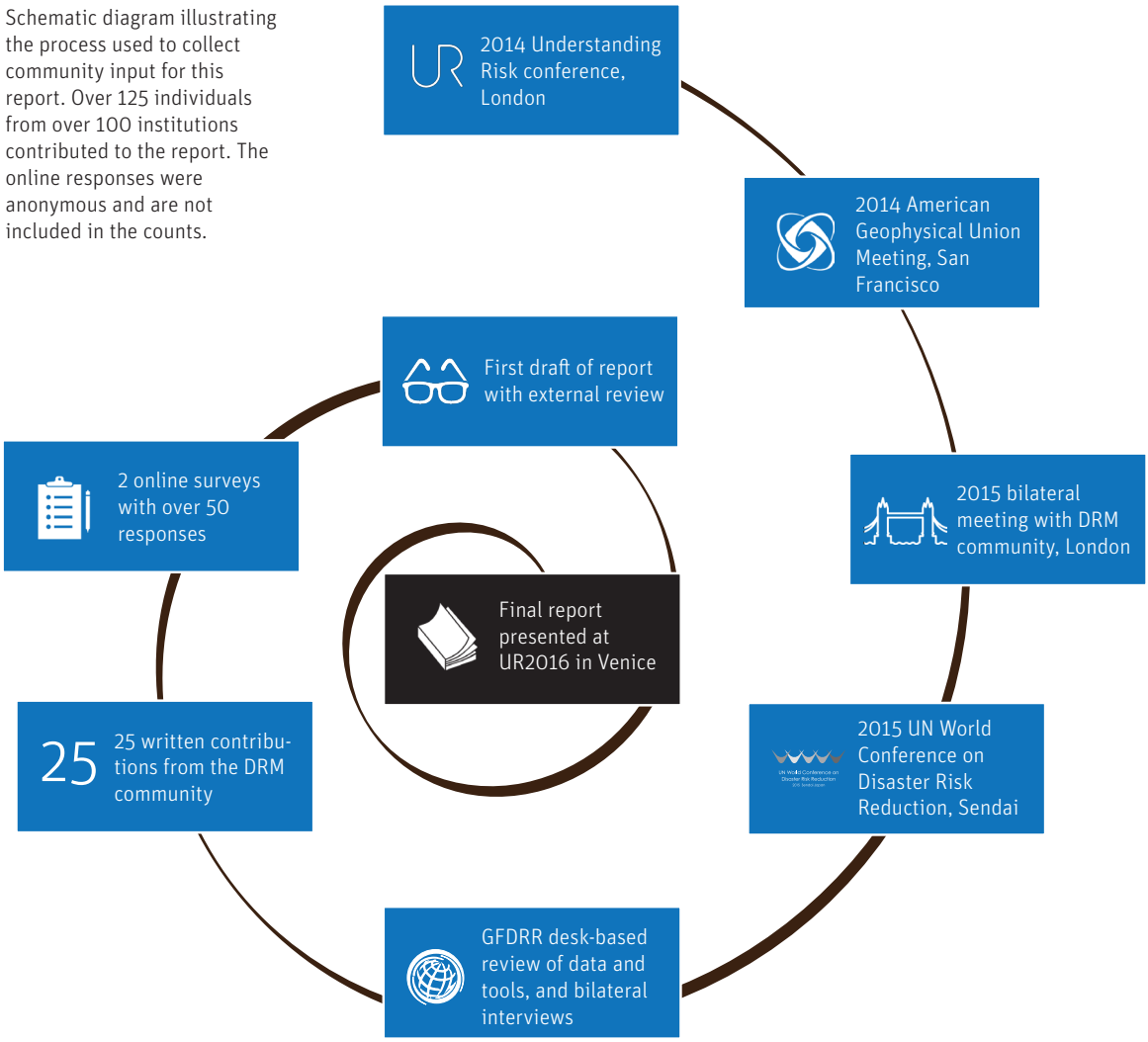
To present a consensus view and be embraced by the community, this report sought to engage the DRM community in order to understand the current state of risk models, data and platforms, as well as the use of risk DRM, and determine the current challenges and needs of the community.

The DRM community is defined as:

- **Donors** that support DRM activities ranging from model development and data collection to risk communication and capacity building;
- **Providers and creators** of risk data, models, analytics, platforms, training, and communication tools; and,
- **Users** of the products and services offered by providers, and who also might be recipients of aid from donors.

Community input was solicited using a variety of approaches, including:

- A series of six consultations in three continents over a course of 1.5 years involving more than 100 organisations.
- Twenty-five written contributions from the DRM community.
- Two open, online canvassing efforts via structured survey.



Schematic diagram illustrating the process used to collect community input for this report. Over 125 individuals from over 100 institutions contributed to the report. The online responses were anonymous and are not included in the counts.

Findings

The current environment as perceived by the DRM community

The key findings of this effort are summarized below:

› Risk Models

Currently, there exists a wide array of risk models for a variety of primary perils such as earthquakes, floods, and tropical cyclones, and secondary perils such as tsunamis, and coastal flooding due to storm surge. Depending on the model and peril, the risk models can be accessed either as licensed proprietary software from the private sector, as freely available pre-compiled code, or as open source code that a user can customize. The proprietary models mainly focus on regions and perils with a mature or quickly growing insurance market, whereas freely available and open source models are not restricted to specific regions, and can be used anywhere. However, all models (open or proprietary) have the downside that they can be difficult to use without significant expertise, and often require hazard, exposure or vulnerability data that is difficult to obtain. Thus, in many cases, the existence of a model is not the issue, the challenge is finding data and accessing and using an existing model.

› Risk Data

Risk data encompasses multiple types of data and, in contrast to risk models, data appear to be the limiting factor when undertaking a risk assessment. Data for risk assessments range from reference data, such as elevation and soil type, through to exposure, hazard and vulnerability data, and all the way to loss data from historical events. The data are often higher resolution, more complete, and easier to obtain in developed regions, but specialized data such as a high-resolution LIDAR data, is almost always expensive to obtain. Development of exposure data is often time consuming with different datasets scattered across government departments and commonly in paper format or without necessary metadata, meaning significant investment is required for its use. Vulnerability data, and loss data that can be used to develop and/or validate vulnerability functions, are relatively hard to come by in all parts of the world. Thus, risk modeling could best be improved not by better models, but by better data.

› Risk Platforms

To facilitate risk assessments, there are a variety of ongoing efforts to develop platforms designed to host data, provide computational resources, or offer tools for analyzing risk data and model results. As with the risk models, the platform efforts range from completely open to proprietary. These platforms are relatively new and have a variety of challenges regarding interoperability, ease of use, and broad community acceptance. Nonetheless, the risk modeling community has significant interest in risk modeling platforms as they offer the promise of improving the process of assessing risk.

› Capacity Building

Effective DRM requires more than outside experts completing a risk assessment. The results from the assessment need to be trusted, understood, communicated, and acted upon. For this to happen, there needs to be improvements in the currently available set of tools for understanding and communicating risk. A variety of resources are available, but there is little in the way of formalized instruction on how to undertake a risk assessment; how to understand, interpret, and use the results; and, how to communicate in an effective manner so that the information is acted upon. Improvements in web-based education might provide a cost-effective means to improve the understanding of risk information and using it in disaster risk management.

Priorities for Future Collaboration and Investment

Consultations with the DRM community have identified a series of priorities for future collaboration and investment. The activities are categorized in a manner that accounts for the different steps in a risk assessment, as relates to hazard, vulnerability and exposure models and data; disaster risk and disaster losses; risk platforms; and risk communication and capacity building. The DRM community ranked activities within each category, not the categories themselves. The activities are summarized in Table S1.

We stress that the priorities identified in this report are not the only method of tackling challenges that exist in disaster risk identification. The priorities represent only the top priorities that have come out again and again through consultations. It is not by any means an exclusive list. We see these as areas where the community, as a whole, agrees that collaboration and investment are needed urgently to make progress on our broader goals.

The activities within each category are the following:

› Hazard

The highest activity was the development of **hazard scenarios** for developing countries that provide examples of historical and plausible events. This activity was ranked highly for several reasons. First, these scenarios would be in the form of open data that was compliant with common standards, and when used with existing, user-friendly, open-source software such as QGIS and InaSAFE, could result in impact scenarios that are easy to understand and communicate. Also, for many hazards, creating scenarios would be straightforward using existing hazard catalogs. In addition, the scenarios would be reusable as exposure and vulnerability data improved or changed over time.

› Vulnerability

The second rated activity was the development of **a set of open vulnerability functions**. Vulnerability functions account for an exposure assets' response to the forces associated with a hazard. For example: how a building reacts to the shaking of the earth during an earthquake, or to winds during an intense tropical cyclone. Vulnerability functions are often fairly generic, or proprietary, but they are critical for getting realistic assessments of loss. Once they are developed, they are usable and adaptable to other areas with similar exposure profiles. Unfortunately, there is a lack of openly available, quality vulnerability functions.

› Exposure

The highest rated activity in the exposure category was the enhancement of an **open exposure dataset**. Exposure data, such as that for population, dwellings, roads and critical infrastructure, is a critical component for assessing risk. Poor exposure data leads to poor loss estimates. In many countries, developing an exposure dataset is often one of the biggest hurdles for completing a risk assessment. Low-resolution exposure data can often be derived from existing and open global datasets, but they are not sufficient for detailed risk assessments that would be needed at a project level.

› Risk Communication

The highest rated activity in the communication category is the **creation of a community of practice** as a means to facilitate and promote actions and responses to effectively communicate risk. There is strong interest in creating a mechanism that can formalize many activities related to risk assessments, capacity building, and communication. For example, experts in risk modeling and risk communication, and community leaders, could develop best practices for effectively communicating the results of risk assessments in a manner that is easily understood by communities and decision-makers, and develop tools to enable such efforts through an online learning space. The creation of a

community of practice would form the foundation for many other efforts.

Capacity Building

The highest rated activity in the capacity category is the **creation of educational modules** to provide training for the interpretation and use of risk assessment results. Online courses designed to teach risk modeling, the interpretation of risk assessment results, and the communication of risk information would promote the use of risk assessments aimed at reducing disaster risk.

Risk Platforms

The highest rated activity in the platform category is support for the **development of standards for model interoperability**. This activity would allow for the use of multiple models as a means of assessing uncertainty, and would promote the use of risk platforms as it would facilitate the transfer of data, models, and results among platforms. This activity has substantial complexity and it's worth noting that there are similar ongoing efforts (e.g., OpenMI).

Disaster Loss

The highest rated activity in this category is the **development of an open loss database** suitable for the development and validation of vulnerability functions. Everyone is interested in loss data because of its many uses. There are a number of ongoing efforts related to loss data, for example DesInventar, EM-DAT, and loss data collected by the (re)insurance industry, but these data are not suitable for developing or validating vulnerability functions. This database would match hazard intensity (e.g. ground motion or wind speed) with damage and loss to a class of exposure (e.g., GDP, population, or building construction and occupancy).

Reference Data

The highest rated activity in the reference category was support for **the development of high-resolution DEM data** for developing countries. This data is critical for a variety of risk modeling activities, particularly for assessing risk due to riverine and coastal flooding, tsunamis and sea-level rise.

TABLE S1 **Potential "next steps" to promote the use of risk assessments by developing countries.**

Category	Potential next steps
Hazard	Develop a suite of reference hazard events that provide examples of historical and hypothetical events for impact analyses in developing countries
Vulnerability	Develop open databases of vulnerability functions for a variety of exposures (e.g. structural damage and social vulnerability), spatial resolutions, and hazards
Exposure	Support the enhancement of an open exposure dataset with structural data and building valuation
Communication	Formalize a community of practice for the communication of risk assessment information
Capacity	Create development modules to provide training for the interpretation and use of risk assessment results
Platforms	Support an effort to develop standards to support risk model interoperability
Disaster Loss	Develop an open database of site-specific loss data that includes standards for data collection
Reference Data	Support development of open, high-resolution DEMs for developing countries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