Youth Science-Policy Interface Publication Special Edition

# DISASTER risk reduction

## a road of opportunities

UN Major Group for Children and Youth

the space for children and youth in the United Nations

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## a road of opportunities

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# Content

**Disaster response, relief & recovery**



**DRR and cross-cutting issues**

# Disclaimer

The United Nations Major Group for Children & Youth (UN MGCY) is the formal, General Assembly mandated space for the meaningful participation of children and youth in intergovernmental and allied sustainable development processes at the UN. It is meant to facilitate the participation of youth in policy design, implementation, follow-up, and review.

*Important note: All content in the publication is solely the responsibility of the author and does not necessarily represent the official views of the UN Major Group for Children and Youth. Furthermore, the special "Disaster Risk Reduction Edition" and articles within it are open source and welcome for all to access.

# Executive Summary

The *Disaster Risk Reduction* Edition of the Youth Science-Policy Interface Publication captures and promotes the role of young people in sharing knowledge of evidence-informed best practices, science and technology, emerging trends, challenges, and solutions in the implementation, monitoring, follow-up, and review of inter-governmentally agreed and allied frameworks on sustainable development – specifically in disaster-related contexts. This initiative is part of the UN MGCY Youth Science-Policy Interface Platform and coordinated by the UN MGCY. Launched in May 2017, it is meant to feed into the discussions of the Global Platform for Disaster Risk Reduction, specifically around the SPI mandate, in order to showcase the contributions of young scientists, engineers, practitioners, and students in strengthening the science-policy interface, further linking policy and practice for a sustainable society. It seeks to build coherence between the Sendai Framework for Disaster Risk Reduction (2015-2030) and the DRR-dimensions of other intergovernmentally agreed upon sustainable development agendas (e.g. 2030 Agenda, New Urban Agenda, etc.).

The Science-Policy Interface (SPI) has become an increasingly important component of sustainable development within the United Nations system. It provides the foundation for empirically-derived policies, facilitates the use of science as an enabler in policy implementation and review, and applies a unique and integral scientific lens to the monitoring of impact. The Rio+20 outcome document, The Future We Want, solidified the role of the SPI and sought to operationalize its place within all sustainable development processes. Additionally, resolution 67/290 that established the High-Level Political Forum seeks to strengthen the SPI.

The SPI has further been utilized as an integral tool for identifying emerging priorities, drawing links between the interconnected nature of thematic issues, and devising solutions to address challenges and barriers to progress. In order to mobilize young scientists, engineers, and practitioners in this discussion, the UN MGCY Youth SPI Platform on Sustainable Development strengthens youth policy priorities and practices in sustainable development by equipping youth with tools to drive empirically-informed, context-specific, and purposeful change through science, technology, innovation, and data.

The *Disaster Risk Reduction* Edition will take the form of a magazine, containing a series of youth-led, peer-reviewed articles highlighting important topics and trends, stemming from both the social and the natural sciences. This reflects only one of the initiatives meant to provide an outlet for young people to contribute to

strengthening the science-policy-practice nexus. It is also an example of the work done within the *UN MGCY Young Scientist Platform on DRR*, as well as a core element of the *Young Scientist Roadmap*, each of which serve to contribute to fulfilling the objectives of the *UNISDR S&T Roadmap and Partnership*, promoting more fit-for-purpose and effective implementation, follow-up, and review of the SFDRR.

Objectives of the Publication:

- Share knowledge generated by multi-sector young and early career scientists, engineers, practitioners, and policy makers relevant to the science-policy-practice nexus for promoting resilience and disaster risk reduction at all levels;
- Contribute formally to the ongoing cycle of Policy Design, Implementation, Monitoring, Follow-up, & Review, through evidence-informed analysis, especially regarding cross-cutting issues within DRR (e.g. infrastructure, health services, etc.);
- Highlight inter-linkages between different thematic issues and identifying emerging challenges/opportunities through case studies;
- Exchange best practices in evidence-informed and data-informed sustainable development;
- Promote cross-disciplinary and collaborative research, as well as qualitative and quantitative analysis;
- Collect submissions from young people on relevant thematic issues, bringing to light emerging trends, implementation challenges, and best practices of follow-up & review for different sustainable development agendas in disaster contexts.

We would like to thank the authors, editors, and contributors, as well as acknowledge others that helped with the preparations of the articles and DRR Edition itself, allowing for more innovative spaces for Major Groups and Other Stakeholders to contribute to sustainable development processes. This is the product of collaborative efforts within the Youth Science-Policy Interface Platform of the UN MGCY, in an effort to enhance the space through which young people are able to strengthen the science-policy interface. As young scientists, engineers, and innovators, we are at the forefront of the implementation, follow-up, and review of recently adopted sustainable development frameworks and are eager to contribute. For any questions regarding the publication, please contact drrspi@childrenyouth.org.

**United Nations Major Group for Children & Youth**
**Youth Science-Policy Interface Platform**

# DISASTER Risk Reduction

## Disaster Reduction & Disaster Preparedness

UN Major Group for Children and Youth
the space for children and youth in the United Nations

**Anthropocentric principles for effective early warning systems**

Spyros Schismenos[1,2]

Email Address: spyros.yuntech@gmail.com
[1]Research Center for Soil and Water Resources and Natural Disaster Prevention, National Yunlin University of Science and Technology
[2]MSc, Analysis and Management of Manmade and Natural Disasters, Hellenic Fire Academy/Fire Officers School– Eastern Macedonia and Thrace Institute of Technology

## Abstract

While the impacts of climate change and extreme weather events are continuously rising, both humanity and the environment as we know it are in great danger. Although international frameworks and normative instruments have been strengthened globally under the United Nations oversight, the number of natural and geophysical disasters taking place each year is noticeably increasing. Over the last decades, enormous amounts of funds have supported governments to establish early warning systems; yet, the society seems unprepared and the lack of information remains, regardless of the technological improvements. This research presents major weaknesses of national or regional early warning strategies for extreme hazards from an anthropocentric perspective and it investigates their factors and causes. Moreover, it suggests comprehensive solutions in global actions for disaster risk reduction that focus on the society and the needs of the local populations.

## Introduction

In worldwide statistics, the extreme weather-driven disasters, such as storm surges, extreme precipitation, floods and heat waves, are becoming more frequent and intense, due to climate change, causing catastrophic disasters[1]. Since 1970 more than 5,000 natural hazards have threatened the Asia and the Pacific region alone; a shocking number that is equal to 43 percent of the global total. These disasters affected more than 6 billion people, caused over 2 million fatalities and cost more than US$ 1.15 trillion (2005), affecting mostly the socio-economic growth of the developing countries[2]. In the West, the impacts of climate change were massively disastrous as well. In 2003, Europe and North America faced floods and storms that

[1]CRED: EM-DAT: The OFDA/CRED International Disaster Database, available at: www.emdat.be (last access: 13 March 2013), Universit´e Catholique de Louvain, Brussels (Belgium), 2011.
[2]Economic and Social Commission for Asia and the Pacific, Overview of Natural Disasters and their Impacts in Asia and the Pacific, 1970–2014, (Bangkok, 2015).

caused 15 deaths and almost US$ 3 billion in total damages[3].

In order to reduce such phenomena, systems related to early warning mechanisms are vital both for the safety of the public, as well as for the efficiency in disaster risk reduction (DRR). The term ''early warning'' refers to the identification of such events that can be detected prior to the causative phase and the damages they may produce. Most early warning systems (EWS) are designed for natural geophysical and biological hazards, industrial hazards, health risks, socio-related, geo-political emergencies, etc. In the current United Nations International Strategy for Disaster Reduction (UNISDR) terminology, early warning is defined as "an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events."[4].

In order for EWS to be effective and complete, they need to comprise four interacting elements: (1) Risk knowledge, (2) Monitoring and warning service, (3) Dissemination and communication, and (4) Response capability[5]. The EWS are usually cost-effective, especially in regions with frequent hazards, such as East and South East Asia, where typhoons and floods occur annually. They can be predicted on time, which is critical for protecting lives and securing properties. According to research undertaken by the World Bank, the investments in hydro-meteorological EWS in developing countries have a cost-benefit ratio between 4 and 36 which means that every dollar that is invested, produces between 4 and 36 dollars in benefits[6].

## Methods and Discussion

The EWS usually cover national or regional territories and their design is based on advanced technological and scientific achievements. Many of them use numerical weather predictions (NWP) as basic input data. This enables the "early" detection of extreme events; therefore, the sufficient lead-time is usually enough for emergency and response planning. The key factor of these systems is that the NWP can increase or even modify the forecast horizon, based on the input data, leading to efficient risk reduction. As a result, the data obtained by the EWS, may determine to what degree a disaster may trigger larger catastrophes, including human and material losses. Nevertheless,

[3] Economic Research and Consulting, Swiss Reinsurance Company. Natural catastrophes and man-made disasters in 2003: many fatalities, comparatively moderate insured losses. (Sigma insurance research series, no. 1). Zurich, Switzerland: Swiss Reinsurance Company, 2004.

[4]UNISDR, 2009. Terminology: Terminology on DRR. http://www.unisdr.org/we/inform/terminology#letter-e, International Strategy for Disaster Reduction, Geneva.

[5]ISDR-PPEW, 2005a. Many of the points presented in this paper have been discussed and illustrated in the early warning web pages of the ISDR. The 4-element view of effective people-centered early warning systems is discussed at http://www.unisdr.org/ppew/whatsew/basics-ew.htm and in ISDR-PPEW (2005b). ISDR Platform for the Promotion of Early Warning (PPEW), Bonn.

[6]Stéphane Hallegatte, "A cost effective solution to reduce disaster losses in developing countries: hydro-meteorological services, early warning, and evacuation", Policy Research Working Paper, No. 6058 (Washington, D.C., World Bank, 2012). Available from https://openknowledge.worldbank.org/bitstream/handle/10986/9359/WPS6058.pdf?sequence=1.

the potential of EWS does not always receive the attention it deserves.

Although a lot of progress has been made in the technical aspect, in matters of policy and socio-education there is still a lot more to be done. Despite the reliable evidence in DRR, the EWS cannot be embodied in national decision-making policies, because of multiple factors. The most significant is, perhaps, the impassive public awareness and support due to other factors of social vulnerability, such as abuse and social exclusion. Nonetheless, the public awareness for natural hazards becomes high, immediately after an extreme disaster. For instance, the magnitude 9.0 richter earthquake that hit northeastern Japan on March 11, 2011, caused a tsunami that left 15,894 dead, 6,152 injured and 2,562 people missing across twenty prefectures, besides the meltdown at the Fukushima Daiichi nuclear plant. This hazard awakened the public awareness and support worldwide.

To further shield the countries against such phenomena, the United Nations adopted the Hyogo Framework for Action, a broader international political approach to promote EWS as an important tool for risk reduction of natural hazards. This framework emphasizes the need for building the resilience of society to disasters and it provides guidance on how to reduce disaster risk and its impact[7]. Indeed, solutions based on pure technically and high quality predictions are insufficient to reduce the levels in losses and impacts on their own. The human factor in EWS is very significant, that is why every phase of DRR must be formulated in such a way so to serve the people; to become more people-centered[8]. Designing, establishing and managing efficient EWS is a complex procedure, full of obstacles, both in the technical and the social level. The different hazards are operated by separate authorized institutions that usually act independently; in some cases their available personnel is not enough to deal with all the issues, especially in developing countries. Due to the dominance of experts, the research data and the related knowledge cannot disseminate easily to the local communities, fact that lows the scientific value from a realistic point of view. Same with the design and the operations of the EWS; there is a narrowed involvement of those at risk, and this often causes the loss of interest of the local populations for the procedures. Furthermore, it leads to misdirected strategies created by the experts, since they do not truly focus on the needs of the local populations, so their feedback is false or limited.

Additionally, warning and response policies may differ among countries and communities, due to the variations in geomorphology, socio-economy, capabilities and previous experience. The main purpose of the global early warning mechanisms is to protect the public; therefore, it is essential to focus on the challenges that affect the people, when it comes to disaster preparedness. Such challenges involve the lack of human and financial resources of the local governments and authorized

[7]United Nations, 2005. Hyogo framework for action 2005–2015: building the resilience of nations and communities to disasters. In: World Conference on Disaster Reduction in Kobe, Japan, 18–22 January 2005.

[8]Twigg, J., 2002. "The human factor in early warnings: risk perception and appropriate communications". In Early Warning Systems for Natural Disaster Reduction (ed. J. Zschau & A. N. Küppers), ch. 1.3, pp. 19-26, Springer, Berlin.

organizations, the lack of DRR awareness of the local populations because of other important issues, such as poverty reduction and life quality improvement which are always perceived as higher priorities, as well as the lack of political will, both at the local and central level, to improve the community-based DDR activities. These causes often lead to a general DRR apathy, which is also adopted and maintained by the younger generations. The Hurricane Katrina disaster in 2005 that hit the US Gulf Coast is an example that includes most of the aforementioned weaknesses of the EWS and the response mechanisms. Although the meteorological warnings were accurate and were sent many hours in advance, the officials' and the public's response were inadequate. Approximately 1,800 people died and the damages were over US$ 80 billion[9].

How can EWS be best used for other priorities and what could motivate and enable communities to participate more actively in DRR? In order to boost the effectiveness and the sustainability of DRR, current approaches should be re-designed. Strict scientifically-driven polices should include sufficient requirements and needs of their end-users; the local societies. Successful cultural and historical experiences against natural hazards of the affected populations should be largely taken into consideration by the experts. Socio-economic strategies should be effectively strengthened by the authorities, in order to influence positively the response of the population, in matters of DRR. All kinds of education and training programs or guidelines in DRR should be translated into many languages and dialects and written in a simple and substantial way, considering the cultural characteristics, lack of education, age, etc. Furthermore, they should also involve the participation of the elderly and people with disabilities; actions that could reduce the casualty percentage of their groups when disasters occur.

However, regardless of the preferred methods and the desired actions, the main purpose is the same; the EWS must be designed by the people and for their life needs. The EWS should not only warn the earliest possible about the threats people face, but also their living conditions and the factors that can slow or even reduce their growth. The idea of EWS should be evolved from its current state to an anthropocentric core of wide defense-warning principles.

## Conclusion

Since the beginning of this millennium, many remarkable goals have been accomplished in the DRR and the EWS globally. The determination of the United Nations on this matter, in combination with the rapid technological improvements in the related fields, specified proper response mechanisms and activated international DRR frameworks. Nevertheless, it is well-known that a wide and multi-national participation is required to direct and accomplish all the essential procedures. The involvement of local populations is vital in shaping polices along with the experts and authorities. All the participants must agree that a commitment focused on people and based on a philosophy for a comprehensive

[9]EWC II, 2004. Early Warning as a Matter of Policy: The conclusions of the Second International Conference on Early Warning, 16-18 October, Bonn, Germany. International Strategy for Disaster Reduction (ISDR) secretariat and the German Disaster Reduction Committee (DKKV), 28pp.

response that is measured by its performance, could benefit those at risk and their environment.

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**Communicating risk information and early warnings: bridging the gap between science and practice**

Mirianna Budimir[1], Sarah Brown [1], Sumit Dugar [2]

Email Address: mirianna.budimir@practicalaction.org.uk
[1]Practical Action UK
[2]Practical Action Nepal

## Abstract

The science of extreme event forecasting and early warning is becoming increasingly sophisticated, giving rise to more complex information on risk and event probability. Such enhanced risk information is both an opportunity and a challenge, particularly in terms of communication of complex risk information or early warning to diverse stakeholders. Bridging the gap between science and practice to enhance uptake and response to risk information and early warning is a critical priority in the field of Disaster Risk Reduction.

This paper explores established best practices, practitioner experience and new areas of research in the communication of complex risk information. Recent practitioner and research experience from the INGO Practical Action provides empirical case studies to complement lessons from the literature.

Key considerations for effective communication include establishing aim, audience, format and dissemination channel, messaging, timing and scale, uptake and evaluation.

Effective knowledge brokering, including co-production of risk information or early warning communication by scientists, practitioners and end users can help ensure tailored information reaches target stakeholders at a time and in a format conducive to uptake. Effective communication can reduce disaster risk, and help save lives and livelihoods in a changing climate and an increasingly vulnerable world.

## Introduction

There is an urgent need to reduce loss of lives and livelihoods in advance of increasingly severe and frequent climate-related natural hazards such as floods, droughts, and heatwaves. Early warning systems can deliver essential advance information, providing people with knowledge and time to prepare. These early warnings need to provide the right information, to the right people, in the right format, at the right time.

Despite advances in science, there remains a difficulty in communicating risk information to end-users[1]. The scientific sphere has its own set of technical terminology, idiosyncratic language, and communication strategies[2]. Disseminating technical

[1] Wilkinson E., Budimir M., Ahmed A.K., and Ouma G., "Climate information and services in BRACED countries", *Resilience Intel*, (2015).

[2] Scienseed, "Communicating climate change and biodiversity to policy makers: A guide by Scienseed", *Bern Convention* (Council of Europe), Madrid, 2nd May 2016, (2016).

information is a skilled task, one that scientists are often untrained or unsuited to perform, yet there is an increasing expectation and requirement for them to do so [3].

Despite increasing research in risk information communication, there all too often remains a gap in the end-mile of communication (i.e. whether the information reaches those in need), and in whether the information communicated is understood and acted upon.

Complex issues such as risk from natural hazards or climate change are difficult concepts for people to understand[4]. Individuals may have difficulty perceiving, understanding and prioritising longer term risk, particularly when this competes with the more immediate and pressing challenges of daily survival, livelihood sustainability, and other more short-term needs[5].

This paper reviews key lessons from the literature, alongside recent practitioner experience, and new areas of research in the communication of complex risk information. A number of key considerations and recommendations are highlighted:

## Establish aim

Before beginning any work on communicating risk information, it must be established what the objectives of the communication are. For example, is the aim of the information to raise awareness, to help make decisions, and/or to influence behaviour? These objectives will frame the remaining communication strategy, and will help assess whether the communication has been effective.

## Audience

The intended audience or end-user of risk information must be established early on. While there may be many common requirements, the information required, the way it will be delivered, and what exactly is communicated will differ between users[6, 7].

Decision-makers are diverse – scientific information needs to be tailored for specific decision makers to address particular needs and context. [8] Understanding end-users' concerns, interests, core values, and capacity to act can enable information tailoring so that it is useful and usable.

Policy-makers at different levels of government, business managers, religious leaders, environmentalists, and farmers have diverse interests, values and goals, need different information, and frame the issue of risk differently. [9] Understanding end-users' pre-existing knowledge, gaps in knowledge, misconceptions and beliefs can enable

[3] Scienseed, "Communicating climate change and biodiversity to policy makers: A guide by Scienseed", *Bern Convention* (Council of Europe), Madrid, 2nd May 2016, (2016).

[4] Moser, S.C., "Communicating climate change: history, challenges, processes and future directions", *Climate Change*, Volume 1, (2010).

[5] Moser, S.C., "Communicating climate change: history, challenges, processes and future directions", *Climate Change*, Volume 1, (2010).

[6] Stott, P.A., Christidis, N., Otto, F.E.L., Sun, Y., Vanderlinden, J.P., van Oldenborgh, G.J., Vautard, R., von Starch, H., Walton, P., Yiou, P., and Zwiers, F.W., "Attribution of extreme weather and climate-related events", *WIREs Clim Change 2016*, 7:23–41, (2016).

[7] Stott, P.A., and Walton, P., "Attribution of climate-related events: understanding stakeholder needs", *Weather*, Vol. 68, No. 10, Royal Meteorological Society, (2013).

[8] Morss, R.E., Wilhelmi, O.V., Downton, M.W., and Gruntfest, E., "Flood risk, uncertainty, and scientific information for decision making: lessons from an interdisciplinary project", *BAMS*, American Meteorological Society, (2005).

[9] Moser, S.C., "Communicating climate change: history, challenges, processes and future directions", *Climate Change*, Volume 1, (2010).

targeted communication[10].
Evidence suggests the most effective method of determining who the stakeholders are and what information they need (to inform specific decisions) is to establish a continuous dialogue between providers of information and users/decision-makers[11, 12].
In addition to establishing the intended end-user, it should be investigated early on who needs to be involved in the communication strategy. Knowledge brokers and communication specialists have the required skills, expertise, and experience to bridge the gap between scientists and communities, providing assistance in communicating risk information. These communicators need to have a seat at the table throughout the process of setting up risk communication strategies, rather than being brought in at the end of the project to merely deliver the message.

**Format and dissemination channel**

Choosing an appropriate format and dissemination channel is important, both to ensure messages reach all relevant stakeholders, and to ensure such messages are trusted. [13]
Communication is most successful when trust and longer-term relationships already exist; involving community leaders and local NGOs in the communication strategy can be highly effective in generating buy-in from affected populations, and increasing the chance that warnings are understood and acted upon[14].
The most appropriate and trusted source of information should be researched for each end-user to establish how to best deliver risk information. In Kenya, the radio is typically used by the public for climate and weather-related information; in India, television or newspapers are more commonly used[15].
In Nepal, the INGO Practical Action has been working in partnership with the Department of Hydrology and Meteorology to pilot dissemination of flood alerts via SMS (first piloted during the 2016 monsoon)[16]. This approach has enabled quick dissemination at a very wide scale. The effectiveness of this approach will be evaluated in monsoon 2017, including a focus on how effective mass SMS dissemination is in reaching the most vulnerable groups.

**Messaging**

The information communicated to the end-user must be carefully chosen to be clear, and of the required level of complexity or simplicity. Language must be reviewed to ensure it is understood by the end user. When simplifying scientific information, care must be taken to ensure the message is clear and simple, but without compromising the underlying message.
Communicating probability or uncertainty is a particular challenge. Although probabilities are a commonly

[10] Scienseed, "Communicating climate change and biodiversity to policy makers: A guide by Scienseed", *Bern Convention* (Council of Europe), Madrid, 2nd May 2016, (2016).
[11] Wilkinson E., Budimir M., Ahmed A.K., and Ouma G., "Climate information and services in BRACED countries", *Resilience Intel*, (2015).
[12] Stott, P.A., and Walton, P., "Attribution of climate-related events: understanding stakeholder needs", *Weather*, Vol. 68, No. 10, Royal Meteorological Society, (2013).
[13] Moser, S.C., "Communicating climate change: history, challenges, processes and future directions", *Climate Change*, Volume 1, (2010).
[14] Moser, S.C., "Communicating climate change: history, challenges, processes and future directions", *Climate Change*, Volume 1, (2010).
[15] Budimir, M., and Brown, S., "Communicating extreme weather event attribution: Research from India and Kenya: Full report", *Practical Action Consulting*, (2017).
[16] Practical Action, "Early Warning Systems", https://policy.practicalaction.org/projects/ews (2017).

accepted means of communicating uncertainty information within the scientific sector, they are associated with particular communication difficulties because they are not well understood by non-experts[17]. Communication formats that use percentages and non-numerical text are generally more liked by non-experts than relative frequency and odds [18, 19].

Understanding of probabilistic and uncertainty information is context-dependent, and needs to be tailored to specific end-users. For example, a study in Kenya found that probabilistic information is very poorly understood by the public in Kenya, and frequency information is easier to conceptualise; the same study in India found the opposite preference[20]. Many of the participants in Kenya perceived uncertainty and error information as too complex, not useful, and preferred not to receive such information[21].

In Nepal, Practical Action, in partnership with the Department of Hydrology and Meteorology (with the University of Lancaster and Zurich Insurance), have developed probabilistic flood forecasts. This forecast enables probabilistic risk information to be presented visually, showing the range of likely scenarios, along with a bar chart of the probability of water levels rising above predetermined warning and danger levels. Such visual probabilistic information has been found useful to technical and semi-technical stakeholders, including NGO disaster risk managers and sub-national government officials. This enhanced (and more complex) early warning has not yet been disseminated to community level – where existing early warning mechanisms are of a much simpler '*Don't evacuate/Prepare to evacuate/Evacuate now*' form. In 2017, Practical Action is aiming to learn from experience elsewhere on whether and how to communicate more complex warning information to at risk community members.

Literacy or numeracy struggles in some end-users will mean alternative communication approaches will be needed. For example, in Kenya, the public in rural Turkana and Kwale districts had difficulty understanding quantitative statistics, such as percentages[22]. In these cases, qualitative information can assist in explaining statistical information using more familiar terms to lay audiences[23,24].

## Timing and scale

Risk communication needs to consider how information might be applied; engaging with stakeholders to understand what lead time and geographical scale of information would prompt them to take action.

[17] WMO, "Guidelines on communicating forecast uncertainty", *WMO/TD-No.1422*, Geneva, (2008).

[18] Morss, R.E., Demuth, J.L., and Lazo, J.K., "Communicating uncertainty in weather forecasts: a survey of the U.S. public", *Weather and Forecasting*, Volume 23, (2008).

[19] Budimir, M., and Brown, S., "Communicating extreme weather event attribution: Research from India and Kenya: Full report", *Practical Action Consulting,* (2017).

[20] Budimir, M., and Brown, S., "Communicating extreme weather event attribution: Research from India and Kenya: Full report", *Practical Action Consulting*, (2017).

[21] Budimir, M., and Brown, S., "Communicating extreme weather event attribution: Research from India and Kenya: Full report", *Practical Action Consulting,* (2017).

[22] Budimir, M., and Brown, S., "Communicating extreme weather event attribution: Research from India and Kenya: Full report", *Practical Action Consulting,* (2017).

[23] WMO, "Guidelines on communicating forecast uncertainty", *WMO/TD-No.1422*, Geneva, (2008).

[24] Scienseed, "Communicating climate change and biodiversity to policy makers: A guide by Scienseed", *Bern Convention* (Council of Europe), Madrid, 2nd May 2016, (2016).

Timing is key in early warnings. In Nepal, Community Based Flood Early warning systems deliver 2-3 hours of early warning to at-risk communities. Such limited lead times are often effective for saving lives, but have limited effectiveness for saving livelihoods, livestock and assets; make evacuation challenging for high risk groups (elderly, disabled, pregnant women, children); and are vulnerable to system failure[25]. In partnership with the Nepal Department for Hydrology and Meteorology, and the University of Lancaster/Zurich Insurance, Practical Action piloted a low data, probabilistic forecasting approach, which has extended lead time by an additional 5 hours[26]. This extended lead time forecasting approach has now been rolled out across all major basins in Nepal.

Issues of geographical resolution and scale are also critical – if forecasts are delivered at a scale that users find inappropriate, action in response to such information is less likely. In Kenya, weather and climate forecasts are often not used by smallholder farmers because the resolution of the information is low, covering large geographic areas, and therefore not reflecting localised patterns of rainfall.[27]

In India, Practical Action (and partners in the King's College London and BGS led Natural Environment Research Council/Department For International Development funded Landslip consortium[28]) are exploring regional/sub-regional landslide early warning, and how such information (that is not at slope spatial scales) might enable enhanced response by certain actors.

**Uptake and Evaluation**

Information dissemination should not be the end of a communication strategy. Often information fails to reach the end-mile or most vulnerable communities[29]. Challenges include whether people can access the information (e.g. do they own a mobile phone, TV, or radio through which information is conveyed?); whether that information is understood (e.g. is the language too complex, is it in the right language, is the information misinterpreted?); and whether they have an ability to take action (e.g. do they know how to respond to the information, do they have the capacity to act upon the information, are they willing to take action?).

In West Africa, Practical Action (and partners in the USAID CISRI consortium on demand led climate services for Africa[30]) is adapting expertise in market system analysis to understand the climate information system in West Africa. This includes reviewing how small-holder farmers access climate and weather information, and what wider systemic factors beyond risk information (e.g. access to alternative seeds, credit) enable or impede them from taking action in response to weather and climate information.

Evaluation of risk communication should consider whether information

[25] Zurich Insurance Group, "Risk Nexus: Urgent case for recovery: what we can learn from the August 2014 Karnali River floods in Nepal", (2015).

[26] Smith, P.J., Brown, S., and Dugar, S., "Community-based early warning systems for flood risk mitigation in Nepal", *Journal of Natural Hazards and Earth System Sciences*, Special Issue: Risk and uncertainty estimation in natural hazards, (2017).

[27] Wilkinson E., Budimir M., Ahmed A.K., and Ouma G., "Climate information and services in BRACED countries", *Resilience Intel*, (2015).

[28] LANDSLIP, http://landslip.org/ (2017).

[29] Wilkinson E., Budimir M., Ahmed A.K., and Ouma G., "Climate information and services in BRACED countries", *Resilience Intel*, (2015).

[30] ClimateLinks, "CISRI", https://www.climatelinks.org/projects (2017).

has been accessed, understood, found useful, and applied.

Evaluations need to carefully consider how effective risk and early warning is in reaching and enabling action by a range of different stakeholders, with explicit evaluation of how effectively communication reaches, and enables action of the most vulnerable or marginalised groups. In 2017, Practical Action is undertaking a specific gender audit of the effectiveness of current flood early warning systems for women and marginalised groups.

## Conclusion

Communicating risk information and early warning in the right format and contextualising it to a particular hazard or extreme event is challenging. Bridging the gap between scientific information and practice requires effective knowledge brokering where user needs are identified and messages are tailored accordingly.

Key considerations for effective communication include establishing aim, audience, format and dissemination channel, messaging, timing and scale, uptake and evaluation.

Involving communities, scientists, practitioners, communicators and other relevant stakeholders in co-producing messages is a critical component that should not be missed. Through this process, the science of early warnings, and risk information can more effectively help to save lives and livelihoods in a changing climate and an increasingly vulnerable world.

**Community preparedness on undetonated explosive remnants of war Kenya**

Ehagi H, Daniel[1] and Gordon Ochieng[1]

Email Address: ehagidaniel@gmail.com
[1] Masinde Muliro University of Science and Technology

**Abstract**

This paper looks at the community preparedness on undetonated explosive remnants of war Kenya. It sheds light on how civilians have been affected by Explosive Remnants of War (ERW) and the importance of mine and unexploded ordnance (UXO) risk education (MRE) programmes to the community. The article utilizes observation techniques and secondary data from online journals, newspaper articles and reports from the government and non – governmental organizations. The paper looked at the impact of explosives at the global, regional and local levels citing how Kenyan citizens have been physically challenged by the IEDs found beneath the ground.

## Introduction

Civilian fatalities in wartime have climbed from 5 per cent at the turn of the century to more than 90 percent in the wars of the 1990s. New weapons and patterns of conflict that include deliberate attacks against civilians are increasingly turning children into primary targets of war. An improvised explosive device (IED) is a bomb constructed and deployed in ways other than in conventional military action. It may be constructed from conventional military explosives, such as an artillery round, attached to a detonating mechanism. IEDs are commonly used as roadside bombs.

Injuries place an enormous burden on individuals, households, and communities and they exacerbate poverty. A substantial but often under-recognized cause of injury in post-conflict environments is the presence of landmines and explosive remnants of war (ERW), such as abandoned ordnance or weapons and cluster munitions, bombs, mortars or other devices that failed to detonate on impact but remain volatile and can explode if touched or moved. This under recognition, which is partly the result of underestimates, has global implications because it affects to what extent the resources assigned to injury prevention and the rehabilitation of

injured people are prioritized.[1] The main points relating to the dangers posed by Explosive Remnants of War (ERW) (other than anti-personnel mines) and their impact on affected communities can be described as follows: Injuries or deaths can take place at a distance from the explosion: most items of ordnance contain an explosive charge and some element of fragmentation designed to kill[2] or injure people at a distance from the explosion.[1] Depending on the ordnance involved, the danger area can vary from a few metres to several hundred metres.[3]

Warnings are the punctual provision of cautionary information to the civilian population, intended to minimize an impending or ongoing risk from ERW. Warnings are often given in advance of, or immediately following, the use of ordnance. They are sometimes provided by the weapon users themselves. Mine and unexploded ordnance (UXO) risk education (MRE) programmes seek to facilitate information exchange between affected communities, government authorities and humanitarian organisations so that individuals and communities are informed about the UXO and mine threat and interventions can be tailored to communities' needs. Warnings alone are unlikely to have a positive long-term impact on behaviour, they should always be followed by community-based risk education.[4]

The Review Conference of the 1980 UN Convention on Conventional Weapons (CCW) in December 2001 established a Group of Governmental Experts on (ERW) to examine the issues relating to ERW. At the Meeting of States Parties in December 2002, it was agreed that the Group would continue its work in 2003 to "negotiate an instrument on post-conflict remedial measures of a generic nature which would reduce the risks of ERW questions need to be considered regarding the provision of information to facilitate clearance, risk education, and warnings to civilian populations.[5]

The Mine Ban Treaty, which became international law in 1999 and today has 162 States Parties, bans the use of mines that detonate due to human contact, also known as "victim-activated," and thereby encompasses improvised explosive devices (IEDs) that act as anti-personnel mines, also called improvised mines.[9]

## Methods

The research article used observation techniques and secondary data from online journals, newspaper articles and reports from the government and non – governmental organizations.[6]

## Discussion

Abandoned explosive ordnance (AXO) is explosive ordnance that has not been used during armed conflict and has been

[1] Peter S. & Damian H. The under reporting of landmine and explosive remnants of war injuries in Cambodia, the Lao People's Democratic Republic and Viet Nam (2013)

[2] UNICEF. Patterns in conflict: Impact of armed conflict on children, Civilians are now the target (2017).

[3] GICHD Explosive Remnants of War (ERW) — Warnings and Risk Education (2017).

[4] UN SOUTH SUDAN / UXO CLEARANCE POCS (2017).

[5] ICRC A new protocol on explosive remnants of war: The history and negotiation of Protocol V to the 1980.
Convention on Certain Conventional Weapons (2017).

[6] TAF M. Street children economic empowerment: a case study of street children in Kigamboni ward Temeke municipal council Dar es Salaam region (2011).

left behind and is no longer under control of the party that left it behind. It may or may not have been primed, fuzed, armed, or otherwise prepared for use. Explosive remnants of war (ERW) are explosive munitions left behind after a conflict has ended[7]. They include unexploded artillery shells, grenades, mortars, rockets, air-dropped bombs, and cluster munitions. Under the international legal definition, ERW consist of unexploded ordnance (UXO) and abandoned explosive ordnance (AXO), but not mines. Unexploded ordnance. Weapons that fail to detonate as intended become unexploded ordnance (UXO). These unstable explosive devices are left behind during and after conflicts and pose dangers similar to landmines.

Mine- and ERW-awareness activities (also referred to as mine/ERW-risk education) are an essential means of preventing mine/ERW- related deaths and injuries among the civilian population in affected countries. In engaging in mine/ERW awareness, the components of the Movement seek to: work with the community to identify its needs and develop a mine-awareness strategy tailored to the local situation; analyse the causes of risk-taking, identify and promote alternative solutions and support communities in changing high-risk behaviour as a means of ultimately reducing the number of casualties and the socio-economic impact of mines/ERW; respond to community needs through the sharing of information with humanitarian agencies and others involved in mine action as part of an integrated response to the mine/ERW problem.[8]

For calendar year 2015, the Monitor recorded 6,461 mine/ERW casualties, marking a 75% increase from the number of casualties recorded for 2014 and the highest recorded total since 2006 (6,573). The sharp increase is mainly attributed to more casualties recorded in armed conflicts in Libya, Syria, Ukraine, and Yemen. The increase also reflects greater availability of casualty data, particularly from unique systematic surveys of persons injured in Libya and Syria last year. The vast majority of recorded landmine/ERW casualties were civilians (78%) where their status was known—a finding similar to the high civilian casualty rate in previous years.[9]

IEDs are generally seen in heavy terrorist actions or in unconventional warfare by guerrillas or commando forces in a theater of operations. In the second Iraq War, IEDs were used extensively against US-led invasion forces and by the end of 2007 they had become responsible for approximately 63% of coalition deaths in Iraq. They are also used in Afghanistan by insurgent groups, and have caused over 66% of coalition casualties in the 2001–present Afghanistan War.[10]

Within the framework of the Movement's mine-awareness activities, the focus has gradually expanded to include other weapons-related dangers posing a risk to civilians after a conflict. Thus the components of the Movement have built on their worldwide experience in raising awareness of the dangers of mines and unexploded ordnance to develop, where appropriate, awareness programmes for

[7] Sean S. Explosive Remnants of War - Landmine and Cluster Munition Monitor (2013).

[8] GICHD. Mine Action and Explosive Hazard Management: Humanitarian Impact, Technical Aspects, and Global Initiatives (2014).

[9] Landmine Monitor 2016 International Campaign to Ban Landmines, Cluster Munition Coalition (2016).

[10] Vishwagujarat Chhattisgarh IED Blast; 2 CRPF jawans injured in IED Blast (2015).

other remnants of war, including abandoned ammunition stores, and, to a more limited extent, the large quantities of military-style small arms and light weapons often left in civilian hands after a conflict.[4]

Decades of conflict in Somalia have resulted in contamination from explosive remnants of war (ERW), landmines and improvised explosive devices (IEDs). While IEDs primarily target Government authorities and security forces, civilians are also heavily impacted, comprising 707 out of 1272 victims in 2016 (55%). Evidence suggests that ERW, including abandoned ammunition, have presented Al Shabaab and other opposition armed groups with the opportunity to harvest explosives or items that can be used to manufacture IEDs. Interventions alone cannot end the threat of IEDs in Somalia; this can only be achieved through political settlement, strengthened stabilization efforts and enhancement of security sector response.[11]

UNMAS has provided support to enhance the protection of civilians and facilitate humanitarian access in areas contaminated by explosive hazards, through supporting and coordinating humanitarian mine action activities, such as survey, clearance and risk education. In 2016, UNMAS provided community based explosive hazards clearance along the border between Somalia and Ethiopia in the federal states of Galmadug and Hirshabelle, to reduce the threat posed by explosive hazards to communities living and working in the identified areas of intervention, while enabling financial injection into the local economy through employment of impacted and at-risk community members. The project has positive impact on the fragile living conditions of those people living in affected areas, particularly youth, who could easily be exploited by Al Shabaab and other opposition armed groups.[9]

In Kenya the citizens continue to be affected with the issue of ERW. Residents of Murang'a south district live in fear after an explosive device was discovered in a farm by a student. The device was discovered by a resident when he was cultivating the land. The device which is believed to have been left behind by colonialists has raised concern among the residents who fear it might explode any time6. Also a 13 year old boy, had one finger on the left hand badly damaged by the explosive device he picked along the SGR line in Sultan Hamud area of Kajiado County.[12]

Britain donation of six new remotely operated vehicles and associated equipment to help train Kenyan soldiers counter explosive devices during their peacekeeping mission in Somalia. Is a plus on Counter Improvised Explosive Device (CIED) wing of the Humanitarian Peace Support School the training will help save soldiers' lives in Somalia and contribute to the defeat of Al-Shabaab. The vehicles allow improvised explosive devices (IEDs) to be destroyed or disarmed remotely at a safe distance, preventing specialized CIED operators from having to put their lives at risk.[13]

## Conclusion

In a nutshell the Explosive Remnants of War (ERW) pose as a challenge to the community and the need for awareness at

[11] UNMAS. Mine action: UNMAS IN Somalia (2017).

[12] The Standard - Kenya: Student in Murang'a finds explosive device (2013).

[13] Counter-IED Report Britain seeks to help Kenya counter explosive devices (2017).

the community level is needed. This is through education on improvised explosive device (IEDs) in Kenya. This preparedness mechanism will act as a safety net to the populace whom have been greatly affected looking at the lenses from a global, regional and local perspective. In Kenya for example there are cases of people being maimed due to the ERW on the ground. However, much is appreciated from the British government on the provision of state machinery to detonate IEDs.

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# Developing and implementing effective (multi-hazard) early warning systems: the vital role of young professionals

Lydia Cumiskey[1,2], Raihanul Haque Khan[3], Erika Meléndez[1,4,5], Vittorio Nespeca[1,4], Robert Sakic Trogrlic[1,6], Patricia Trambauer[5], Shristi Vaidya [1,5], Javed Ali[1, 4], Gabriela Guimarães Nobre [7]

Email Address: l.cumiskey@wateryouthnetwork.org
[1]Water Youth Network
[2]Flood Hazard Research Centre, Middlesex University London
[3]RIMES, Regional Integrated Multi-Hazard Early Warning System
[4]IHE-Delft Institute for Water Education
[5]Deltares
[6]Institute of Infrastructure and Environment, Heriot-Watt University Edinburgh
[7]Institute for Environmental Studies, Vrije Universiteit Amsterdam

## Abstract

Collaboration between policy-makers, practitioners and researchers from multiple disciplines and all geographical regions from local, national, regional and international levels is needed to ensure effective (Multi-Hazard) Early Warning Systems (EWS). This article outlines why young professionals play such a pivotal role in developing and implementing (Multi-Hazard) EWSs globally, the support needed to maintain and improve this role, and actions that young people can take now to realise their important role.

How can we inspire more innovative research and collaboration between disciplines? How can we ensure this skilled capacity at National Hydrological and Meteorological Services (NHMS) and other agencies is sustained?

## What is an effective Early Warning System (EWS)?

As defined by UNISDR (2016), an Early Warning System (EWS) is "*an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events*"[1]. As shown in Figure 1, an effective "end-to-end" and "people-centred" EWS may include four interrelated key elements: 1) disaster risk knowledge based on the systematic collection of data and disaster risk assessments; 2) detection, monitoring, analysis and forecasting of the hazards and possible consequences; 3) dissemination and communication by an official source, of authoritative, timely,

[1]UNISDR. Report of the Open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. (2016)

accurate and actionable warnings and associated information on likelihood and impact; and 4) preparedness at all levels to respond to the warnings received.[1] Warnings are only effective if they are received, understood, and acted upon by those at risk and this comes with its challenges across all four components. Impact-based forecasts and warning services have come forward as a mechanism to help users understand not only what the weather will be, but most importantly, how the weather will impact their daily lives. This paradigm change of translating hazard to relevant sector (user-specific) impacts can provide more meaningful warnings that improve guidance to decision-makers in different sectors and hopefully result in more effective responses[2]. Furthermore, this discourse highlights the importance of partnerships amongst local authorities, non-governmental organisations (NGOs), National Hydrological and Meteorological Services (NHMS), Civil Protection/ Disaster Management agencies and others to generate such a warning which spans the boundaries of the NHMS responsibilities. For example the UK Natural Hazards Partnerships[3] collaborative environment enables the development of innovative products and services that will provide better coordinated and more coherent assessments, research, and advice.

The importance of EWS is reflected in the global target (g) of the Sendai Framework for Disaster Risk Reduction (DRR) 2015-2030 "*Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030*". The 2030 Agenda for Sustainable Development and the Paris Climate Agreement highlight the importance of investing in early warning systems.

Collaboration between policy-makers, practitioners and researchers from all geographical regions and from local, national, regional and international levels is needed to reach these targets, along with training and interdisciplinary exchange, particularly for the younger generation, as argued here.

## Why young professionals play a vital role?

Young practitioners, volunteers, scientists and researchers are playing a pivotal role in developing and implementing effective and people-centred (Multi-Hazard) EWS globally. This section outlines the important role young people are taking across EWS development and implementation.

*Operational backbone*

First and foremost, young hydrologists and meteorologists at NHMS form the operational backbone of EWS; not to forget the young professionals in local or international consultancies, young ICT experts working in disaster management authorities and local volunteers disseminating and responding to the warnings. For example, RIMES (Regional Integrated Multi-Hazard Early Warning System for Africa and Asia) support capacity building in young staff based at national hydro-met agencies through exchanges between regional hydromet

[2]WMO. Guidelines on Multi-hazard Impact-based Forecast and Warning Services. (2015) Available at: http://library.wmo.int/pmb_ged/wmo_1150_en.pdf

[3]Natural Hazards Partnership (2017) Available at: http://www.naturalhazardspartnership.org.uk/

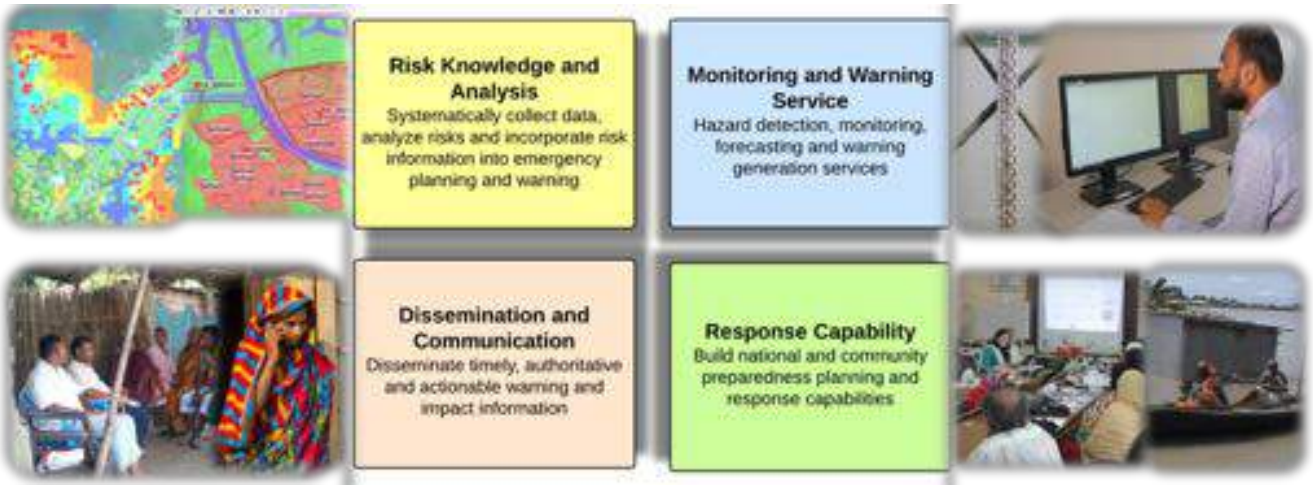


**Figure 1.** Effective Early Warning System (using the four components of people centred EWS, UNISDR 2006[1])

agencies making sure they gain the experience to prepare themselves for future leadership and responsibilities[4]. When given the opportunities, young people play a vital role in new development projects at NHMS and disaster management authorities, consultancies, and NGOs. They are innovating as part of international project teams, making sure to avoid 'business as usual'. Such initiatives have also been recognised by international organizations, for instance, ICT for Mountain Development Award by International Center for Integrated Mountain Development (ICIMOD). A youth led project of RIMES was recipient of this award during 2015 for ICT-enabled innovations, good practices, and applications[5]. There is huge potential for young professionals to contribute to the development of impact-based forecasts and warnings by, for example, identifying and analyzing local vulnerabilities and capacities.

*Innovative research and development*

Young scientists and researchers are paving the way on innovative topics such as impact-based forecasting and warning (e.g. Sai (2017)[6]), warning dissemination through mobile applications (e.g. Nespeca (2017)[7]) and evaluating the effectiveness of warning response (e.g. Cumiskey et al. (2015)[8]) at the community level. Furthermore, young researchers conducting their postgraduate research can take different approaches to tackling such EWS challenges by combining both the technical and social aspects and taking a multidisciplinary approach. A recent workshop brought together young scientist to identify the research gaps and the pivotal role for them to address these

[4] RIMES (2017) Available at: http://www.rimes.int/em/tag/capacity-building/

[5] ICIMOD (2017) Available at: http://www.icimod.org/?q=20601

[6] Sai., Fabio. (2016) Mainstreaming impact based forecasting and warning in Bangladesh. MSc. Thesis. IHE Delft Institute for Water Education

[7] Nespeca V., Alfonso L.. 2017. E-Aid: Smartphone and Web Applications for Community-Based Disaster Management in Accra. MSc Thesis Report. IHE Delft Institute for Water Education.

[8] Cumiskey, L., M. Werner, K. Meijer, S.H.M. Fakhruddin, and A.Hassan. 2015. "Improving the social performance of flash flood early warnings using mobile services." *International Journal of Disaster Resilience in the Built Environment* 6(1): 57–72.

gaps was clearly recognised, see Deltares (2016)[9]. Although innovative research can be driven by academia, it is also being done as part of development projects, where young people work closely with NHMS are encouraged to tackle the challenges from all sides. Figure 2 presents a project conducted by RIMES on 'Mobile Services for Flood Early Warning' and 'ICT Enabled Risk Information Gateway Development' led by a young practitioner from RIMES who is driven to "*connect the unconnected, learning from lessons learned and make use of ICT for the benefit of vulnerable, hard-to-reach communities at risk*"

*Bridging the communication and technology gap*

Young people are seen as a powerful driving force in modern technology and especially communication technology such as mobile applications and social media. Their skills can be capitalized to enhance communication and response to early warnings by creating the links between local people and modern technology.

Young people are creating and contributing to developing open source data and tools, such as Open Street Map initiatives collecting exposure data, for example Fernandez and Shaw (2016)[10]

**Figure 2.** Community meeting (top) and flood level gauge to validate flood warnings (bottom). Pictures nicely highlight the curiosity and interest of the younger generation in the community. (Source: RIMES Bangladesh)

and Ramina Huria (2017)[11], providing crucial information to deliver impact based warnings. Youth are also leading the way developing ICT tools and mobile applications, for example the Messiah application[12], which sends emergency alerts to pre-identified group developed within the Code for Resilience Programme (GFDRR, 2015)[13], a disaster mapping service in Indonesia, Peta

[9]Deltares and UNESCO-IHE. Young Scientists Event on Disaster Risk Reduction. (2016) Available at: https://www.deltares.nl/app/uploads/2016/03/Outcomedocument_YoungScientistsEventonDRR_final.pdf

[10]Fernandez, G., and R. Shaw. "Participation of Youth Councils in local-level HFA implementation in Infanta and Makati, Philippines and its policy implications." *Risk, Hazards & Crisis in Public Policy* 5(3). (2014): 259–278

[11]Ramanihuria. Community-based mapping project (2017) Available at: http://ramanihuria.org/

[12]Messiah. n.d. Messiah App. http://www.messiahapp.com/.

[13]World Bank and GFDRR. Code for Resilience: bridging Communities for Disaster Response (Global Facility for Disaster Reduction and Recovery). (2015) Available at: http://codeforresilience.org/apps/.

Bencana[14] and the E-Aid app for disaster management in Ghana under development by Nespeca (2017). When working together young practitioners from different disciplines such as ICT, media, hydrology, community volunteering can co-develop socially relevant solutions alongside the users.

Risk communication has been highlighted as an area where the potential influence of young people as 'communication agents' (resources and receivers) has been underestimated, particularly for early warning information (Mitchell et al. 2008[15]). The power of young people's social networks should be capitalized on not only to disseminate warnings through schools, households, and communities, but also to build awareness before disasters on how to respond to warnings. Further research on the influence of youth at the local level receiving and transmitting warnings using social media is needed to fully understand the social dynamics and performance of this medium of warning communication. Young people can work towards developing complementary tools and approaches that embrace the heterogeneous nature of communities.

## How can young people be supported?

The global, national and local community engaged in (Multi-Hazard) EWS developments need to take joint-action to support our young practitioners, scientists and researchers today and in the future. This includes bilateral and multilateral donors, local and regional NHMS, the World Meteorological Organisation, Regional forecasting centres e.g. RIMES, NGOs, universities (local and international), engineering consultancies, national governments and others. Here we outline possible ways to do this.

*Challenging roles in international projects and initiatives*

To prepare for the (Multi-Hazard) EWSS now and in the future young people need to part of the conversation at global, national and local levels to develop (Multi-Hazard) EWS of the future. For instance, global initiatives, like the Climate Risk and Early Warning Systems (CREWS)[16] should recognise the value of involving young professionals within development projects. Other ways could include involving youth in national activities such WMO workshops on EWS development[17]. Young practitioners and scientists, if formally involved, can offer new insights from a holistic and fresh perspective. It is important to include young professionals and researchers so that they can get access to invaluable knowledge and experience from these initiatives. This can then be further built upon to help the global and/or local development of EWS and of course to help other young researchers interested in these developments.

[14]Petabencana. (2017) Available at: https://petabencana.id/map/jakarta

[15] Mitchell, Tom, Katharine Haynes, Nick Hall, Wei Choong, and Katie Oven. "The roles of children and youth in communicating disaster risk." *Children Youth and Environments* 18, no. 1 (2008): 254-279.

[16]CREWS. (2017) Available at: https://www.gfdrr.org/crews-climate-risk-early-warning-systems

[17]WMO (2016) Available at: http://www.wmo.int/pages/prog/amp/pwsp/events_workshops_en.htm

*Networking and communities of practice*

The current development of (Multi-Hazard) EWSs demands a multidisciplinary approach. In order to achieve a "people centred" system, networks between young people involved across different sectors (e.g. hydro-met, disaster management, voluntary, media) should be established. By investing resources (e.g. time and financing) to develop these networks young people working or researching on all the different components of an EWS including data collection, forecasting and emergency response, can support each other to understand the current situation from all points of view and plan new developments.

UNISDR and WMO, along with other international and national agencies, announced the establishment of an international network for multi-hazard early warning systems (IN-MHEWS)[18] to share expertise and good practice. It is critical that young people play an active and dynamic role in this network to ensure national and local activities amongst youth can occur. Furthermore, national and regional (hydromet) agencies should ensure meaningful participation by young practitioners and researchers at their interdisciplinary regional and global networking and knowledge sharing events. For example the Expert Forum on DRR in a Changing Climate[19] and the Regional Flood Early Warning System Workshop[20].

Furthermore, some communities focus on specific components of EWS e.g. HEPEX on hydrology[21], Delft-FEWS on flood forecasting[22] or youth engagement e.g. Water Youth Network[23] and Young Hydrological Society[24]. However, none of these communities incorporate all the end-to-end processes involved with early warning nor do they focus on the interdisciplinary nature. Hence, the networking and communities of practice amongst EWS professionals must strongly involve youth.

*Support innovative research at postgraduate level*

Encouraging innovative research within and across disciplines to click together the pieces of the MH-EWS puzzle is critical to ensure the next generation of EWS experts. The complexities of delivering "people-centred" EWS requires much more interdisciplinary research than currently available (see Figure 3), especially if the effectiveness of current EWS is to be evaluated and monitored as part of the Sendai Framework monitoring of Target g. Clearly the current evolution of EWS demands that a multidisciplinary

[18]WMO. A Multi-Stakeholder Partnership for Promoting and Sharing Best Practice in Multi-Hazard Early Warning Systems and Services for Disaster Risk Reduction and Resilience. (2015) Available at: https://www.wmo.int/pages/prog/drr/documents/IN-MHEWSConceptPaper16415.pdf

[19]El Nino Ready Nations. (2015) Available at: http://elninoreadynations.com/lessons-learned-disaster-risk-reduction-in-a-changing-climate/

[20] RIMES and SAWI. Proceedings of the Regional Flood Early Warning System Workshop (2015). Available at: http://documents.worldbank.org/curated/en/431281468000591916/pdf/103879-WP-PUBLIC-Rimes-Workshop-Proceedings-13Jan2016.pdf

[21]HEPEX. (2017) Available at: https://hepex.irstea.fr/

[22]Deltares. (2017) Available at: https://oss.deltares.nl/web/delft-fews/

[23]Water Youth Network (2017) Available at: http://www.wateryouthnetwork.org/

[24] Young Hydrological Society (2017) Available at: https://younghs.com/

approach should be taken on future research. Collaboration between universities and consultancy organisations from all relevant sectors, can provide young researchers with new insights into practical challenges and fuel innovative solutions, especially if local fieldwork arrangements can be made possible to collect data from affected communities. This last aspect is essential if the work of young researchers aspires to evolve towards a more "people centred" perspective.

**Figure 3.** Breakout session identifying Early Warning System gaps on each component [10]

*Education and capacity building*

Educational events in local universities and colleges to encourage new programmes, motivate interest and raise awareness are needed. Furthermore, opportunities for further education once working in a NHMS should be accessible and incentives provided to ensure their return to these agencies. National governments need to encourage higher educated hydromet professionals to return to service the NHMS after obtaining postgraduate degrees abroad. Interdisciplinary training and (peer-to-peer) capacity building programmes are needed to share and generate knowledge across generations. Although often specific sector capacity building programmes, e.g. disaster response, can lack connection to other related topics such as long term risk management and hydro-met components, so it is important that both specialised and cross cutting training is provided.

Regional organizations like RIMES' Asia-Pacific Economic Cooperation Climate Center (APCC) arrange on site and off-site training programs[25] for the professionals of NHMS of their member countries. RIMES arranges secondment training programs for NHMS's professionals where they get opportunity to learn and gain experience from on-the-job training over a span of 3-6 months. There should be explicit opportunities for young scientists to join such initiatives. Moreover, there are exclusive programs for young scientists such as that arranged by APCC[26] which select scientists from developing countries and invites them to APCC to support their research while benefiting from APCC's data and expertise. There are also examples of joint programs for young scientists arranged by RIMES, APCC and other research organizations[27] which can be further promoted and replicated, see Figure 4.

[25] RIMES (2017) Available at: http://www.rimes.int/training.php

[26] APCC. n.d.. Available at: http://www.apcc21.org/ic/yssplist.do?lang=en&bbsId=BBSMSTR_000000000021

[27] WCRP. CORDEX Science and Training Workshop in East Asia. (2015) Available at: http://english.iap.cas.cn/news/201512/t20151214_157356.html

**Figure 4.** Young Scientists from the 4th WCRP CORDEX Science and Training Workshop in East Asia (Source: Institute of Atmospheric Physics, Chinese Academy of Sciences)

## What can young professionals do themselves?

This section aims to provide some general advice targeted at young EWS professionals on their journey towards more effective (Multi-Hazard) EWS:

- Engage in the IN-MHEWS and other WMO related activities.
- Advocate at global, national and local levels to create and enhance your voice as young professionals on EWS developments.
- Join and utilise existing networks (personal and organisational) to meet others 'in the same boat' and share your knowledge on EWS developments e.g. write a blog post.
- Build partnerships and relationships outside your organization's boundaries both horizontally (across sectors) and vertically (across levels).
- Step outside your specialised comfort zone and jointly innovate with other young and not-so-young EWS experts across sectors.
- Contribute to building the evidence base of EWS effectiveness globally evidence-base by conducting and publishing applied research.

## Conclusion

By supporting young professionals on the above identified areas, a bigger space opens for them to contribute innovative ideas towards implementing more "people-centred" and effective (Multi-Hazard) EWS globally. The authors hope that by 2030 young professionals on EWS developments are continuously connected, working closely together implementing projects and have a strong and sustained voice at all levels including within the IN-MHEWS.

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**Disaster risk during flood situations in the dry zone of Sri Lanka**

W.A.S.I. Wijesuriya[1]

Email Address:
swijesur@mymail.mines.edu
[1]General Secretary, EarthLanka

## Abstract

In recent years excessive rain caused significant destruction of human life and damage to infrastructure in the dry zone of Sri Lanka. These events left a significant portion of the community affected in the years 2011, 2014, 2015 and 2016. These occurrences also indicate an increase of severity and danger. Particularly these flood events have threatened the reservoir dams and the river basins of Sri Lanka. The rising concerns over the safety has led to human movements away from the disaster risk areas. The current policies have noted the possible risk of rainfall related disasters but however, the impact assessments, updated water runoff information and dam resilience policies are still inadequate. With the increased concerns after 2016 floods there is a need for research based policy developments addressing these risks.

The policy requirements discussed here focuses on methods of disaster risk assessment, rainfall-runoff mapping, and creating awareness among the vulnerable communities, strengthen the structural analysis of small and medium scale irrigation works of the dry zone of Sri Lanka.

## Introduction

Sri Lanka's radial network of rivers starts from the center of the country. There are 103 major river basins. Our main attention goes to the north and eastern regions of the island which is represented largely by the dry zone. This region has several major river basins including the longest river in Sri Lanka, Mahaweli River.

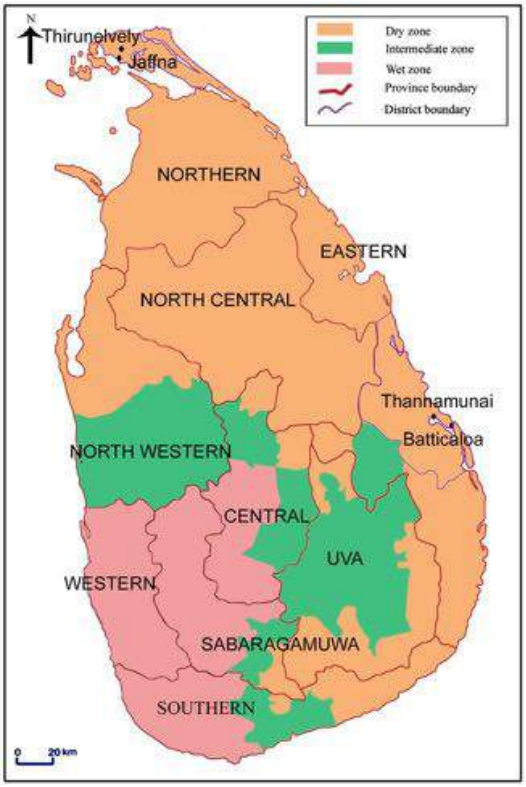


**Figure 1.**The climatic zones of Sri Lanka[1]

[1] Ramasamy, R. and Surendran, S.N., 2012. Global climate change and its potential impact on disease transmission by salinity-tolerant mosquito vectors in

Since 2011, erratic rainfall during the northeast monsoon characterized by flood/drought cycles has led to increased number of affected people in Sri Lanka's Dry Zone. These effects have been both immediate and far-off impacts on the communities. The Immediate impacts are life loss, injuries and property damage. There have been around 250 flood related deaths reported in the dry zone of Sri Lanka during the period of 2010-2016. The affected areas are also known to have communities which are of middle and lower income levels in Sri Lanka. This means the infrastructure in these areas are under developed or in the development stage. Most low-income houses are constructed out of cheap material like clay and wood panels and are easily destroyed.

It is noteworthy that during 2011 and 2014 floods in the Dry Zone a large number of village irrigation works failed. These failures drove the attention of the communities living in close proximity to reservoirs to question the safety measures of dams and water distribution channels. Failure of small irrigation works also highlights the requirement to assess the resilience of the small and medium scale dams. In the recent times, there had been heavy investment in the safety of large dams, but little on the medium and small dams. During May 2016 floods this concern came to the attention of mainstream media due to alarming water level rise in the Kelani River (wet zone)[2]. However, the policy frameworks have failed to capture the impact on the dry zone.

**Figure 2.** Flood damage to the infrastructure in the dry zone of Sri Lanka 2015 [source: Red Cross Sri Lanka]

Currently ongoing GCF funded "Climate Resilient Integrated Water Management Project" pays some attention to ensure the safety of medium and small scale water reservoirs. This project is funded by the Green Climate Fund (GCF) and spearheaded by the Ministry of Mahaweli Development and Environment of Sri Lanka with the assistance of the United Nations Development Programme (UNDP).

## Results and Discussion

In the dry zone of Sri Lanka, human-made reservoirs have served for the collection, storage and distribution of rainfall and runoff and provide irrigation water for the cultivation of paddy for 2000 years. These village irrigation systems also provide a variety of services including drinking water, water for livestock, fisheries etc. So their destruction has a big impact on human life, though little is felt at the national level. Although there have been improvements in knowledge regarding climatic parameters such as rainfall intensity changes, enough studies on rainfall-runoff parameters has not been done to capture the vulnerability of the

coastal zones. *Frontiers in physiology*, *3*, p.198.

[2] Perera, K., Sumathipala, P.L.N.S. and Wikramanayake, P.N., 2015. Interdependence between the Water Levels of Kotte Canal and Kelani River using Copulas. Sri Lankan Journal of Applied Statistics, 16(2).

irrigation works in the dry zone.

In most cases district level or provincial level analysis has been done at the moment[3]. The assessments of 2011 floods and 2016 floods are available as the Disaster Management Center publications. However the mapping of the trends observed in the flood situations since 2010 are not available. There is only limited rapid damage assessment for agriculture[4] in the impacted areas mentioned above.

Many resources are forwarded towards the wet zone of Sri Lanka following the heavy floods that affected the Kelani River basin in 2016[5][6]. Therefore, due attention towards the dry zone disaster impact has been diminished over the last few years. It is important to identify that the 2016 floods also impacted 37,001 people in Northern districts and 24, 874 people in Puttalam district which belong to the dry zone of Sri Lanka. In 2015 9,916 people (6,310 families) were affected by flooding in the districts of Jaffna, Mullaitivu, Kilinochchi, Trincomalee, Puttalam (dry zone) and Gampaha (wet zone)[7][8].

Therefore, village or local council level assessment is required to understand the severity of the damage. The administrative divisions in Sri Lanka are provinces, districts, divisional secretariat divisions (DSDs), and Grama Niladhari (Village Officer) divisions (GNDs)[9]. Considering more decentralized approach, out of the 323 DSDs, and 14,113 GNDs the DSDS GNDs in the dry zone should be considered in mapping and forecasting of flood impacts.

The assessment of the flood hazard involves the identification of:

1. Flood behavior;
2. Topography
3. Population at risk.

These parameters can be further evaluated to identify specific needs of the dry zone of Sri Lanka.

1. In identifying the flood behavior, main focus should be given to the damage to the small reservoirs during the floods and their contribution to failure of further dams in the downstream.

Therefore, the risk cannot be evaluated in isolation for individual reservoirs.

These bunts/dams are vulnerable mostly due to the weak compaction by the local farmers. Therefore, policy recommendations include the consistent structural assessment and studies on rainfall-runoff parameters of the waterways which link these reservoirs. Furthermore, the development of policies regarding the distribution/ diversion of excess water should be done giving emphasis to the river bed conservation policies already in place[10] .

2. The flood topography maps are provided to the Disaster Management Center of Sri Lanka

[3]http://www.preventionweb.net/english/hyogo/gar/background-papers/documents/Chap3/Asia-overview/Sri-Lanka-DRAFT-march-09.pdf

[4]Amarnath, G., Inada, Y., Inoue, R., Alahakoon, N. and Smakhtin, V., 2014, May. Blending satellite data and RADAR tool for rapid flood damage assessment in Agriculture: A case study in Sri Lanka. In *EGU General Assembly Conference Abstracts* (Vol. 16, p. 11099).

[5]http://www.irinnews.org/news/2016/05/26/after-devastating-floods-and-landslides-sri-lanka-plans-new-building-code.

[6]http://www.cnn.com/2016/05/22/asia/sri-lanka-flooding-deaths/

[7]http://floodlist.com/asia/sri-lanka-floods-northern-province-november-2015

[8]http://www.irinnews.org/news/2016/05/26/after-devastating-floods-and-landslides-sri-lanka-plans-new-building-code

[9] Zubair, L., Ralapanawe, V., Tennakoon, U., Yahiya, Z. and Perera, R., 2005. Natural disaster risks in Sri Lanka: Mapping hazards and risk hotspots. *Natural disaster hotspots case studies*, p.109.

[10] http://www.sundaytimes.lk/160612/sunday-times-2/reviving-the-kelani-river-basin-a-sustainable-approach-196873.html

by IWMI[11]. These maps can be used to develop the extrapolated maps indicating the vulnerability of the dry zone communities during the future flood situations.

3. The populations at risk mostly include the families in the agricultural and fisheries sectors. The resilience of small-holder farmers can be enhanced through strengthened local institutional mechanism, social mobilization, participatory planning & monitoring, inclusive development and increased capacity.

Participatory Vulnerability and Capacity Assessment (PVCA)[12] methods are also required in these regions to produce hazard maps, flood extent, exposure and risks. These assessments should also extend to measure the water quality of these regions. Sri Lanka's dry zone has an enormous issue of depleted water quality due to possible reasons of herbicides used in the agricultural practices[13] and the inherent hardness of the water[14]. More importantly timely feed of these information into an online platform possibly from many access points distributed around the affected areas could be a useful given the time sensitive manner of the information. Since the end of the civil war in Sri Lanka in 2009 the northern and eastern provinces have become more physically accessible. However, the transfer of technology required for the purposes of data gathering has not taken place.

There is a need for more awareness creation among the female gender, children and youth. This is mainly due to these parties are generally vulnerable to be affected mostly by these disasters and are also have become the victims of the differences in employment status (women), gendered social roles (women and youth), and social norms (women, children, and youth)[15].

Moreover, there parties tend to engage more with the natural environment and resources surrounding them. Equipping them with knowledge on the disaster risk and response methods shall lead to better responses with regard to evacuation to safety, resilient housing planning and increased community awareness.

Finally, the degradation of infrastructure due to water leakage and moisture transfer is another major concern for the safety of the communities living in these flood risk areas. People tend to return to their homes after severe floods without proper inspection of the construction. Most of these constructions are clay or brick based and therefore has the propensity to absorb and retain more water within the construction envelope. This could lead to failure of structures during heavy rains and in subsequent flood situations. Therefore, short and long term risk assessment policies are a necessity in the dry zone housing in Sri Lanka[16].

[11] http://www.dmc.gov.lk/IndexInnundationMaps.htm

[12] Zhang, L., 2016. Flood hazards impact on neighborhood house prices: A spatial quantile regression analysis. *Regional Science and Urban Economics*, *60*, pp.12-19.

[13] Wanigasuriya, K., 2014. Update on uncertain etiology of chronic kidney disease in Sri Lanka's north-central dry zone. *MEDICC review*, *16*(2), pp.61-65.

[14] Jayasumana, C., Paranagama, P., Agampodi, S., Wijewardane, C., Gunatilake, S. and Siribaddana, S., 2015. Drinking well water and occupational exposure to Herbicides is associated with chronic kidney disease, in Padavi-Sripura, Sri Lanka. *Environmental Health*, *14*(1), p.6.

[15] De Silva, K. and Jayathilaka, R., 2014. Gender in the context of disaster risk reduction; a case study of a flood risk reduction project in the Gampaha District in Sri Lanka. *Procedia Economics and Finance*, *18*, pp.873-881.

[16] Zhang, L., 2016. Flood hazards impact on neighborhood house prices: A spatial quantile regression analysis. *Regional Science and Urban Economics*, *60*, pp.12-19.

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**Redefining disaster (excerpts from a thesis at Kanagawa University in Japan)**

Peter Abraham Fukuda Loewi

Email Address: paflwork@gmail.com

**Abstract**

In the modern world, so focused on economic growth and the highest technologies, I propose that we must look at architecture as if it were in the humanities. An understanding of the history and societal significance of Japanese carpentry leads to the conclusion that what is important in architecture is asking not how something can be built, but why it must be built.

## Introduction

Atmospheric changes are causing hurricanes to grow larger, and rising sea levels are causing flooding; what we have always called "natural disasters" are becoming increasingly man-made. As new water covers old land, or a lack of water renders old land unusable, we are seeing an increase in refugees worldwide. Flooding and drought are causing food shortages, and the new refugees are facing animosity from those they seek shelter from. Having lost everything, even once middle-class and educated people are facing extreme poverty. By widening the common definition of disaster, the areas of knowledge and policy that we can use to combat it grows, as do the architectural possibilities. In order that the literal and metaphorical reconstruction of the home, the transition from temporary to permanent housing, goes smoothly, we must look more widely at the causes, in the search for new solutions.

## Methodology

We must look closely at the cultures of the pre-disaster era, and recognize the importance of traditional architecture. Traditional architectures are those that take into account climate factors, such as elevation, humidity, precipitation, and use the plants and minerals available to the builders. The origin of traditional structures lies in their unique geographic location, and so it, too, is intimately related to the environment.

Many traditional architectures around the world are made by trees that were felled nearby. But whether they had the rocks

and steel to make the axes to cut them down is also a major component. Naturally, different trees have different characteristics, and their assembly also differs from region to region. This applies to the physical structure and to the details. Some places might have very similar structures: if the house is being built in the tropics, the details will require lattice-like walls to allow the air to flow through, but if the house was being built in a region with large year-round temperature changes, the locals commonly spread mud over this lattice. Mud is very good at absorbing heat, so it stays warm in the winter but cool in the summer. It can be structural, and is the main building material in desert regions with few trees.

Climate affects more than just structures and details; it changes the very shape of the architecture. The mud architecture of desert regions has flat roofs, which are often used as another space for daily life. Regions with high levels of precipitation have steep roofs to redirect the water away from the living space.

Similarly, architecture that was built to be most effective in its local climate, was also built to be effective in the local disasters. Many mountainous countries have steep-roofed housing to prevent collapse under the snow, and many buildings in the tropics have long been built on stilts, to mitigate the effects of flooding or constant water level change.

**Discussion**

Japan is a mountainous island nation, blessed by the sea and the forests. A long and skinny country running north-south, it has the Pacific Ocean to the east, and the continental mass of Asia to the west. Two thirds of the nation's area is wooded, and Japanese architecture was developed traditionally as wooden. With lots of precipitation, the roofs are steeply sloped, and while the roof material differs from region to region, it is primarily thatched or covered using thin layers of tree bark. Both of these materials are the byproducts of agriculture or arboriculture, and resources were traditionally used without waste. Japan also lies along four tectonic plates, and so it is a country prone to earthquakes.

"The reason that architecture in Japan focused on wood was, obviously because it was rich in wood resources, but wood was chosen as an architectural material for more reasons than just that. One of those is the tremendous destructive power of natural disasters like typhoons and earthquakes which frequently hit Japan. Wooden structures have a small mass, and are better in seismic situations than stone or brick architectures. Even if an earthquake strikes, the wood frame, an indispensable component of wooden architecture, acts as a buffer, and gives the architecture a flexibility not possible in hard stone or brick architectures."[1]

While ours is an era in which we fear earthquakes, this wasn't always the case. Different periods feared different disasters, and this effected the development of traditional architectures. Being made mostly of wood and grass, Japanese houses are thought to be susceptible to fire. However, wood has a low heat-transfer coefficient, and allows for ample time to escape after catching fire. Just because the architecture itself was weak against fire, doesn't mean that the people inside must be, too. Looking at the records of past disasters, compared to the number of buildings destroyed, the number of lives lost is astonishing low.

"There are exceptionally few cases of fires in wooden buildings leading to casualties. A few years ago, there were fires in hot spring resorts near Minakami in Gunma, Arima near Kobe, and Bandai in Fukushima, and they all had over 30 casualties. These were all first-rate hotels, which were reinforced concrete structures. Around the same time, there was a fire in the Oyasukyo hot spring in Akita. 22 buildings burned to the ground, but not a single person died. So, it can be said that

[1] Seike Kiyoshi, *Nihon no Kigumi*, Tankosha, 1979, pg. 18

because the buildings were made with reinforced concrete that none of them fell down, and that because they were built with wood, that 22 burned down. However, it can also be said that because the buildings were built with wood, nobody died."[2]

Generationally passed down knowledge is much more than just the way to cut or use trees, but also how to grow them, and all of the special characteristics for each species. "Use trees properly (lit. give life to trees.) Don't waste anything. If you can use the habits to your advantage, the building will last longer, and be stronger. That is why we pass on our skills, and what was passed on to me,"[3] says Nishioka Tsunekazu, considered the last great temple carpenter. Both the largest and oldest wooden buildings in the world are in Japan, and the repairs of Horyuji Temple, the oldest wooden building in the world, were left to Nishioka.

However, these traditions and their wisdom are being lost. "Wisdom as a form of culture is only meaningful when it is actually used. Instead of learning to give another life to trees, we live in a time when we only care about speed, cost, and shape. We have forgotten how to live with trees."[4] One reason for this is the development and implementation of new technology.

We can divide the physical structures of Japanese wooden architecture into three major groups: "traditional," "conventional," and "modern."

First we have the ancient technology, including trade with the Asian Continent, which we shall call "traditional" construction. There are of course differences between periods and regions, but any form of construction that was developed in the face of the local climate, before the opening to the West, shall be defined as "traditional." While it is known that Western engineers admired Edo's craftsman culture, and allowed it to continue after the Meiji Restoration, this all changed after the Mino-Owari (or Nobi) earthquake, near Nagoya in 1891. Traditional forms of joinery were said to be weak compared to Western hardware. The Mino-Owari earthquake remains the largest earthquake ever to hit Japan on land, and because proving that a traditional structure based around the material memory of wood was earthquake resistant was impossible with the technology at the time, this kind of knowledge was completely ignored.

The next major blow to the traditional building methods was World War Two. "Even several years after the war, smaller schools and municipal structures were often built with wood, but during the 50's Japan entered a period of huge economic growth and everything began to be built out of concrete."[5]

Called "conventional" wooden structures, they were in fact something much different. "To think that this 'conventional axial framing method' is a logically improved version of 'traditional wooden structures' is fundamentally incorrect."[6] The Japanese method of non-rigid "soft" joints allowed the force of earthquakes to be absorbed in the play of the joint, and directed the force along the wooden beam in a direction that trees are exceptionally strong in. As this was the first major earthquake since there were Westerners in Japan, and there are no earthquakes in Western Europe, the new engineers didn't know that the traditional way was built to withstand the local disasters.

The relationship between the post-war period of economic growth and architecture is problematic. There are known connections between the start of

2 Seike Kiyoshi, *Nihon no Kigumi*, Tankosha, 1979, pg. 37

3 Nishioka Tsunekazu, *Ki no Inochi, Ki no Kokoro*, Shinchosha, 2005, pg. 24

4 Shiono Yonematsu, *Ki no Oshie*, Chikuma Shobou, 2010, pg. 60

5 Sakamoto Isao, *Mokuzou Kenchiku to sono Kouzou*, Mokuzou no Shousai 1: Kouzouhen, 2nd Edition, Shoukokusha, 2000, pg. 7

6 Masuda Kazuma, *Kouzou no Henkaku*, Kenchiku Shichou Kenkyusho Henshu, 1998, pg. 199

the economic growth and the Korean War, beginning in 1950, which is the same year the first Japanese building code was set into law. While a direct link is unclear, we can see that the foreign building methods were preferred. It can be assumed that trade agreements involving North American woods and the associated building methods were deeply involved.

The third construction method, "modern," refers to balloon framing, panel framing, 2×4s, and those that rely on composite woods. Structural plywoods have been certified by the building code, and while the term "carpenter" once meant a master of trees, it has come to mean "the one who screws in pre-cut pieces of wood."

The Japanese structural engineer Hirose Kouji goes a step further: "The root of all evil trying to erase the mentality and technology of Japanese traditional architecture is the national building code, and it can be explained in the following manner:

- The crime of the employment of Western technology without any criticism or critical thinking, and its making into law.
- The crime, the result of the above, which led to the obliteration of Japanese traditional technology.
- The crime of disrespecting traditional craftsmen and inviting the egregious decline in skill.
- The crime of forcing the propensity of labor-saving structures.
- The crime of attacking architectural free thought."[7]

(The character used for "crime" in the original text is actually closer to "sin" or "transgression.")

Despite a no-waste culture before, Japan also faced the implementation of a "use-and-throw-away" culture, under the name of "economic growth." "The overwhelming number of Japanese inhabitants think that modern homes are easier to live in than traditional homes. For this, we can point to the internationalization of the Japanese life style, not that traditional houses became more difficult to live in, but that in recently built houses they have air conditioning, and we can see the great advancements in the kitchen, bath, toilets, and water management facilities, which makes them much easier to live in."[8] This is exactly the kind of "employment of Western technology without any criticism or critical thinking" that Hirose talks about. These advancements have to do with the additional facilities, and have nothing to do with the actual building. Is there any reason that new facilities can't be implemented in traditional structures? It is for this reason that the largest opponents to the proposed 2020 energy building code are the remaining traditional carpenters. Truly vernacular buildings will no longer be able to be built, due to what the government is calling environmental sustainability measures. Any new building must use an insulation with numbers that traditional materials do not meet. The logic is that mud walls don't do enough to insulate, and that artificial materials would save money and energy on heating and air conditioning. There is no mention of using less artificial heating or air conditioning at all.

The United Nations stresses the importance of responsible policies and learning from our ancestry and tradition. It is clear how much architecture is affected by politics and economics, and I propose that this connection can be used to think about disaster risk management. Preparing for natural disasters begins with thinking about the environment.

Japan is currently facing a labor shortage. It is raising the cost of construction, and is slowing the reconstruction of disaster hit areas. However, it is causing one more large problem: traditional knowledge and technology aren't being passed on

[7] Hirose Kouji, *Zairai Kouhou wo Kangaeru: Sanjigen de aru koto wo Wasureta Kenchiku*, Kenchiku to Machizukuri 1984 April Edition, Shinkenchikuka Gijyutsusha Shudan, pg. 3

[8] Uchida Yoshichika, *Taiyaku: Gendai Kenchiku no Tsukurarekata*, Ichigaya Shuppansha, 2002, pg. 10

anymore. Fearing that this would happen, Nishioka shared his secrets, something traditional carpenters had never done before. We are seeing the digitization and preservation of the shapes of traditional technology, and advancements in the natural sciences are giving birth to new ways of preserving the environment, but the connection between those two is being forgotten, and causing a rift in architecture.

"It is a sad truth that of the over 5400 people killed in the Great Hanshin earthquake, over 90 percent of them were crushed to death by collapsing buildings. After the earthquake, I talked to many people, but none of their words struck me quite as the master of Sukiya carpentry, Kinoshita Kouichi. I summarize:

The tragedy of the collapsing of so many wooden buildings during the Great Hanshin earthquake is pretty close to a man-made disaster. Here is why:

1. They are being designed by those unfamiliar with trees,
2. They are being certified by cursory municipal employees,
3. They are being put together by irresponsible carpenters just trying to earn a living,
4. Finally, there isn't a single person out there who is racking their brains about the structural research."[9]

The first point is clearly about the separation of architecture and the endemic. It should be the carpenters in point three (above) who know these kinds of things. However, as they are being disrespected, they can't even take pride in their own work, and this is directly causing disasters. But this can hardly be called the carpenters' fault.

"I think it important that we reflect on the knowledge held by those who associated with trees, ways of interaction with nature. It should teach us something that we have forgotten."[10]

## Conclusion

To effectively close this rift, we must address the inadequacies in our education systems and the political reasons behind them. New technologies are being developed faster than people can test their true sustainability. The Japanese term for "vertical integration" comes from forestry and the history of sending timber down river. The market is intimately related to the environment. Only through understanding the whole system can we begin to address the parts. We need a more human-centered, holistic, adaptable, yet localized approach to architecture.

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9 Masuda Kazuma, *Kouzou no Henkaku*, Kenchiku Shichou Kenkyusho Henshu, 1998, pg. 185

10 Shiono Yonematsu, *Ki no Oshie*, Chikuma Shobou, 2010, pg. 13

**Reducing disaster risks by better prediction of the impacts of El Niño and La Niña**

Gabriela Guimarães Nobre[1], Sanne Muis[1], Ted I. Veldkamp[1] and Philip J. Ward[1]

Email Address: g.guimaraesnobre@vu.nl
[1]Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, Amsterdam, Netherlands

## Abstract

El Niño-Southern Oscillation (ENSO) events have been linked to billions of dollars of economic damages in large parts of the world, through the triggering of extreme events like floods and droughts. Climate forecasts can predict ENSO conditions months in advance, and as such, governments and other organizations have the opportunity to take precautionary measures to reduce disaster risks. Taking adequate action requires a global understanding of which regions are at risk during El Niño/La Niña events. In this policy brief, we summarize recent research on the global effects of ENSO on natural disasters, including droughts, and river- and coastal flooding. Also, we provide some policy recommendations showcasing opportunities and challenges of responding to ENSO forecasts.

## 1 Introduction

The recent 2015-16 El Niño is one of the strongest ever recorded. El Niño conditions began to emerge in mid-2014 and intensified throughout 2015. The event was predicted months in advance[1]. The event triggered severe droughts and water shortages in Africa for two consecutive years, and contributed to food-insecurity and famine[2]. Donors, like the European Union, are increasing their funds to more than €500 million to respond to the crisis that is partially driven by the impact of the El Niño on East Africa[3].
Simultaneously, the 2015-16 El Niño caused severe flooding in the northwest of Latin America and forced 150,000 people to leave their homes in Paraguay, Argentina, Brazil and Uruguay[4]. In 2017, forecasts give a 50% chance of El Niño developing again[1].
El Niño conditions occur when there are unusually warm oceanic and atmospheric conditions in the tropical Pacific. This can cause the trade winds,

[1] Australian Government - Bureau of Meteorology. "ENSO Outlook 28 March 2017 - An Alert System for the El Niño–Southern Oscillation." (2017)
[2] Famine Early Warning Systems Network (FEWS). "Key message update East Africa." (2017)
[3] Francis, O. "Combat East Africa Famine, Drought." *Bloomberg* (20 Mar. 2017).
[4] "Flooding 'Worst in 50 Years', as 150,000 Flee in Paraguay, Argentina, Brazil and Uruguay." BBC News (27 Dec. 2015).

that usually blow towards Indonesia and Australia, to slow down or even reverse direction, allowing the warmer water to spread eastward all the way to South America[5]. However, El Niño is just one side of the story. Opposite conditions, with unusually cold oceanic and atmospheric conditions in the eastern tropical Pacific, are called La Niña. These oceanic and atmospheric variations are known as the El Niño-Southern Oscillation (ENSO), which is the dominant driver of the year to year variability in the global climate conditions[6]. While their frequency and intensity is irregular, El Niño and La Niña events occur on average every two to seven years. The conditions typically last 9-12 months, but can persist much longer.

ENSO can affect weather patterns worldwide through so-called "teleconnections". In turn, these changes in weather patterns can influence the frequency and severity on natural hazards, including droughts and flooding. The impacts of ENSO are well-studied at local and regional scales, and are being studied more and more also at the global scale[7]. These studies are leading to an improved understanding of how ENSO impacts society.

Over the past few decades, the prediction of ENSO conditions has improved considerably. ENSO events can now be predicted with reasonable skill 6 months or more in advance[8,9]. Many major climate centers such as the NOAA Climate Prediction Center use operational forecasting to give advance warning to governments, decision-makers and end-users around the world. Reliable forecasts enable the prioritization of adaptation efforts in the most affected regions ahead of those extreme events and allow for early warning and disaster planning by local governments and non-governmental organizations, like the Red Cross or United Nations[10], especially when there is a good understanding of the societal impacts that may be caused by ENSO.

In this policy brief, we summarize recent research on the global effects of ENSO on natural disasters, including droughts and river- and coastal flooding.

## 2 Increased disaster risk due to El Niño and La Niña events

### 2.1 Drought and water scarcity

The connection between ENSO events and rainfall deficits, droughts, and water scarcity is increasingly well understood[11]. Connections between ENSO and low river flows exist in northern America[12], Southeast Asia[13], Southern Africa[14], and Australia[15].

[5] https://www.climate.gov/enso

[6] McPhaden, M.J., Zebiak, S.E., and Glantz. M.H. "ENSO as an Integrating Concept in Earth Science." *Science* 314.5806 (2006): 1740–1745.

[7] Ward, P.J. et al. "Usefulness and Limitations of Global Flood Risk Models." *Nature Climate Change* 5.8 (2015): 712–715.

[8] Jin, E.K. et al. "Current Status of ENSO Prediction Skill in Coupled Ocean–atmosphere Models." *Climate Dynamics* 31.6 (2008): 647–664.

[9] Zhang, R. H. et al. "A Successful Real-Time Forecast of the 2010-11 La Nina Event." Scientific Reports 3. (2013): 1108.

[10] Coughlan De Perez, E. et al. "Science to prevent disasters." Nature Geoscience 7.2 (2014): 78-79..

[11] Dilley, M., and Heyman ,B. N. "ENSO and disaster: droughts, floods and El Niño/Southern Oscillation warm events." Disasters 19.3 (1995): 181-193.

[12] Ryu, J. H. et al. "Potential extents for ENSO-driven hydrologic drought forecasts in the United States." Climatic Change 101.3 (2010): 575-597.

[13] Lü, A. et al. "El Niño-Southern Oscillation and water resources in the headwaters region of the Yellow River: links and potential for forecasting." Hydrology and Earth System Sciences 15.4 (2011): 1273.

[14] Richard, Y. et al. "20th century droughts in southern Africa: spatial and temporal variability, teleconnections with oceanic and atmospheric conditions." International Journal of Climatology 21.7 (2001): 873-885.

Worldwide, disasters triggered by droughts occur twice as often during the second year of an El Niño event than during other years, especially in Southern Africa and Southeast Asia[14]. Regional water scarcity conditions become more extreme under El Niño and La Niña phases for almost one-third of the global land area[16]. Regions where rainfall and hydrological extremes are influenced by ENSO[17,18] also show a connection between ENSO and annual total water availability or water scarcity conditions. In these areas, rainfall deficits during an ENSO event feed droughts, which possibly result in water scarcity events if consumptive demands outweigh the available water resources[11].

## 2.2 Agricultural effects

ENSO influences global agriculture in several ways, including: changes in hydro-meteorological[19] and climate extremes[20], which directly impacts crop production and export prices; and cascading effects on livelihoods and health[21]. The global-mean yields of maize, rice and wheat under both El Niño and La Niña conditions are likely to be below normal (-4.0 to -0.2%), while El Niño causes on average positive impacts on soybeans yields (+2.9 to +3.5%), especially in the United States of America and Brazil, where most of the global soybean is currently produced[22].

Even today, drought-related crop failures due to El Niño are a major contributor to famine. The rapid shift between El Niño and La Niña conditions in 2016 intensified the shortage of rainfall, driving major hydrological crises over Eastern and Southern Africa, where 50 million people are food insecure due to the combination of drought exacerbated conditions and conflict [21].

## 2.3 Extreme rainfall and river flooding

El Niño or La Niña intensifies extreme rainfall mostly in boreal winter, and least during summer seasons[23]. The deviations from normal conditions are often asymmetric, which means that most parts of the world experience higher/lower extremes only for either El Niño or La Niña. Extreme rainfall during ENSO condition can be up to 50% higher compared to neutral conditions. Extremes are more severe in the boreal winter during El Niño mainly in central and southern North America, southeast and northeast China, and southeast South America, and during La Niña in western Pacific areas[23].

During El Niño conditions, about one-fifth of the global land surface is more likely to experience abnormally high

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[15] Chiew, F HS, et al. "El Nino/Southern Oscillation and Australian rainfall, streamflow and drought: Links and potential for forecasting." Journal of Hydrology 204.1-4 (1998): 138-149.

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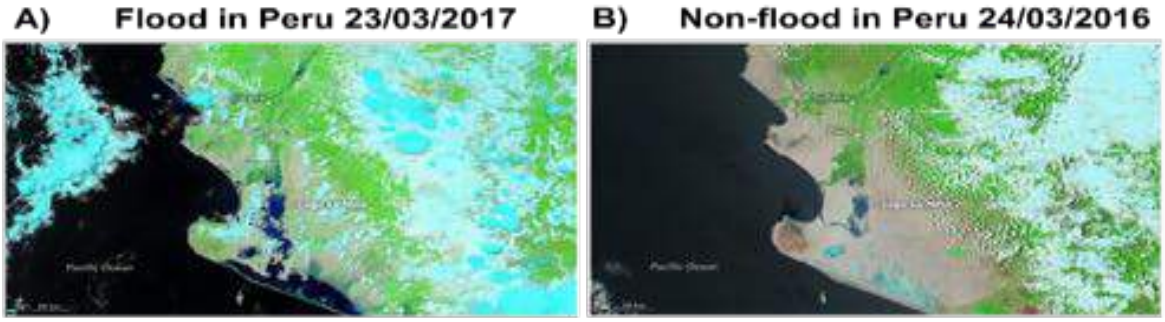


**Figure 1.** Comparison between flooding and non-flooding conditions in Peru as captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite. Between 19 and 23 March 2017, multiple storms hit Peru's north coast between, bringing heavy rains and extensive flooding to the country. Source: NASA.

river flow, especially in the tropics[24] (Figure 1). In terms of economic damage, El Niño years are associated with anomalies in annual expected urban damage in 29% of the Earth's land surface, while during La Niña years anomalies are observed across 23% of the Earth's land surface[25].

### 2.4 Coastal hazards

ENSO events have been linked with increased probabilities of beach erosion and coastal flooding around the world. Two mechanisms cause this: (1) warmer ocean temperatures and changes in ocean circulation can induce an increase in mean sea level; and (2), perturbations of the tropical and subtropical atmospheric circulation influence storm activity around the world. Increases in mean sea level particularly affect the tropical Pacific[26]. El Niño/La Niña conditions result in changes in mean sea level of ± 20-30 cm[27]. Along the North American west coast, mean sea levels were on average 0.11 m higher during the five largest El Niño events[28]. In most parts of the world, the generation of extreme sea-levels is dominated by tides and storm surges. However, in regions with a large change in mean sea-level and a small tidal range is small, these effects can have a significant influence on the generation of extremes. Changes in storm activity result from changes in tropical cyclone activity[29], as well as extra-tropical cyclone activity[30].

## 3. Policy recommendations

### 3.1 Responding to ENSO

The risk of drought and flooding can vary from year to year due to ENSO. As

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[28] Barnard, P.L. et al."Coastal vulnerability across the Pacific dominated by El Niño/Southern Oscillication." *Nature Geoscience 8*. (2015): 801–808

[29] Saunders, M.A. et al. "Atlantic hurricanes and NW Pacific typhoons: ENSO spatial impacts on occurrence and landfall." *Geophysical Research Letters 27*-8. (2000): 1147–1150.

[30] Eichler, T. and W. Higgins. "Climatology and ENSO-related variability of North American extratropical cyclone activity." *Journal of Climate 19.* (1981): 2076–2093.

ENSO can be predicted with reasonable skill, individuals, organizations, and governments can make use of ENSO forecasts and take actions to reduce the impacts of potential disasters. Here we provide practical examples of how ENSO forecasts are being put to use. More and more, governments respond to ENSO forecasts and make an attempt to reduce disaster risk. Peru provides a prime example. In the past, El Niño events have contributed to huge economic losses with the 1982-83 El Niño causing 2 billion USD[31] and the 1996-97 El Niño 3.5 billion USD[32]. This is because the countries' main economic activities, like fishing, agriculture and tourism, are heavily exposed to El Niño. In response to the forecast of a strong ENSO in 2015, the Peruvian government declared a 60-day state of emergency, and spent around $20 million for flood and drought prevention. This included building reservoirs in areas predicted to be affected by drought, dredging and deepening rivers in flood-prone areas, and providing agricultural insurance for farmers[33]. Also, based on seasonal climate forecasts, the government has established guidelines on how to achieve agricultural production goals and advises farmers about the optimal combination of crops to sow[31].

Similar strategies are being implemented in Africa, where ENSO forecasts are used to assist agricultural producers to select crops most likely to be successful in the coming growing season[34]. At the same time, crop insurance systems based on ENSO forecasts are becoming more established. An example is the African Risk Capacity, an index-based insurance mechanism for infrequent, severe drought events[35]. Early warning forecasting systems, like FEWS-NET[36], are providing outlooks that help governments and non-governmental organizations to plan for humanitarian crises, for example via the pre-stocking of foods, medicines and disaster relief goods, and the redeployment of health staff to the worst-affected areas[10,37].

### 3.2 Challenges

Despite the increasing understanding and skill of climate predictions, ENSO continues to surprise the world[37]. This is depicted clearly by the false prediction of a really strong El Niño in early 2014, whereas an unforeseen strong El Niño developed in 2015. Furthermore, the changing climate may also have an impact on the frequency and strength of ENSO events. These potential changes can have profound socio-economic consequences. Hence, it is important to improve our understanding of how ENSO may respond to climate change. Still, the uncertainties surrounding the likelihood of an ENSO-driven droughts or floods are high. Each ENSO event is unique and can have a different signature. For instance, during the strong 2015-16 El Niño, several countries took preparedness measures for expected flooding. While, Peru experienced severe flooding no floods were registered in other likely locations such as Japan. Furthermore, Indonesia also suffered from floods when much

[31] Lagos, P., and J. Buizer. "El Niño and Peru: A Nation's Response to Interannual Climate Variability." *Natural and Technological Disasters: Causes, Effects and Preventive Measures*. (1992).

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[34] Tall, Arame, et al. "Scaling up climate services for farmers: Mission Possible. Learning from good practice in Africa and South Asia." (2014).

[35] http://www.africanriskcapacity.org/

[36] https://www.fews.net/

[37] McPhaden, M.J. "Playing hide and seek with El Niño. *Nature Climate Change 5* (2015): 791–795

drier river conditions were expected[24].

Therefore, communicating and mobilizing funds to mitigate ENSO seasonal risks remains a challenge, this includes translating uncertain early warning risks into multiple and flexible early actions. In addition to a fast response to critical food insecurity and health conditions, efforts must be focused on strengthening national climate resilience and "Build Back Better" strategies, especially in poorest communities which are hit hardest[21]. Since mid-2015, the Central Emergency Response Fund has allocated $117.5 million to 19 countries for early action in response to disasters associated with El Niño. Reflecting recent pledges and new funding requests of a total of $5 billion by twenty-three countries, the current funding gap is almost $3.1 billion[38].

## 4. Conclusions

ENSO events have been linked to billions of dollars of economic damages in large parts of the world, by triggering extreme events like floods and droughts. Climate forecasts can predict these events months in advance, and as such, governments and other organizations have the opportunity to take precautionary measures to reduce disaster risks. To take adequate action requires a global understanding of which regions are at risk during El Niño/La Niña events. While various scientific and institutional challenges remain, there are more and more examples of good practices of actions taken to reduce natural hazard impacts based on ENSO forecasts.

[38] United Nations Office for the Coordination of Humanitarian Affairs (OCHA) (2016), "El Nino: overview of impact, projected humanitarian needs and response". September 2016.

**Role of Nepali nurses in disaster risk reduction: a need for capacity building**

Sushila Paudel[1,2]

Email Address: epinursenepal@gmail.com
[1]Disaster Nursing Global Leader Program, University of Kochi, Japan
[2]Member of Nursing association of Nepal (NAN), Kathmandu, Nepal

## Abstract

Nepal is one of the hotspots of disaster. This article reflects on 25 April, 2015 Gorkha Earthquake, and one of projects undertaken in Nepal, targeting the local Nepali nurses who originally belong to their community, and their significant contribution in monitoring living environment and promoting health of community people after disaster. It focuses on the monitoring process, challenges and recommendations that might be beneficial to nursing practice in terms of enhancing roles of nurses and capacity building in disasters, and enabling national and global policy makers to deal more effectively in order to promote Disaster Risk Reduction.

## Introduction

Nepal is a landlocked, Himalayan country located in South-Asia in between China and India. Nepal often faces high magnitudes and intensities of multiple hazards such as earthquakes, floods, landslides, fires, lightning, windstorms, hailstorms, droughts, epidemics and so on because of its rugged and fragile geophysical structure, very high peaks, high slopes, complex geology, variable climatic conditions, active tectonic processes, unplanned settlement, increasing population, weak economic condition and low literacy rate[1]. World Bank classifies Nepal as one of the global 'hot-spots' for natural disaster[2]. The country stands at the top 20th list of the most multi-hazard prone countries in the world. It is ranked 4th, 11th and 30th in terms of climate change, earthquake and flood risk, respectively[3].

On 25 April 2015, a massive earthquake of magnitude 7.6 struck Nepal, having

[1] The Government of Nepal, Ministry of Home Affairs (MoHA) and Disaster Preparedness Network-Nepal . "Nepal Disaster Report 2015".Nepal.2015.

[2] The World Bank. "Natural Disaster Hotspots: A Global Risk Analysis".the World Bank and Columbia University:Washington D.C.2005

[3]UNDP/BCPR."Reducing Disaster Risk: A Challenge for Development.A Global Report". United Nations Development Programme/Bureau for Crisis Prevention and Recovery conference draft:New York.2004

the epicenter near Barpak village of Gorkha district, northwest of capital city Kathmandu. It was the worst quake to strike the country in more than 80 years. On 12 May 2015, another 6.8 magnitude strong aftershock caused further damage and sufferings. These earthquakes took the lives of 8,896 and injured seriously 22,303 people[1].

Disasters pose various threats to physical and psycho-social wellbeing. Critical attention should be given to address health needs of people to maintain minimum health safety level. So nurses, being the largest healthcare professionals group, must be well prepared for disasters. The world Health organization report acknowledges that nurses lack knowledge and skills in disaster and recommends that nurses to be involved in planning, policy making for disaster preparedness and response. Furthermore, WHO demonstrates that training nurses will have a great impact on risk reduction and response to a disaster[4]. A developing country like Nepal, which has been hit by the earthquakes frequently, should have well prepared nurses in order to respond to a disaster effectively.

## Methodology

This article reflects on 25 April, 2015 Gorkha Earthquake and one of projects undertaken in Nepal called "EpiNurse project". Objective of the EpiNurse project was to assess the communicable diseases, assessing local living environment for surveillance, interventions and priority activities, and passing information to government, donors and other concerned authorities. Monitoring was conducted by 24 trained local Nepali nurses, given name as 'EpiNurse', from selected 10 affected districts for 4 months in 34 temporary shelters. Monitoring was started from September 2016. Purpose of study was explained before monitoring, and toolkit training was given. Toolkit included simple questionnaire regarding living environment assessment and item of Surveillance in Post Extreme Emergencies and Disasters (SPEED), developed by WHO/WPRO, and a post-disaster Early Warning Alert and Response Network (EWARN), used by Ministry of Health. The EpiNurse center was launched at Nursing Association of Nepal (NAN) in Kathmandu to help improving the accuracy of data recorded by nurses.

## Results & Discussion

The total population of the Registered Nurses in Nepal in 2017 is 43,139[5]. Basnet et al. has found that "The majority of the RNs worked in government hospitals (63.2%) and two thirds (78%) had never attended disaster training drills. Knowledge of the RNs regarding earthquake disaster was at a moderate level (70.07 ± 10.01). In regards to the knowledge, the knowledge in the response phase was at a low level whereas, that in the recovery phase was at a high level. The lowest score of nurses' knowledge was related to assessment and triage in earthquake disaster response. Nurses working in governmental hospitals have a higher mean score of knowledge than those working in non-governmental hospitals ($P < .05$)[6]. It reveals the necessity of

[4] WHO. "The Contribution of Nursing and Midwifery in Emergencies." Report of a WHO consultation:WHO, Geneva.2006.

[5] "Registration status of Nurses upto 12 March, 2017". Nepal Nursing Council. 2017.Available from: http://www.nnc.org.np/. (Assessed on 25 March,2017)

[6] Basnet, Songwathana P., and Sae-Sia W. "Disaster Nursing Knowledge in Earthquake Response and Relief among Nepalese Nurses working in Government and Non-Government

disaster nursing training course in community health nursing level and in non-governmental hospitals to improve their knowledge in order to respond to future disasters. Nurses play key roles in disaster preparedness. They can save lives and reduce public fear and assist in mitigation measures. They have exceptional knowledge of the most vulnerable populations, and this information can be immediately used in a disaster.

Another study by Loke and Fung focused that with the complexity nature of disasters, special competencies are required if nurses are to deal with adverse happenings in their serving community. Nurses' perceived disaster nursing competencies reported by nurses were grossly inadequate, demonstrating the needs to develop a comprehensive curriculum for public health. The establishment of a set of tailor-made disaster nursing core competencies for the community they served is the first step in preparing nurses to deal with disastrous situations for the health of the public[7].

"EpiNurse "was given the name after "the nurses who can perform epidemiological approach" and they are the main health professionals in touch with the community. Every community has its own culture and social structure. So, local Nurses can understand best, the local community needs, and assets, thus assessing out the local living environment for surveillance and interventions and priority activities, providing optimum care and also communicating information with concerned authorizes at the local and national level.

A two-day workshop was conducted with representative nurses of the disaster affected areas on collecting information about shelters. Specifications of the survey tool kit were done, and skills training on monitoring and rapid assessment were given, so that they pay more attention to the hygiene control to maintain minimum health safety. Data collection was the critical challenge. Traditional paper and telephone methods were used by nurses for data collection which took more time. To solve this problem, new application was developed in collaboration with the local nonprofit organization. Mobile application collected data and information of shelter such as location and timestamps, geo-tagged photos, and specific questionnaire with location information by the geo-tagging function. This system development and action engagement process was designed to engage local nurse in a quality improvement process. Initially, a relatively low commitment was seen to the continuous monitoring but the use of mobile application increased the health professionals' sense of responsibility towards the care they provided. All the living environment data and health information as per questionnaire sent by the local nurses were monitored for accuracy in the EpiNurse Center NAN(Nursing Association of Nepal) and the information was shared with government, donors and concerned authorities. Lack of geographic information, unavailability of IT infrastructure and lack of knowledge of nurses in information technology were the issues faced during monitoring and data collection. However, mobile application was useful for EpiNurses in reporting epidemiological health security information regardless of timing and systems. It is urgent to apply geospatial technology for people's behavior modeling in disaster situation,

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Sector". *Journal of Nursing Education and Practice* 6.11.(2016): 111

[7]Loke, Fung O.W.M. "Nurses' Competencies in Disaster Nursing: Implications for Curriculum Development and Public Health." *International* J*ournal Environment Research Public Health* 11.3.(2014): 3289

and suggest exploring the potential use of social networks to enhance the government's understanding of people's health security level. Hence we can say, if provided minimum training, local Nurses can play the vital role in reducing disaster risks and supporting Sendai Framework for Disaster Risk Reduction.

The concept of EpiNurse contributes to development and ongoing enhancement of sustainability in the communities. The national nursing association should be supportive for such simple change that enhances the working environment for nurses in a way that can be sustained.

## Policy Recommendations

Resources are often limited and do not allow monitoring tool to incorporate all of the reporting sources. It is required for government to coordinate the inter-operability of rapid assessment with other data services for further cooperation with other sectors. Routine health security monitoring and communication is essential in ensuring to adapt over time to changing social context, environments systems and technology.

Similarly, Capacity building including human and technology is necessary for sustainable community.

## Conclusion

At the time of disaster, effective monitoring to reduce disaster risk has been a challenge. This project explores how the data collected by local nurses using the simple technology can become the basis of the daily community health information system, which could be the monitoring model and benchmark of Nepal towards Sendai Framework for Disaster Risk Reduction from the point of view of nursing science. The Nepali local nurses gather first-hand information from evacuees in shelters and transmit data in near real-time communication to other health organizations, who would make informed decisions for prevention of health hazards through the action research which assess living-environmental conditions and health risks, to improve the quality of reporting system in shelters, to enhance organizational development through teamwork around data collection, and to improve the quality of care by linking community and government surveillance records. So, disaster nursing education and training to develop competencies for the capacity building of Nepali nurses is vital.

## Acknowledgements

I would like to acknowledge Dr. Sakiko Kanbara, Associate Professor, Graduate School of Nursing, University of Kochi, Principal Investigator from Japan, for carrying out EpiNurse project in Nepal, and Prof. Tara Pokhrel, President of Nursing Association of Nepal, Assistant Prof. Apsara Pandey Khanal, Vice president of Nursing Association of Nepal, Prof. Chandrakala Sharma, President of Nepal Nursing Council, Principal Investigators from Nepal, for their warm guidance and support, and opportunity given to me to coordinate Epinurses. In addition, I sincerely thank all EpiNurses for their efforts in monitoring health of people during disaster.

**Staying safe: disaster risk reduction**

Sharmishtha Agarwal

Email Address: sharmishtha.agarwal@gmail.com

## Abstract

Developmental gains are directly related to the exposure of any community to disaster risk. In the same light, the level of disaster risk prevalent in a community is linked to the developmental choices exerted by that community[1].

Natural hazards often lead to disasters when the society is not well equipped to face the natural hazard, hence calling it a natural disaster. Disaster Risk Reduction targets to minimize the damage caused by natural hazards like earthquake, cyclones, floods, droughts and others, using an ethic of prevention.

Education for Disaster Risk Reduction caters to the relationships between society, environment, economy, and culture and their impacts. It helps to create resilient societies through a holistic and interdisciplinary approach to learning and problem solving. Children play an important role in saving and protecting lives of a community at the time of a disaster. Including disaster risk reduction in primary and secondary school curricula is essential to fostering awareness and understanding of the environment. This article aims to make disaster risk reduction a part of education at all levels to move towards a resilient community.

[1] UNDP, 2004

## Introduction

According to the World Bank, losses brought about by disasters in developing countries are 20 times higher than those in developed countries in terms of Gross National Product. There is an increasing deposition that investing in Disaster Risk Reduction leads to economic and development benefits. Few instances are stated below:

1. Potential losses of $12 billion have been deterred by an investment of $3 billion in flood control measures over 40 years.
2. It has been assessed that for every dollar invested in Disaster Risk Reduction, two to four dollars are recovered in terms of risk averted or reduced disaster impacts.[2]

Human actions lead to natural hazards becoming disasters. However, we can minimize the disaster risk by making the wise choices of intelligent planning and taking right steps.

Climate change, by increasing the intensity and frequency of the disasters is increases a community's vulnerability to disasters. The term disaster risk therefore refers to the potential disaster losses in lives, health status, livelihoods, assets and services, which could occur in a particular

[2] www.dfid.gov.uk

community or society over some specified future time period. The impact of a hazard is different on communities, depending on the coping mechanism of a particular community. The underprivileged and downtrodden communities suffer the most from disasters, since they are the least equipped and most exposed. Disaster risk can be attributed to three factors:

a. hazards (natural or anthropogenic)
b. vulnerability to a hazard
c. coping capacity linked to the reduction, mitigation and resilience to the vulnerability of a community associated with the hazard in question.

The primary intention of Disaster Risk Reduction should not only be reduction of loss by disaster but sustainable development, human welfare and well-being. Steps to mitigate negative effects of natural hazards should be taken. Planting of mangroves to minimize the threat posed by tidal surges is one of the examples. In Vietnam, mangrove plantation was done to provide protection to dykes and coastal communes. It had direct economic and ecological benefits, safeguarding assets outside the sea dykes. This Vietnam Red Cross project has had an exceptional achievement in improving the protection of dykes and coastal communities and is the reason for more than a quarter of the existing mangroves in the eight northern provinces.[3] Thus, mangrove afforestation can be deduced to be one of the most effective ways of disaster and climate change mitigation.
Education in schools can be used as a tool to raise awareness about natural hazards. The role of education in Disaster Risk Reduction can be simplified as below:

- Engaging children, teachers, parents, school management, local authorities.
- Investing in school infrastructure to make buildings and surrounding areas safer.
- Using schools as centers for community action, training and coordination on Disaster Risk Reduction.
- Raising the awareness of children and their communities on climate change and disaster prevention and mitigation.
- Tracking how climate change is affecting communities.
- Helping vulnerable children and their communities to claim the rights that will allow them to live in safer conditions.
- Campaigning for the implementation of the Hyogo Framework for Action by all signatory governments.
- Persuading and supporting governments to integrate Disaster Risk Reduction into all areas of their work and to replicate successful Disaster Risk Reduction models.
- Supporting civil society networks and experts at local, national and international levels.
- Documenting and sharing experiences and learning with peers, governments, academics and donors.

[3] www.ifrc.org

## Discussion

Swelling susceptibilities emanating from population increase, rapid urbanization, environmental degradation, socio-economic conditions including conflicts for climate change, diminishing resources, poverty and developmental pressure, are the reasons for disaster risk being a global concern. Therefore, building safe and resilient communities should be at the heart of the approach to Disaster Risk Reduction.

Children are the most vulnerable at the time of a catastrophe and if taught about natural risks, they can play a vital role in safeguarding the community at the time of a disaster. Building or investing in strengthening school buildings to withstand the forces of nature, will protect generations of children, considering the loss of each child represents 40-70 years of lost life and productivity. Each scar indicates 40-70 years of expensive medical care[4]. Disaster risk education and building resilient school infrastructure are the primary goals outlined in the Hyogo Framework for Action 2005-20015: Building Resilience of Nations and Communities to Disasters.

The calamitous earthquake of Gujarat, India in 2001, has etched harrowing memories of casualties among school children. Several school buildings crashed, with the most excruciating tragedy in Anjar, where 400 school children lost their lives.[5] While executing the extensive rehabilitation programs in the aftermath of the disaster, the government undertook the Gujarat School Safety Initiative to cultivate a practice of disaster safety in schools. The project through a series of activities sensitized teachers, school administration, students and parents on disaster management issues associated with school communities. It has directly impacted 105,000 students across 175 schools and has become a model for an initiative of its kind.

The Disaster Risk Reduction through Schools (DRRS) project in Haiti has helped the people change the way they approach disaster management and take initiatives to reduce risks and protect themselves. It has trained people to perform rescue operations and damage assessments incase a disaster strikes. In a certain part of the country, parents have built a wall around a local school to be used as community shelter in times of emergency.[6]

To attain a sustainable development to Disaster Risk Reduction, it is crucial to achieve a balance between human security and environment. Thus, at the level of policy making, education can serve as the paramount tool to join issues of disaster, environment and sustainable development to achieve human security. The paradigm of Disaster Risk Reduction requires the governments to increase their investments in corrective and compensatory risk management.

Nalbari district of Assam, India, has been affected by annual flooding for decades. As a part of the Action Aids project, a number of students from local schools have formed a disaster management committee, given the residents hope and tackle disaster in a new way. It makes them feel safer.

[4] www.seedsindia.org

[5] www.unisdr.org

[6] http://www.actionaid.org

## Conclusion

Education, till now, has focused on disaster response and recovery instead of proposing actions to reduce risk. To build disaster resilience in societies around the world, education will assist in how disaster risk can be understood and reduced — not only reducing existing risks, but also preventing the creation of new risks.

Disaster Risk Reduction is required to have an adequate part in planning and development projects. Education policies seeking to promote Disaster Risk Reduction within local contexts should include the knowledge and practices of the region's indigenous people. Effective education calls for policymakers to promote gender equality and complete involvement of women and girls within any education policy or initiative. Thus, it is imperative for the stakeholders in development including government, professionals, legislators, inspectors, builders, councilors, and ultimately the beneficiaries to be a part of the policy making. The aim of Disaster Risk Reduction should be to reduce risks by building capacity and resilience of communities at risk, ensuring their welfare and security.

# DISASTER risk reduction

## Science, Technology & Innovation

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# Digital government for better disaster risk governance? added value and challenges

Serena Tagliacozzo[1]

Email Address: serena.tagliacozzo.13@ucl.ac.uk
[1]Institute for Risk and Disaster Reduction, University College London

## Abstract

This policy brief outlines the potentialities and pitfalls of digital government for Disaster Risk Governance (DRG). It is suggested to maintain an optimistic but questioning mindset in order to overcome the social, cultural and organisational barriers that prevent the full exploitation of digital technologies for social good.

## Disaster risk governance: drivers and desired outcomes

The Sendai framework for Disaster Risk Reduction (DRR) 2015-2030 consolidated a shift of focus from the management of disaster consequences to better understanding and addressing disaster risks worldwide[1]. Disaster risk is hereby acknowledged as resultant from the interactions between a natural hazard and the conditions that make a societal system vulnerable and exposed to disaster losses[2]. It follows that disaster risk is not equally distributed across all the countries and population strata. Poor and middle-income countries and people are more vulnerable to the impacts of natural and non-natural hazards to the extent that some have regarded disasters as ultimately a development issue[3]. The concept of

[1] United Nations. *Sendai Framework for Disaster Risk Reduction 2015-2030*, Sendai, Japan: UN, 2015.

[2] UNISDR. *Making Development Sustainable: The Future of Disaster Risk Management.* Global Assessment Report on Disaster Risk Reduction. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction (UNISDR), 2015.

[3] UNISDR. *Making Development Sustainable: The Future of Disaster Risk Management.* Global Assessment Report on Disaster Risk Reduction. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction (UNISDR), 2015.

governance transcends the one of government and emphasises the concerted effort of multiple actors to define mechanisms and institutions to regulate and negotiate their interests and exercise their rights[4]. Disaster risk governance (DRG) is thus defined as the "*the system of institutions, mechanisms, policy and legal frameworks and other arrangements to guide, coordinate and oversee disaster risk reduction and related areas of policy"*[5] .

In the conception of the Sendai Framework, DRG drives effective disaster risk management. DRG encompasses the understanding of disaster risks in all its dimensions, the enforcements of institutional policies and financial incentives at local, regional and national level, the establishment of partnerships between institutions and within government levels, the sharing and communication of information about disaster risk[1]. The ultimate desired outcome of this process is the implementation of instruments relevant to DRR and sustainable development[1]. The achievement of this process requires that:

*Disaster risk policies are well defined and their implementation is driven by competence, flexibility and a clear vision*.

Effective DRG implies that: a) Responsibilities and roles for disaster risk governance are established; b) Indicators to assess disaster risks are defined; and c) Mechanisms for monitoring and reporting on policy compliance are set up.

*Inter-sector and intergovernmental collaboration and coordination is put into practice*.

DRG has often been compartmentalised and fragmented between various sectors and government levels[6]. Instead DRG should be conceived as a multi-stakeholders process[7].

*A whole-of-government and whole-of-community approach is adopted*.

DRG requires a broad participation of diverse stakeholders including non-governmental actors (e.g. civil society organisations)[8]. Responsibility for DRG has to be shared among all the societal stakeholders including citizens.

*Disaster risk is informed*.

Risk communication is a crucial component of DRG. On the one hand, DRG policies have to be informed by comprehensive and accurate data. On the other, risk has to be communicated in a way that

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[4] UNDP. *Disaster Risk Reduction, Governance and Mainstreaming*, New York (NY): UNDP, 2010

[5] UNISDR. "Disaster risk governance". *UNISDR website*. Terminology, 3 February 2017 https://www.unisdr.org/we/inform/terminology#letter-d Accessed 27 March 2017

[6] Gall, Melanie. Cutter, Susan L. and Nguyen, Khai. *Governance in Disaster Risk Management*. IRDR AIRDR Publication No. 3. Beijing: Integrated Research on Disaster Risk, 2014.

[7] Florin, Marie-Valentine and Xu, Jianhua. *Risk Governance: An Overview Of Drivers And Success Factors*. Input paper prepared for the Global Assessment Report on Disaster Risk Reduction 2015. Lausanne: International Risk Governance Council, 2014.

[8] Yao, Keping. E-Government for Disaster Risk Management. Presentation at the *Regional Training Workshop in Asia and the Pacific: Sustainable Development and Disaster Risk Management Using E-Government,* 25-27 March 2015, Songdo, Republic of Korea

empowers people to make informed choices about its management[9]. Risk communication has to be tailored, inclusive, transparent and sensitive to the needs of underserved communities.

*Accountability and sharing of lessons learned is improved*.
Governments must be held accountable for the enforcement of disaster risk regulations. Lessons learned should be shared across contexts, sectors, entities and countries.
The realisation of the DRG process and of its components as described above is far from straightforward. Challenges have to be overcome that include:

- Lack of resources, capacity, political stability/legitimacy [5].
- Issues of authority (e.g., jurisdictional powers), representation (e.g., elected officials, stakeholder participation), and administration (e.g., bureaucratic processes, collaborative arrangements)[5].
- Handling "systemic risks" with increased complexity, ambiguity and uncertainty [8].
- Communicating new and emerging threats and risks.
- Achieving transformative learning, which mobilises a culture of risk and materialises DRR strategies.

## Digital government for better disaster risk governance: added value

The rise of risks complexity and of new interconnected threats has led governments to find innovative solutions to govern disaster risks[6]. At the same time, citizens' expectations of responsiveness have increased to the extent of boosting government's adoption of new communication technologies, such as social media[10]. By making reference to the scope and components of DRG as described in the previous section, the added value for disaster risk governance brought about by technology developments in government services delivery is debated.

*Better definition of roles and policies through enhanced intergovernmental and inter-sector coordination of efforts and communications (whole-of-government*).
Digital technologies offer opportunities for cooperation across the boundaries of agencies, sectors and departments. This can manifest, for example, into the realisation of one-stop shops, which provide citizens with integrated online services and knowledge repositories[11]. However a whole-of-government approach requires a shared vision, the establishment of a chief information officer who

[9] International Risk Governance Council (IRGC). *An introduction to the IRGC Risk Governance Framework,* Lausanne: IRGC 2012.

[10] Mergel, Ines. "Designing Social Media Strategies and Policies". *Handbook of Public Administratio*n. Ed. James. L. Perry and Robert. K. Christensen. New York: Wiley & Sons, 2015. 456-468

[11] Mimicopoulos, Michael and Kauzya, John M. "Taking a whole-of-government approach". *United Nations E-Government Survey 2012*. Ed. Department of Economic and Social Affairs. New York (NY): United Nations, 2012. 55-73

oversees the management and implementation of ad-hoc ICT policies and ensuring systems interoperability and integration of online services[11]. The same hold true for disaster risk-related online services. The provision of digital technologies *can* bolster a move away from a silos approach to better cross-department and cross-sector collaboration and communication for disaster risk governance but it is not sufficient *per se.*

*Facilitated dissemination of risk information*

Risk communication has greatly benefited from digital technologies in respect to facilitated dissemination of risk-related information. Over the last years, various countries have implemented online platforms to display disaster trends with the scope to enhance risk understanding among citizens and other key stakeholders. For example in Latin America the *Disaster Inventory System - DesInventar*[12] is available for consultation and visualisation of information about disasters. In the Philippines, *Project NOAH* (Nationwide Operational Assessment of Hazards)[13] provides high-resolution flood hazard maps. In USA, the *Potential Storm Surge Flooding Map*[14] produced by the National Hurricane Centre displays the risks associated with coastal flooding as result of storm surge. The US National Government also has a web portal (data.gov/disasters) that aggregates datasets about disasters and potential risks.

*Improved accountability and lessons sharing through open data*

Accountability is becoming a major concern for governments partially due to the widespread distrust of citizens and the increased availability of alternative information sources. Open data platforms have been conceived as possible solutions for governments to demonstrate their accountability in terms of expenditures to prevent disaster-related risks. In the wake of major disasters, government in various parts of the world have published online information about expenditures and projects associated with recovery and reconstruction activities. For example in the aftermath of the earthquakes of 2012 in Emilia-Romagna (Northern Italy), a web platform named OpenRicostruzione[15] allows people tracking recovery projects by locality or type. The Openreconstruction[16] portal created after Typhoon Haiyan/Yolanda in 2013 in the Philippines and the Aid Management Platform[17] created after Nepal earthquake in 2015 serve similar functions of ensuring accountability and transparency in recovery-related disbursements. These platforms however, rarely provide information specifically about how DRR strategies have been integrated into recovery activities

[12] DesInventar http://www.desinventar.org/

[13] Project NOAH http://center.noah.up.edu.ph/

[14] National Hurricane Center, Potential Storm Surge Maps http://www.nhc.noaa.gov/surge/inundation/

[15] OpenRicostruzione platform http://www.openricostruzione.it/

[16] OpenReconstruction platform http://openreconstruction.gov.ph/home

[17] Aid Management Platform http://amis.mof.gov.np/portal/about

and projects. The sharing of information about lessons learned from small, medium and major disasters is facilitated by open knowledge online repositories such as the Homeland Security Digital Library.[18]

*Stakeholder engagement and participation.*
Stakeholder engagement in decision-making about disaster-risk does not only have to do with information dissemination. On the contrary, stakeholder voices should be listened to and their inputs constantly harvested in order to build effective DRG. Digital technologies can make this easier and faster. In particular applications that enable crowdsourcing information open up space for co-production of knowledge about disaster risks detection and prevention. *LastQuake* produced by the European Mediterranean Seismological Centre (EMSC) is one example of these kinds of applications harnessing social media and collective intelligence for disaster risk governance.

*Whole of community approach.*
FEMA's whole of community framework[19] fosters cooperation among all the societal stakeholders (i.e. governments, citizens, private and public sector, NGOs, community groups etc.) in understanding disaster risks and collaboratively assessing community's needs and capacities. The framework suggests a definitive move from a government-led DRG to a shared responsibility for disaster risk management. This shift guarantees that the interests and needs of all the societal members are taken into account within DRG policies and frameworks. Social media technology can make easier for societal members to join together as partners in disaster risk communication, assessment and prevention[20].

## Digital government for better disaster risk governance: challenges

Apart from the benefits described above, the use of digital technologies for DRG conceals some pitfalls that need to be unveiled. When talking about DRG one should always bear in mind that disaster risks can be more or less purposively created (see the concept of "disaster risk creation"[21]) and influenced by private and political interests. In other words, we have to analyse the world *as it is* and not *as it should be.* Asking questions that challenge shared assumptions is one way to proceed.

*Does digital government help to realise a really inclusive DRG?*
Research on digital divide suggests that web technologies can ameliorate social and demographic

[18] Homeland Security Digital Library https://www.hsdl.org/c/

[19] FEMA. *A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action*. Washington D.C.: FEMA, 2011

[20] Culleton, Eileen. "The importance of a whole of community approach to using social media for disaster resilience and how the Emergency 2.0 Wiki can help". *Planet@Risk,* 3(1), Special Issue on the 5th IDRC Davos (2014).

[21] Lewis, James and Kelman, Ilan. "The Good, The Bad and The Ugly: Disaster Risk Reduction (DRR) Versus Disaster Risk Creation (DRC)". *Plos Current Disasters.* Jun 21 . Edition 1. (2012) doi: 10.1371/4f8d4eaec6af8

inequalities. In other words, digital technologies can make vulnerable people (who should be the primary target of DRG policies) even more marginalised. For example, the Humanitarian Technologies project[22] found that interactive technologies were neither beneficial for poor people to receive information from humanitarian agencies nor for humanitarian agencies to improve their action and accountability in the aftermath of Typhoon Haiyan in the Philippines. These results suggest that the advantages of using digital government for inclusive DRG should be regularly questioned.

*Does digital government resolve issues such as lack of resources and capacity?*
The takeup of digital interactive technologies requires capacity building in terms of trained staff and improved time-management skills[12]. Governments that lack a strong leadership and internal structure or that suffer from a chronic shortage of resources represent an arid soil where the potential benefits of digital technologies hardly materialise. Moreover competition among government entities and between levels can strengthen the silos structure and make it hard the realisation of a digital whole-of-government strategy.

*Are open data and transparency sufficient to mobilise a culture of risk?*
Open government initiatives carried out in various parts of the world to increase transparency and accountability tended to focus mainly on open data[23]. However recent research[24] suggests that e-governance dimensions related to openness are a necessary but not sufficient condition for the realisation of open government. Organisational, legal and cultural aspects play a more prominent role. One should question to what extent the mere provision of data about disaster risks through web platforms could actually enhance DRG and management.

*Do online interactions decrease ambiguity, complexity and uncertainty in risk communication?*
The increase of risk complexity requires government communication to manage ambiguity and uncertainty. However theories on computer-mediated communication (i.e. SIDE model[25] and Reduced Social Cues model[26]) suggest that online interactions may add ambiguity about the message due to the lack of social cues in online interactions (i.e. facial expressions and tone of the voice). Governments should handle the

[22] Humanitarian Technologies project (http://humanitariantechnologies.net/)

[23] Linders, Dennis. "Towards open development: Leveraging open data to improve the planning and coordination of international aid". *Government Information Quarterly* 30.4 (2013): 426-434

[24] Misuraca, Gianluca and Viscusi, Gianluigi. "Is Open Data Enough? E-Governance Challenges for Open Government". *International Journal of Electronic Government Research (IJEGR)* 10.1 (2014): 18-34

[25] Lea, Martin and Spears, Russell. "Computer-mediated communication, de-individuation and group decision-making". *International Journal of Man-Machine Studies* 34 (1991): 283-301.

[26] Sproull, Lee and Kiesler, Sara. "Reducing social context cues: Electronic mail in organizational communication". *Management Science* 32 (1986): 1492–1512.

drawbacks of communication about disaster risk via online environments in order to take advantage of the benefits it brings along.

## Conclusions

Existing social disparities and power structures are the ultimate drivers of disaster risks. Digital government policies can facilitate the realisation and materialisation of good practices in DRG. However effective DRG requires a political and societal will to turn theory-based policies into real-world interventions. While some steps have been made toward this direction in the last decade, other old and new forms of exploitation have risen to prominence. Digital technologies can represent one of the possible allies in fighting these trends provided that an investigative and questioning mind-set is maintained.

**Two-dimensional Mudflood Simulation in Arequipa, Peru**

Reyna Natalia Huancara Puma[1], Flor Cutire Sivincha[1]

Email Address: huancararnhp@hotmail.com
[1]National University of Saint Augustine, Faculty of Civil Engineering. Arequipa, Peru.

## Abstract

The annex of Pescadores, district of Ocoña, province of Camaná, region of Arequipa, in Perú is periodically affected by mud floods in the summer period resulting in the obstruction of the traffic of the Panamericana Sur Highway, causing economic losses to the region of Arequipa and affecting the inhabitants of the zone, as well the travelers. This study presents a two-dimensional mud flood model calibrated with the event of February 12, 2012, using FLO-2D software, in order to obtain a map of hazards for the aforementioned area with return periods of 100 years. In addition, this study simulates the model with the construction of four dams for sediment retention in the upper zone of the floodplain of the gully of Pescadores to mitigate this natural disaster. Bringing, as a result, a decrease of economic losses to Arequipa due to paralyzed traffic and safeguarding the life and health of the settlers and the travellers.

## Introduction

It is common to see that every year during rainy seasons there are mud floods or floods that affect the region of Arequipa, mainly to the Panamericana Sur highway at km 756+400 in the annex of Pescadores, Ocoña, Camaná, Arequipa. This is due to the fact that Pescadores gully is formed by abrupt slopes, landslides and erosion in the lower part of the gully, together with the high precipitations in the upper part of the basin, causing mud floods. The annex of Pescadores, Arequipa, does not have a hazard map, meaning the Pescadores gully that crosses that annex lacks topographic and hydrological studies; this was a motivation to carry out this study and obtaining the model.

The model was calibrated with the event of February 12, 2012, which was documented by videos, that paralyzed the traffic by three days.

The FLO-2D finite-difference model is a dynamic flood routing model that simulates channel flow, unconfined overland flow and street flow. It models water flows and hyperconcentrated flows (avenue of mud, mudflow and debris flow)[1].

[1] FLO-2D, "*Reference Manual*", Arizona,

FLO-2D has been used in countries such as the United States, Venezuela, Italy, Japan, etc., generating the acceptance of the researchers. In addition, the FLO-2D is a model accepted and recognized by FEMA (Federal Emergency Management Agency).[2]

**Figure 1**. Mud flood blocks major Panamericana Sur Highway. Source: Pescadores, February 2012.

## Methods

Topographic characterization: The Pescadores-Caraveli basin extends over an area of 1932 km$^2$, with a maximum height of 4257 m.a.s.l. and a minimum of 39 m.a.s.l. The main length of the basin is 140 km, with an average slope of 3%.

Hydrological characterization: The liquid hydrograph was obtained from the annual maximum precipitation of 24 hours. For the calculation was used HEC-HMS hydrological model and Soil Conservation Soil (SCS) methodology. The liquid hydrograph obtained has a peak flow of 200 m$^3$ / s.

Geological-geodynamic characterization: According to the geological map drawn up by the "Instituto Geológico, Metalúrgico y Minero" (INGEMMET), the Pescadores gully is located in a V-shaped valley with landslides and erosion problems. The valley of Pescadores presents superficial alluvial and fluvial deposits[3].

Simulation of the model: It was introduced the topographic, hydrological and geological-geodynamic data to the model and was calibrated for the event occurred on February 12, 2012.
The objective of the calibration is to adjust the volume obtained from the FLO-2D model with the volume observed in the field, in addition it was verified the heights of the flow and the speed.
The plasticity index of the soil samples collected in the floodplain was 6%, being classified as mud flood, type Aspen Pit1 (O'Brien & Julien, 1988).
The volumetric concentration of sediments "Cv" was estimated by making a first initial approximation of 0.20 until reaching a value of 0.45, which are values corresponding to "mud flood", which was identified in the event of February 12, 2012, obtaining valid values between 0.25 and 0.40.
Soil specific gravity obtained was 2.65, resistance parameter of laminar flow assumed was 2285 and number of Manning assumed was 0.15 along the channel of the gully.
The urban attributes that were considered for the simulation were the

http://www.flo-2d.com. , 2000, 01 Dic. 2016.

[2]Castillo Navarro, Leonardo F.," Aplicacion de un modelo numerico de flujos de escombros y lodo de una quebrada en el Perú". Lima: UNI,2006. Print

[3] INGEMMET. "*BOLETIN N°23 ESTUDIOS RIESGOS GEOLOGICOS FRANJA 1"*, Lima, http://www.ingemmet.gob.pe/, 2000, 01 Dic. 2016.

Panamericana Sur Highway, housing, schools, health posts and recreational centers, which influence the transit of the flow. A church that due to its location would function like a dam to certain flow straps in addition to hydraulic structures such as culverts.

Mitigation Measure: It is proposed to build dams for sediment retention to make stablize the slopes, laminate the flow and protect the highway.
These dams for sediment retention have a useful life of 25 years, for a period of return of 75 years, fulfilling the recommendations made in the book of Ven Te Chow[4]. Being four dams located to 500 m. before reaching the zone of cultivation of the valley of Pescadores, with a separation between them of 500 m. These dams are of the gravity type, with a variable height between 2 meters and 5 meters, they have a length between 100 and 200 m. In total, the 4 dams have a length of 600 m.

**Results & Discussion**

For the hazard map with a return time of 100 years, it was obtained a peak flow of 200 $m^3/s$. From the results obtained from the model, there are higher values of flow straps in the upper part of the valley of Pescadores; it was observed that it overflows along the Panamericana Sur Highway, while in the lower part, the flow decreases in both height and speed. It was observed that the model provides us similar values to those obtained in the field.

Hazard map: According to the Federal Emergency Management Agency (FEMA), in the case of the occurrence of mud or debris flow at a flow height greater than 1.00 m or for a velocity greater than 1.00 m/s is considered a high hazard. In addition, for flow heights between 0.20 m and 1.00 m and for velocities between 0.20 m/s and 1.00 m/s is considered a medium hazard[5].
The valley of Pescadores, as well as the Panamericana Sur highway, are located on the floodplain of the gully of Pescadores. In accordance with the above-mentioned and taking into account the event occurred on February 12, 2012, has been established three danger levels, whose limits of danger zone come from the model FLO-2D. These zones are of high, medium and low danger (Fig. 2). The most affected point would be the Panamericana Sur Highway at the km 765 + 400, which would cause the interruption of the highway, and besides that it would affect homes, basic services such as school, health post, church, etc., as well as, more importantly, the loss of lives of the inhabitants and the travelers.

Dams for sediment retention: In order to mitigate disasters, the implementation of dams for sediment retention that was described above was chosen like the structural measure more economical, viable and efficient. It is observed that with this construction, the delimitation of the danger zone would be diminished (Fig. 3). Reducing the height and speed of flow in the Panamericana Sur Highway, which will allow a free transit, in addition

[4] Chow, V.T. Hidraúlica de Canales Abiertos. Santafé de Bogotá: McGraw-Hill, 1994.

[5] FLO-2D, "*Mapper Manual*", Arizona, http://www.flo-2d.com. , 2000, 01 Dic. 2016.

to safeguarding housing, basic services and human lives mainly.


**Figure 2.** Hazard map of the Valley of Pescadores. Source: Authors, flo-2d v.2009, 2017.

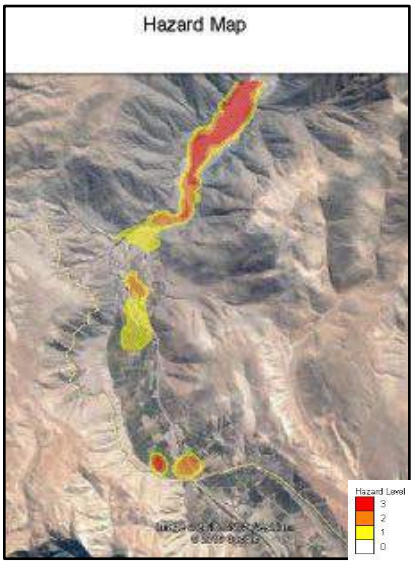


**Figure 3**. Hazard map of the Valley of Pescadores, with dams for sediment retention. Source: Authors, flo-2d v.2009, 2017.

## Conclusion

The results obtained from the simulation in the FLO-2D model are similar to the results obtained in the field of the event occurred on February 12, 2012, which validates the model.

The hazards maps will help to Annex of Pescadores to optimize the plan of urban development and zoning of the Valley of Pescadores.

The mitigation measure proposed in the present study is the construction of dams for sediment retention, which represents the most efficient measure.

This research is an effort to contribute to the study and mitigation of mud flood disasters according to the Sendai Framework with the objective of reducing the risk of this disaster, the loss of human lives and economic assets.

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**Synthetic biology and its effects on environment and human health**

Bartlomiej Kolodziejczyk[1,2], Kauthemy Manirajan[1]

Email Address: bart.kolodziejczyk@scientistsinresidence.org
[1] Scientists-*in*-Residence
[2] International Union for Conservation of Nature (IUCN)

## Abstract

Synthetic biology is a young, ever-growing, and interdisciplinary branch of biology and engineering. It is providing numerous great opportunities for virtually every branch of industry. This includes the development of biofuels, value-added chemicals, drug delivery, and protein therapeutics among others. However, just like any new development, synthetic biology is not challenging or problem free and is currently minimally regulated. The lack of standards and regulations regarding who can practice synthetic biology and how it can be applied are becoming issues. This, coupled with defining safe use and disposal of synthetic biology, raises numerous questions and worries among citizens, scientists, experts, policy makers and governments alike. There are many stakeholders at play here and to add to the mix there is also a growing movement of Do-It-Yourself (DIY) synthetic biologists, citizen scientists, and other home-grown practitioners. This document discusses opportunities and challenges in the rapidly growing synthetic biology field, urging policymakers to regulate the field before its advancement.

## Introduction

Recent technological developments are leading to solutions that can potentially address many world challenges. One of these developments is synthetic biology, where naturally occurring biological systems can be altered to be more efficient or to acquire new functionalities. Synthetic biology is already employed in several faculties, improving medicine and pharmacy, as well as animal sciences and food production among many other fields. Synthetic biology is an interdisciplinary branch containing both biology and engineering. It is (I) the design and construction of new biological parts, devices, and systems, and (II) the re-design of existing, natural biological systems for useful purposes. [1,2]

In other words, synthetic biology can be viewed as engineering and creating biological systems. Synthetic biology includes the broad redefinition and expansion of biotechnology, with the ultimate goals of being able to design and build engineered biological systems with a purpose. They may aim to process

[1] Bhattachary D., Calitz J.P. and Hunter A. "Synthetic Biology Dialogue." *Biotechnology and Biological Sciences Research Council (BBSRC)* (2010).

[2] "Synthetic Biology: scope, applications and implications." *The Royal Academy of Engineering* (2009).

information, fabricate chemicals, produce materials and structures, generate energy or fuel, provide food, and maintain and enhance human health and the environment.[3]

Studies in synthetic biology can be classified into subclasses depending on the approach they use to create. (I) Biomolecular engineering includes strategies which aim to create a toolkit of functional units that can be introduced to present new technological functions in living cells. (II) Biomolecular design is the general idea of starting a design from scratch and building a product by an additive combination of smaller biomolecular components to achieve some goal. (III) Lastly, genetic engineering is based on approaches to constructing artificial chromosomes for whole or individual sections of the organisms.

Each of the above approaches shares similar strategy; to develop a more synthetic entity at a higher level of complexity, or novel function, by manipulating their simpler parts that at the lower level of complexity.[1,3]

Another synthetic biology approach that shows promise is the re-writing of deoxyribonucleic acid (DNA). This method looks to edit the genetic code of extant biological systems, but this can be difficult due to the complex nature of the language of natural biological systems. Many have proposed it may be simpler to re-build the natural systems of interest from scratch using simple building blocks or molecules.[1-3]

Due to the relative immaturity of the field, many synthetic biology products are still in the early stages of development. Despite this, scientists hope to use synthetic biology approaches to develop many useful types of products. This includes, but is not limited to, the following technologies. (I) Synthetic life; artificial forms of life created in vitro from biomolecules and their component materials.[1,2] (II) It includes cell transformation; where DNA or even an entire genome is integrated into a living cell to invoke desired new functions and capabilities.[2,4,5] (III) Another application is information storage; where a vast amount of digital information is encoded on a single strand of synthetic DNA.[2] (IV) Additionally, custom-designed proteins are a goal; novel protein structures that match or improve on existing proteins.[2-4] (V) Biosensors can also be developed. These are mechanisms capable of sensing and reporting some ambient phenomenon such as brain activity or the presence of toxins in its environment.[2,3] (VI) Lastly, synthetic biology can be used for materials production; where living cells function as microscopic molecular foundries to produce materials with desired, genetically encoded, properties.[2,5] These technologies have both benefits and dangers associated too numerous to completely cover in this document. Instead, discussion will focus on current political and governing bodies that have become invested in this issue and highlight policy being made.

While synthetic biology has a potential to address some of the biggest challenges that the world faces, it can be a challenge itself. It is important to recognize that the topics explored in this field are not

[3] Collins J.J, Maxon M., Ellington A., Fussenegger M., Weiss R. "Synthetic biology: How best to build a cell." *Nature* 509 (2014): 155-157.

[4] Fu P. "Grand challenges in synthetic biology to be accomplished." *Front. Bioeng. Biotechnol.* 1.2 (2013).

[5] "Future brief: synthetic biology and biodiversity." *Science for Environment Policy, European Commission* 15 (2016).

completely understood, and the precautionary principle should be applied when inventing, manufacturing, using and disposing of products based on synthetic biology.

## Discussion

In addition to numerous scientific and technical challenges, synthetic biology raises numerous ethical and biosecurity issues. Some of these problems have been already raised during the earlier DNA manipulation attempts and with the rise of genetically modified organism (GMO). There are already extensive policy and regulations addressing genetic engineering and biomolecular research. However, there is a growing need for uniformity and their enforcement application.

The three most often mentioned threats that synthetic biology poses are potential the adverse health effects of these new developments, potential environmental and biodiversity issues, and potential weaponization or bioterrorism.

SYNBIOSAFE, a European Union funded research project published several reports describing risk managements related to synthetic biology.[6]The paper identified key issues in safety, security, ethics and the science-society interface, which the project defined as public education and ongoing dialogue among scientists, businesses, government, and ethicists).[6] Another European initiative, COSY focused on public perception and communication of synthetic biology to better communicate opportunities and challenges of synthetic biology to a border public.[6, 7]

In September 2016, the European Commission followed up on the SYNBIOSAFE project issuing a document called *Future brief: Synthetic biology and biodiversity*.[8] This document describes the possible impact of synthetic biology on biodiversity. The brief ends with a series of recommendations calling for application of the precautionary principle, early warning systems, coordination between the Member States, and open debate that in turn may enforce unified policy development. The report claims that "*public acceptance of synthetic biology will inform policy, funding, and regulation*."[8]

The European Commission is not the sole international body worried about the further developments in synthetic biology projects and their outcomes. In March 2015, United Nations Environment Programme (UNEP) issued together with the Convention on Biological Diversity (CBD) a technical note.[9] This note describes potential impacts of synthetic biology on biological diversity, as well as points out gaps and overlaps with the provisions of the Convention and other agreements. Other international organizations, including but not limited to, the Organization for Economic Cooperation and Development (OECD), the International Union for Conservation of Nature (IUCN) are pursuing activities towards regulating this new and yet not completely understood field of science. The World Health Organization (WHO)

[6] Schmidt M., Torgersen H., Ganguli-Mitra A., Kelle A., Deplazes A., Biller-Andorno N. "SYNBIOSAFE e-conference: online community discussion on the societal aspects of synthetic biology. Systems and Synthetic Biology". 2 (2008):7-17

[7] "COSY: Communicating Synthetic Biology," http://www.synbio.at/ accessed July 5, 2016

[8] " European Commission "Future brief: Synthetic biology and biodiversity." 15 (2016)

[9] Secretariat of the Convention on Biological Diversity "Technical Series No. 82, Synthetic Biology". (2015)

and the Food and Agriculture Organization (FAO) are looking at potential threats of synthetic biology on human health and well-being, while NATO investigates potential threat in applying these developments to next generation biological weapons and bioterrorism.

The threat of inappropriate or dangerous use of synthetic biology is more pertinent with the advent of Do-It-Yourself (DIY) synthetic biology. This emphasizes the need for application of disaster risk reduction procedures, precautionary principle, and policy development to minimize danger.

DIY Synthetic Biology is a rapidly evolving and emerging social biotechnology movement in which individuals, community groups, and small organizations study biology and life science using the same or similar methods as traditional research institutions. DIY synthetic biology is primarily undertaken by individuals with extensive research training from academia or biotech and pharmaceutical corporations, who then mentor and supervise novice DIY biologists with little or no formal training.

This rapidly growing movement of homegrown scientists is worrying governments to a point where policy is being made. Germany's Federal Office for Consumer Protection and Food Safety (Bundesamt für Verbraucherschutz und Lebensmittel-sicherheit) issued a statement[10] prohibiting the use of DIY synthetic biology and genetic engineering kits outside of the specialized facilities and research institutions.

Ordering and utilizing a DIY kit outside of a designated facility will be liable to a fine of up to €50,000 in accordance with Section 38 (1) (2) Genetic Engineering Act (GenTG).[11] Furthermore, in the case where Genetically Modified Organisms (GMOs) are released within the framework of the use of the DIY kits, the offender can face imprisonment of up to three years or a fine as stated under Section 39 (2) (1) of the GenTG.

The German government is not alone in this fight. A few days before the German statement, the US Food and Drug Administration (FDA) quietly proposed regulations[12] that would require any genetically engineered organism to go through a strict regulatory procedure. In essence, the FDA wants to define any organism that a scientist purposefully genetically modifies as a "drug," and such development would have to pass strict and lengthy clinical trials to be approved.

There are still some questions that await a clear answer such as '*who will have control and access to the products of synthetic biology?*'. In addition to safety issues, there is a significant and ongoing debate whether securing rights (IP) related to living organisms and human embryos are ethical.[5,6]

## Conclusion

Synthetic biology has a great potential to alter and improve existing biological systems. Possible applications of

[10] Bundesamt für Verbraucherschutz und Lebensmittelsicherheit "Gentechnik mit Biologiebaukästen: Einfach, aber möglicherweise strafbar". (2017) http://www.bvl.bund.de/DE/06_Gentechnik/04_Fachmeldungen/2017/2017_01_25_DIY-Kits.html

[11] Bundesministeriums der Justiz und für Verbraucherschutz "Gesetz zur Regelung der Gentechnik (Gentechnikgesetz - GenTG)." (1990) http://www.gesetze-im-internet.de/bundesrecht/gentg/gesamt.pdf

[12] United States Food and Drug Administration "Guidance for Industry #187, Regulation of Intentionally Altered Genomic DNA in Animals". (2017)

synthetic biology include developments in the fields of medicine, pharmacy, and food production, as well as energy and biodiversity among others. Synthetic biology and its effects on the environment and human health are still poorly understood and inappropriate use and disposal of products containing synthetic biology may lead to long-term, sometimes irreversible, consequences. We propose that additional environmental and toxicity studies must be performed before synthetic biology can be applied in various fields of industry. Environmental and health policy needs to adapt and address this emerging field before it becomes commonplace to facilitate further development and advancement, while still protecting ecosystems and human health.

**Call to action**

We urge world governments to do devote resources to better understand and regulate this new field of science. While we understand the possible opportunities and benefits, we are worried about unexpected and unforeseen challenges and problems that may arise. We call for policy and regulation development, as well as the adaptation, the application to, and enforcement of the precautionary principle to any new synthetic biology developments.

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# DISASTER Risk Reduction

## Disaster Resilience

UN Major Group for Children and Youth

the space for children and youth in the United Nations

**Incremental Shelters for Refugees and Host Communities (Case Study: Turkana County – Kalobeyei New Settlement, East Africa)**

Jia Cong Ang[1]

Email Address: angjiacong@gmail.com
[1]UN-HABITAT/ United Nations Urban Planning and Design Branch, City Planning, Extension and Design Unit, Nairobi, Kenya

## Abstract

Using the developing Kalobeyei New Settlement as a Case Study, this article seeks to discuss the demands of the growing refugee crisis – previously temporary shelters and settlements require remodelling to cater to long-term situations of displacement. Incremental housing schemes addressing cultural differences between communities, shelter material innovations, the utilization of participatory processes and urban planning schemes will aim to support the creation of livelihoods for refugees and host communities and contribute to socio-economic goals of Turkana County and Kenya.

## Introduction

The worsening global refugee crisis has been brought forth by new forms of conflict and re-emerging disturbances in major world regions. Over the last decade, Sub-Saharan Africa has generated and hosted the world's largest refugee population – by 2015, Turkana County was home to thousands of displaced refugees from neighbouring countries such as the Republic of South Sudan, and Somalia[1] (See Figure 1 in the supplementary material).

Mainly hosted in Dadaab and Kakuma camps, Refugees have also settled within Nairobi city. Over the years, excessive pressure from overcrowding populations in camps – such as Kakuma, which hosted 182,000 people by the end of 2016, 60% more than the initial planned capacity of 100,000 people[2], have caused great pressure on land and available resources, resulting in demand for alternative hosting sites (See Figure 2 in the supplementary material for Kenya Refugee Distribution).

[1] "Kakuma Camp Population 2016", UNHCR, 2016 (http://data.unhcr.org/horn-of-africa/country.php?id=110)

[2] "Kakuma Camp Population 2016", UNHCR, 2016 (http://data.unhcr.org/horn-of-africa/country.php?id=110)

With support from Turkana County Government and UNHCR, UN-Habitat has embarked on the Kalobeyei Integrated Socio-Economic Development Plan, as part of Kenya Vision 2030.[3] In June 2015, 1500 hectares of land was allocated to jointly mobilize resources for a new settlement project. With the average time of displacement of a refugee ranging from 7 to 20 years, the Kalobeyei site is positioned to rapidly respond to the emergency situation, but also provide a durable solution in the long term perspective.

Shelters of the past encompassed temporary natures, and were provided rapidly as emergency responses. They often failed to respond effectively to the needs of refugees – such as UNHCR's "T-Shelters" (See Image of T-Shelter in the supplementary material), tents of tarpaulin measuring 3 metres by 6 meters. Issues arose from the lack of changeability of shelters and resources to be converted into durable long-term shelter. Refugees often choose to remodel shelters or create more permanent extensions with attainable materials to better reflect their cultural needs and aspirations. Furthermore, planning decisions were often unable to adequately provide public amenities and infrastructure for the community.

Hence, "a paradigm shift" from traditionally temporal refugee camps towards sustainable urban centres demands a rethinking of planning design and construction approaches for ~~e~~emergency shelters, transforming traditional shelters into long-term sustainable settlements.

[3] Turkana County Government, "Turkana County Investment Plan" 2016-2020, 2016

**Incremental Housing and Livelihoods Creation**

For the Kalobeyei Project, a sustainable and "incremental" approach to housing is recommended to provide low-cost partial solutions that residents can expand and complete.

In terms of settlement modifications, refugees and host community of Kalobeyei site have intentions modifying living quarters for a variety of reasons - constructing new structures for growing families, fencing plots for increased security, internal space modifications such as partitioning rooms etc. Extensions are mostly done to incorporate trading areas like hotels, shops, posho mills, or to attain cooking space in the absence of provision for such facilities. Extensions are likely to be order of the day in the camp, hence reinstating the importance of allocating such spaces.

An interesting concern against building vertically - due to cultural implications of attachment to land, and fear of it being too expensive, there is also a general non-willingness to live in multi-storied buildings. Despite this, perhaps it is worth mentioning the intention to promote double-storeyed developments with the aspirations of Kalobeyei serving a greater and denser population in the future.

**Building sustainably with local materials**

Available materials for building in the Kalobeyei area are largely based on traditional and modern construction technologies - utilizing a combination of different materials such as mud (brick or smeared on wooden frame), wood, twigs or grass, for hugely constructed shades using materials to protect from harsh weather. The use of corrugated iron

sheets is a recent walling material. Most households construct roofing using grass, makuti, sisal, and old canvas available within refugee camps. Within households, earthen floors are the most common flooring, followed by a small percentage using cement.[4] The implementation of new technologies and construction methods can provide safer environments for the residents and decrease environmental impact, helping to improve thermal comfort and weather friendly materials.

With high thermal mass and high U values on the site, options to explore include Interlocking Stabilised Soil Block (ISSB). Unlike burnt bricks, which are strong and water resistant from the burning with firewood, this option of improving soil qualities to make suitable long-term housing generates greater stabilization with cement as a binding agent. The resultant blocks are water resistant and their compressive strength is increased to make it strong enough to build buildings up to 3 storeys high without using columns, when using normal blocks are cemented together with mortar.

The ISSB (see image of ISSB in the supplementary material) technology reduces construction costs as cement mortar is not required to lay the blocks, and construction time and labour is significantly reduced. Furthermore, there is often no wastage in production. Unskilled workers can also learn how to build the blocks fast. The ISSB Machine is also manufactured in Kenya. It currently costs USD $1200 to construct an ISSB Shelter, and USD $400 to construct a T-Shelter. Both shelters can host up to a maximum of 5 members.

Other than ISSB, Compressed Agricultural Fibre (CAF) panels which are more expensive can also be utilised. They are constructed from locally sourced wheat straw left over from the harvest, compressed by a CAF machine into boards. The panel is secured in place by attachment and bolted. Vertical holes in the interior create a chase for electrical utilities. These prefabricated, panelised systems of CAF also allow quick speed of construction.

The production of such panels is environmentally friendly, economical and efficient. It has been independently calculated that the growth of wheat and unattributed removal of construction waste from disposal produces a negative carbon footprint for a CAF board. See Figure 4 in the supplementary material of traditional shelters for drawings on typologies.

**Respecting Local Culture and Aspirations**

In terms of adherence to cultural preferences, the incremental nature of housing construction also coincides with the culture within communities, which does not follow conventional housing unit standards. Instead, a household often has many separate rooms, each serving a particular role or hosting various ages. In Turkana culture, children do not share houses with their parents, always having separate rooms or sleeping outside. Cooking activities are rarely undertaken in the main rooms, as most kitchens are standalone units within the compound. While some residents have demarcated a bedroom and kitchen, most refugees prefer having meals and communing inside the house, which is different from

[4] "Socio-Economic Survey and Mapping of Kalobeyei Settlement", UNHCR, 2016

the host community.[5]
Hence the design for incremental shelters demands a level of flexibility and transformation. It is also worth mentioning that in recent years, the participatory process of design implementation and adaption has also allowed for greater seamless integration into local cultures and communities. Social mobilization is the first step of community development to recover from conflict, and by providing people the opportunity to think and understand their situation; they can take action collectively by developing a strategy rather than one imposed from the outside.

**Private Sector Business Creation and as part of Kenya Vision 2030**

The design for shelter, ease of construction and maintenance processes will have to consider the likelihood for expansions of businesses, the nature of work, and the proximal relationship between private and public space. In the case for Kalobeyei, there is a great opportunity for the development of a jointly run market to contribute to integration. Furthermore, there is also expressed in the ownership of kiosks selling clothing, alcohol, and readily affordable goods and businesses such as *bodabodas* (motorcycles), welding, charcoal selling, poultry keeping and currency trade[6]. These factors can contribute to private sector business creation which will encourage greater integration in the long run.
Furthermore, traditional modes of livelihoods are to be replaced with new ways of making a living. In the past, the pastoral nature of local Turkana communities required large lands for livestock keeping. However, the result of population growth, and the effects of climate change have caused access to good pasture lands to decrease. Upon redevelopment, an alternative means for livelihood creation is commercial farming. The desire for local residents to diversify their farming activities into crop husbandry also present a great opportunity for the promotion of urban agricultural activities which will be in the vicinity to shelters.
Additionally, on a larger scale, the Kalobeyei site hopes to be an urban centre contributing to the development of KKISEDP and the Kenya vision 2030. With private businesses contributing to capacity building within the local communities, and the growth of a healthy internal economy, the center can then contribute as part of the Lamu Port-South Sudan-Ethiopia-Transport (LAPSSET) Project, which aims to strengthen the country's position as a gateway and logistics hub to the East African sub-region and inter-country growth. The proximity of the Kalobeyei site to the LAPSSET project provides for it a platform for growth and improved accessibility, which will encourage greater sustainable economy. A mix of renewable resources and developed sustainable energy mix can also be harnessed as a potential market for the region and future projects.

**Conclusion**

The research that has supported this urban planning project as a response to the dire need for more appropriately designed living settlements for refugees has highlighted the growing need for

[5] "Socio-Economic Survey and Mapping of Kalobeyei Settlement", UNHCR, 2016
[6] "Socio-Economic Survey and Mapping of Kalobeyei Settlement", UNHCR, 2016

greater sensitivity towards holistic shelter designs. This reinstates the importance of equipping future designs with the tools for improvement within the household, street, and neighbourhood levels, and allowing the empowerment of the community to participate in these various innovative implementations. It is the aspirations of the UN-Habitat to develop realistic proposals of durable, incremental designs which respond to humanitarian functions and support the occupation for displaced members from the emergency phase into the long term.

**Acknowledgements**

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**References**

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## Supplementary Material

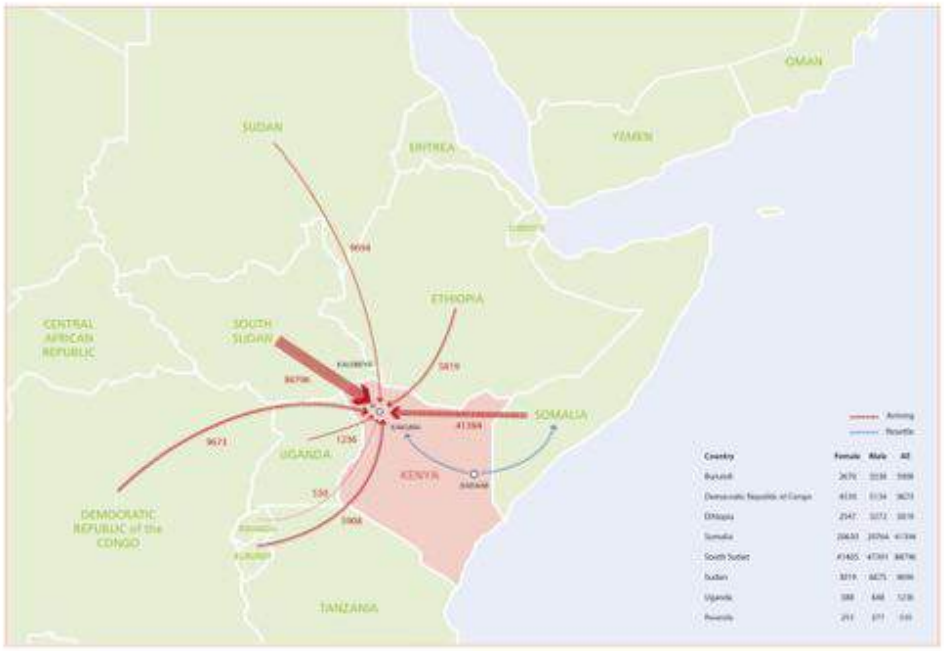


**Figure S1.** Refugee Migration into Kenya

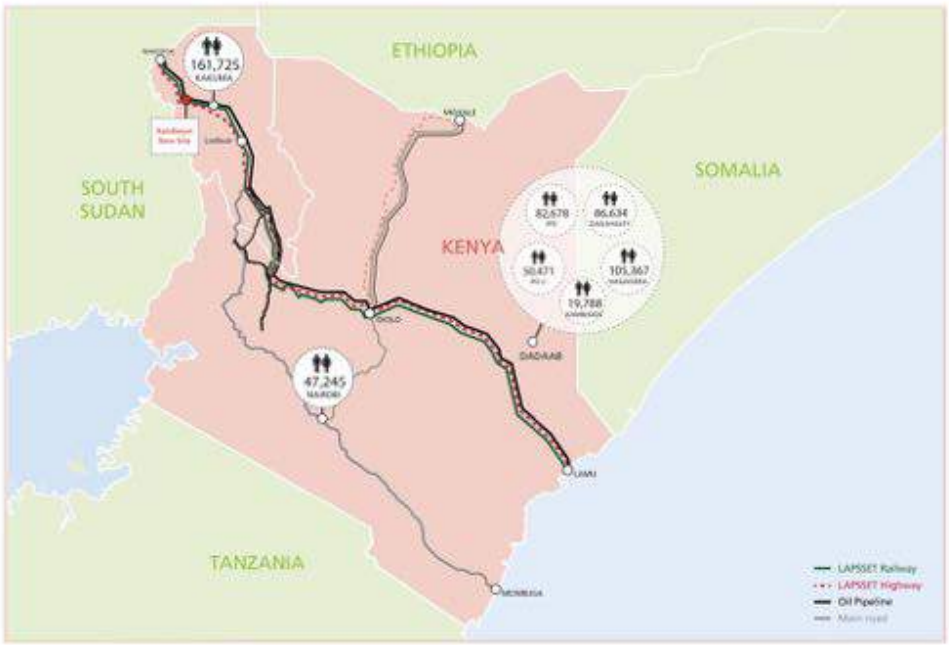


**Figure S2**. Population within Kenya Refugee Camps

**Figure S3.** T Shelter and ISSB in Kakuma

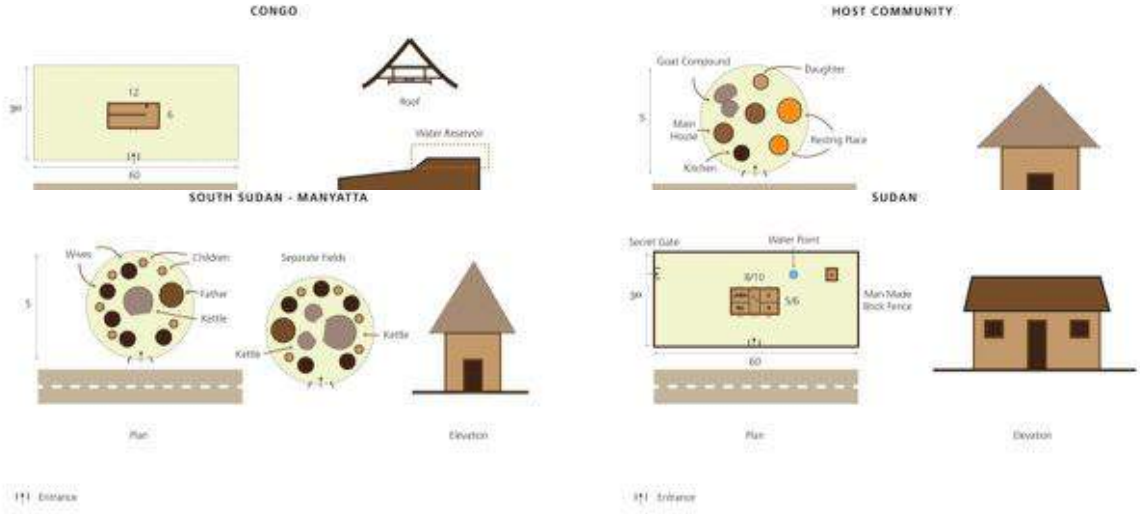


**Figure S4.** Traditional Shelters in Kalobeyei

**Children in disaster risk reduction: building resilience among migrant families**

Szymon Parzniewski[1]

Email Address: s.parzniewski@gmail.com
[1]PhD doctoral researcher, University of Birmingham, UK

## Abstract

This brief looks into the role migrant children can play in building resilience among their families and communities. It builds upon the existing literature on the role of children in disaster risk reduction (DRR) and integrating migrants in DRR efforts. Based on the Japanese case study, this brief argues that education amongst children in disaster preparedness can generate a range of positive spillover effects and increase disaster preparedness among migrant families.

## Introduction

Children are among the most vulnerable groups during disasters and require protection from adults. However, they have the right to actively participate in DRR. Research has highlighted the importance of integrating children in DRR actions that reduce risk. They can play important roles in areas, such as in: communicating disaster risk and sharing knowledge around the drivers of risk at the local level[1].

Organizations working in the field of child protection and support, continue their efforts to put children at the heart of DRR activities; develop DRR training programs and materials for children and advocate for evidence-based child-centred disaster risk reduction and resilience (C-CDRR)[2].

Children are highly motivated to share their knowledge and experiences, which can lead to increased household and

[1] Seballos, F., Tanner, T. "Enabling Child-Centred Agency in Disaster Risk Reduction: Global Assessment Report on Disaster Risk Reduction." *UNISDR/Children in a Changing Climate* (2011).

[2] Save the Children International "Reducing Risks, Saving Lives: Save the Children's approach to Disaster Risk Reduction and Climate Change Adaptation" London (2011).

community resilience[3]. Recent research shows that children should no longer be seen as passive observers during hazardous events, but rather as agents of change that can take action in order to reduce their own risk and mobilize the response in their families and communities[4]. In line with the participatory view this brief explores the role of children in integrating migrants in DRR efforts.

## Migration and the Sendai Framework for Disaster Risk Reduction

The Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) signed in March 2015 by the United Nations (UN) Member States at the Third World Conference on Disaster Risk Reduction in Sendai, Japan serves as a global blueprint for reducing the impact of hazards worldwide. The document recognises the role of migrants as crucial for effectively building the resilience of communities and societies. This notion finds its direct reference in the following points:

- **Paragraph 7 (p.10):** Governments should engage with relevant stakeholders, including […] migrants […] in the design and implementation of policies, plans and standards.
- **Paragraph 27(h) (p.18):** Empower local authorities, as appropriate, through regulatory and financial means to work and coordinate with […] migrants in disaster risk management at local level.
- **Paragraph 36(a)(vi) (p.23):** Migrants contribute to the resilience of communities and societies and their knowledge, skills and capacities can be useful in the design and implementation of disaster risk reduction[5].

As part of the implementation phase of the SFDRR, guidelines[6] as well as a range of principles and practices at the national and regional level were developed in order to integrate the above principles into DRR strategies[7]. While the DRR-mobility nexus has gained recognition in global policy circles challenges still remain in building resilience among migrant families. This gap can be filled by developing mechanisms supporting migrant children's role in DRR.

## Children's Role in Disaster Risk Reduction

In the last few years, child-centred DRR

[3] Tanner, T., Seballos, F. Action Research with Children: Lessons from Tackling Disasters and Climate Change" 43.3 (2012): 59-70.
[4] Rashid, M., Ronan, K. R., Towers, B. "Children as Change Agents in Reducing Risks of Disasters", In Winograd, K. (ed.) *Education in Times of Environmental Crisis Teaching Children to Be Agents of Change*. London: Routledge. (2016).
[5] UN "Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR)" (2015).
[6] MICIC, "Guidelines to Protect Migrants in Countries Experiencing Conflict or Natural Disaster." (2016).
[7] Guadagno, L. "Reducing Migrants' Vulnerability to Natural Disasters through Disaster Risk Reduction Measures: Including Migrants in Disaster Prevention, Preparedness, Response and Recovery Efforts." *Migrants in Countries in Crisis Initiative (MICIC) Issue Brief* (2015).

approaches gained high recognition in policy circles. The 'Children's Charter for Disaster Risk Reduction (DRR)'[8] and Children's Action for DRR report were published in 2011 as a result of consultations with more than 600 children in 21 countries in Africa, Asia and Latin America[9].

In the growing body of literature on the role of children and young people in disaster preparedness three main focus areas can be identified: (i) preparedness of children and young people for unexpected events and emergencies[10]; (ii) the role of schools and disaster education in helping children and young people to respond to an emergency[11] [12]; (iii) the role of children and youth in enhancing preparedness among their families and communities[13] [14]. The third area will be further discussed in the following sections.

## Children's Role in Reducing Vulnerability and Enhancing Preparedness among Migrant Families

A range of factors (including social and structural barriers) can make the community newcomers more vulnerable in times of a crisis[15]. Areas in which children can contribute towards reducing vulnerability include among others:

*Transition process* – newly coming families in the community often adjust at different pace. Children can adjust to the new situation faster than their parents or grandparents and help the family develop new coping strategies.

*Language barrier* – language skills are key to overcome communication barriers and have a decisive impact on how people cope with hazards and emergency situations. Research shows that children and youth not only play a unique role in communicating disaster risk[16], but often help in translation for victims during disaster[17].

*Access to information and services* – even

[8] UNICEF/Plan/Safe the Children/World Vision "Children's Charter for Disaster Risk Reduction (DRR)" (2011).

[9] UNISDR/Plan "Children's Action for Disaster Risk Reduction: Views from Children in Asia" (2012).

[10] Ronan, K. R., Alisic, E., Towers, B., Johnson, V. A., Johnston, D. A. "Disaster Preparedness for Children and Families: a Critical Review." *Current Psychiatry Reports* 17.58 (2015).

[11] Mutch, C. "The role of schools in disaster preparedness, response and recovery: what can we learn from the literature?" *Pastoral Care in Education* 32.1 (2014): 5-22.

[12] Ronan, K. R. Child-centered disaster risk reduction: can disaster resilience programs reduce risk and increase the resilience of children and households? *Australian Journal of Emergency Management* 31.3 (2016): 49-58.

[13] Plan International. Child-centered DRR toolkit. London: Author. (2010).

[14] Wisner, B. "Let our children teach us! A review of the role of education and knowledge in disaster risk reduction." Bangalore: Books for Change (2006).

[15] Lutheran Immigration and Refugee Service "Disaster Preparedness in Migrant Communities: A Manual for First Aid Responders" (2013).

[16] Mitchell, T., Haynes, K., Hall, N., Choong, W., Oven, K. "The Roles of Children and Youth in Communicating Disaster Risk." *Children, Youth and Environments* 18.1 (2008): 254-279.

[17] Mathew, A. B. "Disaster Preparedness in Urban Immigrant Communities: Lessons Learned from Recent Catastrophic Events and Their Relevance to Latino and Asian Communities in Southern California." A Tomás Rivera Policy Institute and Asian Pacific American Legal Centre Report (2008): 18.

if migrant families have access to information in their mother languages they may still lack the means or knowledge needed to access that information. Children often play a key role in facilitating contact between migrant families. For some migrants internal and informal networks constitute a vital source of information.
Therefore, planners, local governments and agencies responsible for disaster response need to be aware of and sensitive in response to the issues listed.

## Integrating Migrant Children in Disaster Prevention Trainings: the Japan case study

In Japan, disaster prevention trainings and drills take place several times a year in schools and local communities throughout the country. In addition, local fire departments organise disaster preparedness activities for children and their families. Events like these create opportunities for both Japanese and foreign residents leaving in the area to interact and learn from each other. The benefits of local preparedness activities are manifold and contribute towards building resilience among migrant families and communities.
First, many training programs use an original approach, ensuring the children can learn and have fun at the same time. This includes a range of activities including: 'Fire Extinguisher Target Game'; 'Blanket Stretcher Time Trial' or the 'Disaster Prevention Duck' gesture game for small children[18].
Second, children get to know better their local area. As part of group activities they can design and draw their own disaster safety maps. Children learn what are the potential areas of danger and where the local evacuation areas are located.
Third, training exercises help children to imagine what might happen in a real emergency, what would be the best response and what roles should other members of the family play.
Activities and experiences gained by migrant children lead to a range of positive spillover effects on their parents and family members that among others contribute towards: access to information; community engagement; disaster prevention and awareness. Most importantly, strategies and practices deriving from disaster prevention trainings contribute towards building stronger social ties and migrants' integration within the local community.

## Recommendations

Practices developed in line with the principles derived from the SFDRR show that the role of migration in strengthening resilience of local communities has been clearly recognised. This brief outlined the potential deriving from child migrant's role in DRR and building resilience among their families and local communities. The recommendations provided below can contribute towards the success of future policy development.

[18] MOFA, "Disaster Prevention Training", *Kids Web Japan*. Available at: http://web-jpn.org/kidsweb/cool/10-07/index.html

Firstly, there is a clear gap in the research about strategies and practices in building resilience to hazards among migrant and refugee families. There needs to be further rigorous research in examining children's role in DRR and disaster preparedness among migrant families. In addition, there is a clear need for indicators to account for appropriate and effective policies that empower and integrate migrants in the local DRR efforts.

Secondly, there is a clear need for the development of DRR programs that promote child-parent interaction in migrant families. The program content can be structured around simple tasks contributing towards the development of home emergency and/or family communication plans in multiple languages.

Lastly, the difficult task of building resilience to hazards among migrant families is often based on grassroot supported initiatives and locally developed practices. In order to recognise the increasing role and utilise the capacities that migrants bring, national and local actors should continue their efforts in sharing practices that are applicable in different settings and decision-making cultures.

**Ecosystem-based adaptation as a means to strengthen the role of women in flood risk management and climate change adaptation**

Pham Thi Dieu My[1], Hagedoorn Liselotte[2], Dillenardt Lisa[3], Lasage Ralph[2], Bubeck Philip[3]

Email Address: dieumy.csrd@gmail.com
[1]Centre for Social Research and Development (CSRD), Hue, Vietnam
[2]Institute for Environmental Studies, VU University Amsterdam, Amsterdam, The Netherlands
[3]Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany

## Abstract

The Sendai Framework for Disaster Risk Reduction calls for the participation of people disproportionately affected by disasters and highlights the need to strengthen the link between environmental and natural resource management and disaster risk reduction. A major group in the society that is disproportionately affected by flood impacts in developing countries are women. In this policy brief we argue that ecosystem-based adaptation (EbA) can be a complementary risk reduction strategy that is more accessible and inclusive to vulnerable groups such as women and poor. This makes EbA a promising means to strengthen the role of women in disaster risk management and climate change adaptation. However, little is currently known about how to integrate EbA and strengthening the role of women in disaster risk management (DRM) and climate change adaptation (CCA).

## Women, flooding and disaster risk management

The Sendai Framework for Disaster Risk Reduction calls for an all-off society engagement and partnership to reduce disaster risk, with an inclusive and accessible participation of people disproportionately affected by disasters. It also identifies the need to strengthen the link between environmental and natural resource management and disaster risk reduction[1].

Floods remain the most devastating natural hazard globally, particularly affecting Asia. According to the EM-DAT database, more than 60 percent of the human and economic losses between 1980 and 2015 occurred in Asia[2].

A group of society that is disproportionately affected by flood impacts in developing countries are women. Women commonly experience disadvantages in social, cultural, economic and political domains, as well as

[1]UNISDR. "Sendai Framework for Disaster Risk Reduction 2015 – 2030". The United Nations Office for Disaster Risk Reduction.Geneva (2015).
[2]Bubeck, P., Otto, A., Weichselgartner, J. "Societal Impacts of Floods Hazards". Oxford Research Encyclopedia on Natural Hazard Science.(Forthcoming).

in legal status and opportunities. These disadvantages increase the vulnerability of women to climate related disasters, such as flooding, in a number of ways.

The study of Neumayer and Plümper (2007) presents results that link the lower socio-economic status of women to the total number of women dying, as well as at a younger age, during and in the aftermath of disasters.[3] Similarly higher fatality rates of women compared with men were observed during the Cyclone Nargis in Myanmar in 2008 (61 percent), the 2004 Indian Ocean tsunami (70-80 percent) and the 1991 cyclone in Bangladesh (91 percent)[4].

Due to disadvantages related to the division in labor, income and assets, there are more women living in poverty compared with men[5]. This results from higher unemployment rates among women, unpaid care work and lack of basic rights, such as land rights[6,7]. Additionally, women are more likely to be employed in the informal sector, a sector that is subject to income insecurity and high vulnerability to disasters [5,8,9]. For example, flood damage to small stores or houses, where activities such as selling home-baked goods take place, can lead to diminished or complete loss of income generated by these activities[5,7,8.]

Another aspect is the presence of gender roles and cultural patterns, which affect the level of education obtained by women, and also their mobility, or lack of it[7]. Women are usually the caretakers of the children, elderly and sick as well as of the house, belongings and nutrition. Consequently, a woman's mobility is reduced during disasters, as she must help her dependents and protect the home, and with that the ability to access shelters or otherwise escape harm[5,8].

It also means that during and after disasters, women are subject to the increased burden of securing food, water and safety for all, and to clean up and recover the house and land, causing psychological stress[8]. The results of Mason and Agan (2015) reveal that during and after floods, women are concerned about the difficulty for their children to go to school, decreased ability to fulfil daily tasks, and health effects on the family[10].

While the above mentioned factors make women especially vulnerable to flood impacts, they also demonstrate that women in developing countries are already at the frontline of disaster risk management and climate change adaptation. Women's responsibilities in households and communities position them especially well to understand and

[3]Neumayer, E., Plümper, T. "The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life expectancy, 1981–2002". Annals of the Association of American Geographers, 97.3 (2007): 551-566.

[4]UNDP. "Gender and disaster risk reduction". Gender and Climate Change – Asia and the Pacific.Policy Brief No. 3.

[5]GIZ. "Gender and urban climate policy: gender-sensitive policies make a difference". Bonn and Eschborn (2015).

[6]Ibid.

[7]Jabeen, H. "Adapting the built environment: the role of gender in shaping vulnerability and resilience to climate extremes in Dhaka". Environment and Urbanization, 26.1 (2014): 147-165.

[8]Ajibade, I., McBean, G., Bezner-Kerr, R. "Urban flooding in Lagos, Nigeria: patterns of vulnerability and resilience among women". Global Environmental Change, 23.6 (2013): 1714-1725.

[9]Nelson, V., Meadows, K., Cannon, T., Morton, J., Martin, A. "Uncertain predictions, invisible impacts, and the need to mainstream gender in climate change adaptations". Gender & Development, 10.2 (2002): 51-59.

[10]Mason, L. R., Agan, T. C. "Weather variability in urban Philippines: a gender analysis of household impacts". Climatic Change, 132.4 (2015): 589-599.

develop (additional) measures and strategies for adapting to changing environmental realities. In particular, as pivotal managers of natural and environmental resources, women have the experience and knowledge to build the resilience of their communities. They thus represent an immense source of potential and power to combat the increased disaster risks that climate change will bring in many places.[11]

However, gender bias in decision making often means that women do not have the opportunity to express their needs to reduce the impact of disasters on their wellbeing[5,7]. Women are underrepresented in decision making at all levels, in both public entities and the private sphere[5].

**The role of women in building flood resilience in Hue city, central Vietnam**

A recent study into the role of women in building climate resilience in ThuaThien Hue province (Central Vietnam) confirms the important role that women play in securing the wellbeing of their families and communities during and after disasters, and, at the same time, their limited influence on disaster risk management decisions[12]. The study is based on a literature review and participatory research methods. The latter included focus group discussions at the local level with a total of 203 people,as well as85 in-depth interviews with representatives from local authorities, city planners and local people.Results were validated during a stakeholder workshop.

Currently, about 1.31 million people inhabit ThuaThien Hue province, of whom 330.000 reside in the city of Hue. Between 1975 and 2005, 40 flood events occurred in the province that heavily impacted the province and especially vulnerable groups of society such as women.

Also in the Vietnamese context, women are traditionally responsible for the elderly and children, limiting their mobility. Their position in the family often means that they are the first to suffer shortages of basic resources such as food, water and electricity. Moreover, they are occupied by their domestic duties, and have little room for further training or professional development. This hinders them from creating independent financial reserves for the management of disasters. But, there is also potential in their position. As caregivers, they appreciate not only their own needs, but also the needs of others within their families and communities.

While women in Hue play a key role for livelihoods, the study also revealed that, women hold only minor roles at the level of policy formulation[13]. The reason for this is that women face cultural and educational barriers, and also limited time for community activities. This leads to a male bias in planning and decision-making, resulting in a failure to consider the different needs of women. Also the National Target Program to Respond to Climate Change does not take gender issues particularly vulnerability of women into account. Accordingly, no funding is allocated specifically for women under the program to enhance their adaptation at local level. Moreover, existing laws and policies that were developed in Vietnam to promote gender

[11]UNISDR. "Gender perspectives: Integrating Disaster Risk Reduction into Climate Change Adaptation. Good practices and Lessons Learned". Geneva (2008).

[12] Pham, T.D.M., Lam, T.T.S. "Gender needs and roles in building climate resilience in Hue City, Vietnam". Asian Cities Climate Resilience Working Paper Seriens No. 33 (2016).

equality are often not translated into gender equitable practice.[12]

## Ecosystem-based adaptation as a means to strengthen the role of women in disaster risk management

A complementary approach to the current focus on "top down" and "structural" flood risk reduction measures such as dikes, which can have negative side effects on vulnerable communities directly depending on natural resources, is eco-system based adaptation (EbA).[13]
EbA "uses biodiversity and ecosystem services in an overall adaptation strategy. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to the adverse effects of natural disasters and climate change."[14]EbA can be a cost-effective alternative strategy, which is more accessible and inclusive to vulnerable groups such as women and poor, making them a promising means to strengthen the role of women in DRM and CCA. Moreover, EbAcan:

- support the integration and maintenance of traditional and local knowledge as well as cultural values, and
- generate multiple social, economic and cultural co-benefits for local communities[15].

One example for an EbA-measure which is highly relevant across South-East Asia is the maintenance and/or restoration of mangroves to reduce coastal flooding and erosion[16].In addition to reducing wave and tidal energy, mangroves improve water quality and provide important breeding and nursery grounds to many terrestrial and aquatic species[17], thus supporting the livelihoods of those groups directly depending on natural resources. EbA thus addresses the crucial link between natural disasters, climate change and ecosystem services, considering natural resource management through a lens of enhancing human resilience.[18]
However, little is currently known about how to design and implement EbA in a way that it simultaneously supports the role of women in DRM and CCA.[19] How to integrate EbA and strengthen the role of women in flood risk management is currently explored and tested in two seed projects of the *Global Resilience Partnership Water Window*(GRP) in Central Vietnam.[20] The planned activities include the implementation and restoration of EbA jointly with women's groups and local authorities, capacity

[13]ISPONRE."Operational Framework for ecosystem-based adaptation to climate change for Viet Nam.A Policy Supporting Document".Institute of Strategy and Policy on Natural Resources and Environment.Hanoi (2013).
[14]Secretariat of the Convention on Biological Diversity."Connecting Biodiversity and Climate change mitigation and adaptation: Report of the Second Ad Hoc Technical Exprt group on Biodiveristy and Climate change".CDB Technical Series No. 41. (2009).
[15]Ibid.
[16]Bao, T.Q. (2011): Effect of mangrove forest structures on wave attenuation in coastal Vietnam. Oceanologia, Volume 53(3), 807-818.
[17]Mumby, P. J., Edwards, A. J., Ernesto Arias-Gonzalez, J., Lindeman, K. C., Blackwell, P. G., Gall, A., Llewellyn, G. "Mangroves enhance the biomass of coral reef fish communities in the Caribbean". Nature, 427.6974(2004): 533-536.
[18]ISPONRE."Operational Framework for ecosystem-based adaptation to climate change for Viet Nam.A Policy Supporting Document".Hanoi (2013).
[19]UNISDR, UNDP and IUCN.Making Disaster Risk Reduction Gender-Sensitive.Policy and Practical Guidelines.Geneva (2009).
[20]www.globalresiliencepartnership.org/news/2017/03/15/Water-Window-Challenge-Winners-Announced.

building for women, a holistic valuation of the multiple benefits of EbA measures and research on the impact of floods on the well-being of women, both in an urban and coastal environment.

**Figure 1.** Planting of mangroves in the Tam Giang Lagoon in ThuaThien Hue Province, Central Vietnam (Centre for Social Research and Development, Hue, Vietnam).

An important barrier for a system shift towards a more inclusive approach to disaster risk managementand climate change adaptation comprising EbA-measures is the lack of awareness andevidence in terms of their effectiveness, costs and benefits. The multi-faceted economic, social andcultural benefits of EbA-measures are difficult to account for in traditional cost-benefitsanalyses. This makes decision makers often reluctant to opt for such types of measures.[18]The two GRP seed projects aim at overcoming this barrier by providing evidenced-based support on the holistic value of EbA at the local level, amongst others.

Insights into the integration of Eba and strengthening the role of women in DRM can help to meet the goal of the Sendai Framework for Disaster Risk Reduction, that calls for the participation of people disproportionately affected by disasters and highlights the need to strengthen the link between environmental and natural resource management and disaster risk reduction.

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**Empowering Local Actors to Build Disaster Resilience**

Amanda Lanigan[1], Julia Rayberg[1]

Email Address: alanigan@worthyvillage.org
[1]Worthy Village

## Abstract

One of the greatest challenges in building disaster resilience is creating sustainable solutions that fit within the cultural norms of a local population. The Sendai Framework provides a method through which high-risk areas can be identified to cultivate preparedness for future catastrophic events. In an effort to follow the "Build Back Better" model, this proposal calls for the mobilization of local actors within cultural norms. In order to develop increased coping capacity, this model focuses on specifically vulnerable segments of the population, namely impoverished women in indigenous communities. By improving the resiliency of basic service infrastructures such as food and water security, health, and education, this method seeks to improve sustainability and decrease mortality. This method was introduced in Guatemala, a nation with limited coping capacity due to the prevalence of risk drivers such as climate change, environmental degradation, poverty and inequality, poorly planned urbanization, and weak governance.[1] The 2017 Risk Index placed Guatemala at a 5.5, the highest rating in Central America.[2]

## Introduction

The reactionary nature of disaster response often fails to involve and empower the local population. Left to rebuild amidst the cultural confines of governmental and non-governmental institutions, local populations become trapped in an ineffective solution. A study of the wastewater treatment crisis in the Lago de Atitlan region of Guatemala correlated the physical breakdown of wastewater management in the community with the political breakdown of the indigenous peoples around the lake. When a new wastewater treatment plant was built by an outside entity with little regard for the existing communal maintenance structure, the project failed due to a lack of adherence to cultural norms, and the contamination crisis worsened.[3]

[1] Aitsi-Selmi, A., Egawa, S., Sasaki, H. et al. Int J Disaster Risk Sci (2015) 6: 164. doi:10.1007/s13753-015-0050-9

[2] Guatemala- Inform Country Risk Profile, *Inform Index for Risk Management*. Inter-Agency Standing Committee, 2017. Web. 07 Apr 2017

[3] Blake D. Ratner and Alberto Rivera (*2004*) Reasserting Community: The Social Challenge of Wastewater Management in Panajachel, Guatemala. Human Organization: Spring 2004, Vol. 63, No. 1, pp. 47-56.

Past events and interactions with outside actors also impact the sustainability of disaster response methods. Experiences such as the cholera epidemic at the end of the Guatemalan Civil War and the disruption to the water supply after Hurricane Stan led to shifting views of water security within the community. In response to these crises, chlorination campaigns were launched to decontaminate the lake. Due to lack of communication with local community leaders, this only enhanced the water crisis as the indigenous people around the lake became suspicious of the smell and refused to drink the treated water.[4] Resiliency enhanced coping capacity and sustainable disaster response can only be achieved when past experiences are taken into account and community leaders are included in the development process. By utilizing the Sendai Framework to identify high risk areas and empowering local leaders to develop preparedness, governmental and nongovernmental institutions can enhance the coping capacity of vulnerable populations prior to a major catastrophe.

Numerous political, cultural, and economic factors render the indigenous and rural population of Guatemala particularly vulnerable to catastrophes. These communities cope with immense food and water security challenges, as well as crippling health crises within the confines of limited economic development and limited access to political capital.

These factors have a ripple effect through the community, decimating quality of life, specifically for women and children. The communities surrounding Lago de Atitlan have one water source, the lake itself. Interviews with local leaders revealed that if the current rate of contamination continues, the lake could be rendered completely toxic within five years. Even now, lack of access to clean water is at crisis levels, which in turn has socioeconomic implications throughout the community of over 200,000 residents. A recent study published in the *Brazilian Journal of Infectious Disease* found that 32% of residents in the Lago De Atitlan region suffered from *cryptosporidium* infections, which further exacerbate preexisting health issues prevalent within impoverished communities. The rate of *cryptosporidium* infections increase with the intense weather fluctuations of particularly dry or wet seasons because of disruptions to the water supply[5]. As climate change continues to alter weather patterns, this health crisis will only worsen, calling for the immediate development of an effective response system.

The same study found that water-borne illnesses presented at a much higher rate of 44% in females.[6] This marked difference is due to the different roles occupied by each gender. While men and boys leave their homes to work during the day, women and girls remain in their homes cooking and cleaning, thus causing more exposure to contaminated water. Outgoing Under-Secretary-General for Humanitarian Affairs, Valerie Amos,

[4] Nagata, Jason M., Valeggia, Claudia R., Smith, Nathaniel W., Barg, Frances K., Guidera, Mamie, & Bream, Kent D. W. (2011). Criticisms of chlorination: social determinants of drinking water beliefs and practices among the Tz'utujil Maya. *Revista Panamericana de Salud Pública*, *29*(1), 09-16.

[5] Laubach, H. E., Bentley, C. Z., Ginter, E. L., Spalter, J. S., & Jensen, L. A.. (2004). A study of risk factors associated with the prevalence of Cryptosporidium in villages around Lake Atitlan, Guatemala. *Brazilian Journal of Infectious Diseases*, *8*(4),319-323.

[6] Laubach, H. E., Bentley, C. Z., Ginter, E. L., Spalter, J. S., & Jensen, L. A.. (2004).

stated, “Humanitarian action should be more than just delivering aid after a disaster. It should empower people, especially women and girls, to live with dignity.”[7] A shift in disaster response is needed, a shift that empowers local actors, specifically women, to build resiliency. Because of the unique cultural norms of the indigenous community, the most effective method to develop resiliency involves mobilizing local actors within vulnerable communities to develop coping capacity.

## Methods

Various assessment and research methods were utilized to identify areas of high risk and develop targeted solutions in collaboration with local leaders. Upon arriving in Panajachel in 2014, the NGO *Worthy Village* conducted extensive field analysis. Worthy Village began by initiating dialogue with local community leaders to build relationships and gain firsthand knowledge of the needs in the community. Due to the unique social structure of the indigenous community, the local indigenous women emerged as the primary actors in the assessment and project implementation process.

As with many economically disenfranchised communities, women represent a unique segment of the economy through cottage industries of traditional handcrafts produced within the community and home. As a result, women are the keepers of tradition and cultural norms. Coupled with the fact that they are the primary caretakers of the family unit, indigenous women have a unique place of leadership and important perspective on specific needs and potential solutions. These leaders helped to implement a series of peer-developed projects based on cultural traditions, thereby promoting real empowerment and engagement of highly vulnerable peoples.

In addition, site visits and field research were utilized to quantitatively corroborate information given by the community leaders. Through an exchange program, medical staff were brought to the indigenous communities surrounding Lago de Atitlan to conduct health assessments. These assessments found high rates of water-borne illnesses, disease transmission, and malnutrition amongst the majority of the Mayan population. These findings as well as communication with local leaders were used to enhance resiliency by addressing issues such as water quality, health, and hygiene.

Community leaders were called on to help develop educational and training programs focused on health, hygiene, and community organization. Structuring these programs within existing cultural norms was an essential element to implementation. Worthy Village trains members of the local Mayan population to act as social workers within the villages. These individuals conduct site visits, assess needs, and monitor ongoing projects to assess outcomes. This method addresses the key element of cultural proficiency and local empowerment when developing solutions. Using these methods, Worthy Village developed peer-initiated, targeted projects that strengthen vulnerable populations and enhance resiliency.

[7] "Sendai Framework Is Key: Latin America, Caribbean." *Sendai Framework Is Key: Latin America, Caribbean*. UNISDR, 26 May 2015. Web. 07 Apr. 2017.

## Discussion

In a regional declaration, Latin American countries pledged to utilize the Sendai Framework to develop a disaster preparedness program.[8] The delegation from Guatemala cited the interrelatedness of sustainable development and risk management to address the vulnerabilities of at-risk populations.[9] The population surrounding Lago de Atitlan is an example where "poverty, inequality, hunger, underdevelopment, exclusion, social marginalization and discrimination are causes that exacerbate vulnerability."[10]

Of the approximately 200,000 people living on Lago de Atitlan, 90% are Mayan people. Annual medical clinics consistently find that a third of the Mayan population suffer from waterborne illnesses. Worthy Village found that an average of 8 out of 10 children in the indigenous communities suffer from malnutrition. Worthy Village found that 100% of indigenous families within the lower socio-economic sector lack access to clean water due to contamination and lack of capital.

Given Guatemala's high ranking on the Sendai Scale, establishing a foundation for disaster response is crucial to reducing mortality rates and risk impact.[11] Based on the specific needs and norms of each community, Worthy Village developed and implemented targeted project plans to develop resiliency. These plans were based around mobilizing local leaders. About 90% of Worthy Village employees are female community members. This cohort was able to develop a series of small scale projects from the ground up. For all communities, providing access to clean water is the first step in addressing the larger socio-economic issues in the villages surrounding Lago de Atitlan.

The growing water crisis in Panajachel calls for rapid response as the number of households lacking access to clean water increases. Trained community members identify families in dire need to determine placement of water filtration apparatuses, thus increasing the resiliency of individual households. These water filtration apparatuses are portable, durable, and easy to use. Families have access to clean water for up to ten years with each filter. Field analysis conducted in 2016 shows that the filter program reduced the presence of water borne illness in 9 out of 10 participants. As evidenced, this response method to the growing water crisis in Panajachel has the potential to address water crises around the globe.

Alongside the growing water crisis in the community, is the high rate of disease transmission across geographic areas and age groups. Researchers found that poor hygiene practices coupled with water contamination are the driving factors behind this crisis. The presence of human and animal feces near dwellings is a driving factor. Lacking awareness of hygiene practices, children are especially vulnerable to infection in such conditions.[12] Worthy Village developed a

[8] "Sendai Framework Is Key: Latin America, Caribbean." Sendai Framework Is Key: Latin America, Caribbean. UNISDR, 26 May 2015. Web. 07 Apr. 2017.

[9] "Sendai Framework Is Key: Latin America, Caribbean.

[10] "Sendai Framework Is Key: Latin America, Caribbean.

[11] Aitsi-Selmi, A., Egawa, S., Sasaki, H. et al. Int J Disaster Risk Sci (2015) 6: 164. doi:10.1007/s13753-015-0050-9

[12] Laubach, H. E., Bentley, C. Z., Ginter, E. L., Spalter, J. S., & Jensen, L. A.. (2004). A study of risk factors associated with the prevalence of

health and hygiene program designed to enhance the standard of living for this vulnerable population. Hygiene education is taught in schools and households. The curriculum was developed by a physician alongside community social workers. It covers hygiene, infection prevention, and proper nutrition - life saving topics in the communities of rural Guatemala. Toothbrushes, toothpaste, and soap are provided to those participating in the program to encourage incorporation of the new knowledge into daily routines. Community leaders and local educators are primary actors in the implementation of this process. This model is an example of a culturally sensitive and effective process that holds legitimacy among local actors.

Finally, supports such as monthly supplies of nutritional food, doctor visits, vitamins, and scholarships is provided through a monthly sponsorship program. This response system is coordinated and implemented by our social workers. This creates a coordinated system of trained and knowledgeable actors in the field through which disaster response can be quickly mobilized. In addition, by providing these vulnerable populations with a strong base, resiliency is thereby increased.

## Conclusion

Adherence to cultural norms, developing targeted solutions, and mobilization of local actors are key factors to consider when developing programs to enhance coping capacity or promote disaster response. Although large-scale rapid response may be effective in the short term, promoting sustainable development alongside disaster resiliency requires a more locally based and culturally sensitive approach. Working with communities to build on pre-existing cultural norms leads to the development of projects with greater legitimacy, thereby enhancing effectiveness. This is specifically important for vulnerable segments of the population whose limited political, social and economic capital is further reduced by disasters and large scale responses. The evaluation tools provided by the Sendai Framework are conducive to the development of resiliency building programs to reduce disaster risk in a more targeted fashion. As evidenced, identifying such areas and initiating localized resiliency development should be top priority in the quest to reduce disaster mortality.

## Acknowledgements

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Cryptosporidium in villages around Lake Atitlan, Guatemala. *Brazilian Journal of Infectious Diseases*, *8*(4),319-323.

**The influence of religion on disaster risk reduction and resilience: a case study of Typhoon Haiyan-affected areas in the Philippines**

Olivia Wilkinson[1], Aaron Clark-Ginsberg[2]

Email Address: wilkino@tcd.ie
[1] Trinity College Dublin
[2] Stanford University

## Abstract

Religion plays a critical role in many people's lives, yet little is known about how religion affects resilience in an international aid context. This policy brief presents primary evidence of the intersection between resilience and religion for people affected by Typhoon Haiyan in the Philippines. Focus group discussions were undertaken with 154 people affected by the typhoon. Respondents stated that religion provided many functions key to personal and community resilience: it supported mental strength, encouraged community cooperation, and motivated sentiments of stewardship towards the environment. Local religious institutions were described as key actors for supporting resilience. Results from this study suggest that external actors - both secular and faith-based – can facilitate religious institutions in supporting resilience by providing disaster risk reduction and preparedness training. With the appropriate contextual analysis to understand religious dynamics, this suggests aid organizations could focus more often on the potential of local religious partners when designing disaster risk reduction and resilience interventions in other contexts.

## Introduction

Aid organizations often undertake disaster risk reduction (DRR) and resilience building activities in highly religious societies, but they rarely consider the impacts of religion on disaster resilience[1]. Additionally, research at the intersection of religion, risk, and resilience in international aid is relatively recent[2345] and not explicitly recognized in the Sendai Framework, apart from the need to protect religious sites because of their cultural importance. As a foundational component of people's culture, worldview, and daily life, however, religion has the potential to both positively and negatively affect risk,

[1] UNISDR's definition of resilience. https://www.unisdr.org/we/inform/terminology#letter-r, 2007. Consulted in 2017.
[2] Krüger, Fred et al., eds. *Cultures and Disasters: Understanding Cultural Framings in Disaster Risk Reduction*. Abingdon: Routledge, 2015;
[3] Cannon, Terry et al. *World Disasters Report: Focus on Culture and Risk*. Geneva: International Federation of Red Cross and Red Crescent Societies, 2014;
[4] Ager, Joey, Elena Fiddian-Qasmiyeh, and Alastair Ager. "Local Faith Communities and the Promotion of Resilience in Contexts of Humanitarian Crisis." *Journal of Refugee Studies* 28.2 (2015): 202–221;
[5] McGeehan, Kathleen M., and Charlene K. Baker. "Religious Narratives and Their Implications for Disaster Risk Reduction." *Disasters* (2016): 258-281.

risk reduction, and resilience in a profound way. For instance in Hawai'i the beliefs held by different faith communities directly lead to different levels of preparedness[6]; and in the U.S. as a whole religion has influenced ideas of climate change[7].

To add to the growing understanding of the role of religion in risk management, this brief describes how religion influenced the resilience of communities affected by Typhoon Haiyan in the Philippines. Typhoon Haiyan devastated the Philippines, a country in which almost all the population are associated with a religion, and prompted a large international response. The typhoon made landfall on 8 November 2013. It created deadly storm surges in coastal regions and produced high winds that destroyed shelters and crops. The typhoon killed over 6000 people and affected 14 million[8]. Given the devastation caused by the typhoon and the highly religious nature of the Philippines, examining the response to the typhoon can provide evidence about the impact of religion on disaster resilience.

## Methods

This study used data from 13 focus groups conducted in six different locations across the islands of Cebu, Leyte and Samar[9] 16 months after the typhoon. In total, 154 people took part in the focus groups. The locations represented a range of typhoon experiences, from those in Leyte and Samar that had been impacted by storm surges to those in Cebu that were mainly affected by high winds. The groups were a mix of men and women of different ages. Local member organizations of Misean Cara, an Irish non-governmental organization supporting missions, helped arrange the focus groups for the researcher to facilitate. Research participants were mainly Catholic, with a few representing other Christian denominations.

Religion might influence DRR and resilience in several ways. For instance, it can provide a psychological framework to help individuals overcome disaster, as well as a foundation for bringing communities together. Thus, religion has recovery and transformative potential, fundamental components of resilience. While it does not capture all the ways religion might influence risk, Lisa F. Schipper's representation of the nine entry points for analyzing religion in disaster risk reduction (DRR) and climate change adaptation (CCA) provides a structure for asking questions around religion:

[6] McGeehan, Kathleen M., and Charlene K. Baker. "Religious Narratives and Their Implications for Disaster Risk Reduction." *Disasters* (2016): 258-281.

[7] Jones, Robert P., Daniel Cox, and Juhem Navarro-Rivera. *Believers, Sympathizers, & Skeptics: Why Americans Are Conflicted about Climate Change, Environmental Policy, and Science*. Washington D.C.: Public Religions Research Institute; American Academy of Religion, 2014.

[8] OCHA. *Philippines: Typhoon Haiyan Situation Report No. 22 (as of 10 December 2013)*. N.p., 2013.

[9] Minglanilla, Cebu City, Northern Cebu, Tanuan, Tacloban, Marabut.

**Table 1**. Religion in the context of DRR and CCA[10]

| A: Focus on capacity | B: Focus on reducing risk | C: Focus on responding to disasters |
|---|---|---|
| A-1 Role of religion in supporting development | B-1 Role of religion in influencing policy on environment and climate change | C-1 Role of religion in helping people to emotionally overcome disaster (mental health) |
| A-2 Role of religion in encouraging social capital (organization) for coping during difficult times | B-2 Role of religion in raising vulnerability to hazards | C-2 Role of religious institutions in supporting disaster relief and recovery processes |
| A-3 Role of religion in influencing preventive and reactive responses to disaster risk and climate change | B-3 Role of religion in reducing vulnerability to hazards | C-3 Role of religion in influencing relief and recovery processes (rebuilding, planning) |

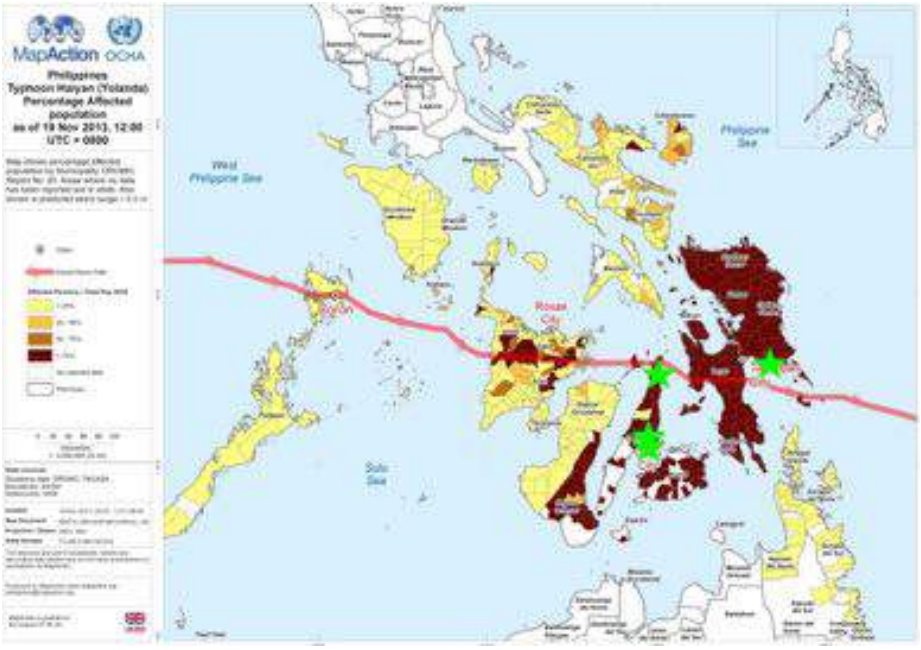


**Figure 1**. The path of Typhoon Haiyan. Areas visited for the research are starred.[11]

[10] Schipper, E. Lisa F. "Religion and Belief Systems: Drivers of Vulnerability, Entry Points for Resilience Building?" *Cultures and Disasters: Understanding Cultural Framings in Disaster Risk Reduction*. Ed. Greg Bankoff et al. Abingdon: Routledge, 2015.
[11] Map Action, 19 November 2013. Consulted in 2017. https://maps.mapaction.org/dataset/224-3075

To draw out key themes data was analyzed using NVivo, a computer program for assisting in qualitative data analysis.

## Results & Discussion

Respondents described religion as contributing to resilience in many ways. The most widely discussed theme was the personal strength that their faith gave them in relation to the disaster. The second was strength that religion provides communities. From quantifying the coding in NVivo by analyzing the number of times a topic was mentioned, it was seen that women slightly prioritized community strength over personal strength and men marginally prioritized personal strength over community strength. Male participants spoke of needing faith to help them feel internally strong to face up to the multitude of problems that they, their families, and their communities faced following the typhoon. Women spoke more about faith as part of the fundamental social glue holding their families and communities together.

The place of religion for personal resilience relates to Schipper's designation C-1 (emotionally overcoming disaster) and those that approach resilience from a psychological perspective, a large part of the resilience literature[12]. This personal strength that religion provided was of primary importance for the resilience of people affected by Haiyan. People described this as having trust in God's plan for them, and their resiliency as a sign of God's grace. In the English spoken in the area, research participants frequently used the term "cope up," which conveyed ideas of resilience in both coping with the disaster and making improvements "upwards" or forwards for the future. As one female participant in Tacloban stated,

*"…without faith in God nothing is possible. God would not give us the trials if we could not cope up. It's a test of how deep is our faith in God. Because God is a loving God, as we believe. He showed that we get back to normal after a short time. You can see the remnants of the typhoon still, but little by little we come back to normalcy."*

They attributed both their own ability to bounce back, recover, and transform and the provisions from external organizations, to God's grace. This worldview provided a positive psychological benefit as they felt the support of a loving God, giving them the resilience to recover and actively move forward.

The role of religion in building community-level resilience linked to Schipper's categorizations that focus on capacity (A-1, A-2, A-3), as well as religious institutions in response and recovery (C-2, C-3). It also relates to the critical role of social capital in disaster reduction and recovery[13]. The ideas of serving others and stewardship were central to this. Participants explained that religious beliefs encouraged their willingness to serve other people in their communities, which was then tied into the cultural concept of '*bayanihan*,' or the idea that villages will come together to help each other. This is the role of

[12] Alexander, D. E. "Resilience and Disaster Risk Reduction: An Etymological Journey." *Natural Hazards & Earth System Sciences* 13.11 (2013): 2707-2716.

[13] Aldrich, Daniel P. *Building Resilience*. Chicago, Ill.: The University of Chicago Press, 2012; Nakagawa, Yuko, and Rajib K Shaw. "Social Capital: A Missing Link to Disaster Recovery." *International Journal of Mass Emergencies and Disasters* 22.1 (2004): 5–34.

religious belief in supporting social capital for disaster resilience, which was also highlighted in relation to the place of religious institutions in response. Participants noted the importance of the church building in acting as a place of community cohesion, not just in religious festivals such as Christmas, but other social events such as fiestas and meetings. One notable element was the role of religion in encouraging community action on disaster risk linked to climate change. Participants saw human agency as the main cause of climate change, but included the role of God as creator and people as stewards of that creation. As one male participant explained,

"*We try to ask why God did this to us. But we never think also that we the people are caretakers of this environment and this world. We are the stewards of God's blessings and God's nature. But sometimes we never try to think about how beautiful this world is. We threw things without thinking what will happen to the future generations. The garbage in the sea, in the open canal, and it comes back to us. We don't question God; we question why we do this. We have to follow and take good care of this world, by doing things properly."*

Participants related how they had learned about climate change in sermons from the pulpit at Sunday Mass. The Christian message of stewardship of creation was resonant with secular messages of prevention and preparedness. Lessons on DRR and preparedness were also included at a local seminary. Religious institutions thus played adaptive and transformative roles in resilience, bringing communities new knowledge and activities on DRR and CCA.

Furthermore, participants stated that religious institutions were viewed as long-term community supporters, present well before external organizations arrived and remaining after they had left. They therefore held the trust and authority to disseminate such messages, while also continuing to provide material assistance to help develop their community where possible.

## Conclusion & recommendations

Religion related directly to people's personal and community resilience in the aftermath of Typhoon Haiyan. It was critically both an emotional support that provided meaning and mental strength and a way to motivate community organizations and cooperation. Religious institutions also supported community cohesion and disseminated messages on DRR and preparedness. Indeed, most of Schipper's entry points were seen in the case study.

This case study can be drawn out to provide insights for other contexts. For external actors, particularly secular organizations, it may seem as though little can be done to support resilience provided by religion. Indeed, in this case it was one of the elements of pre-existing social capital that allows individuals, families, and communities to cope and organize following typhoons without external assistance. Nevertheless, there are ways in which all organizations, secular and faith-based, can engage with religion to improve disaster resilience. For example, respondents displayed a great appetite for messages on disaster risk reduction and preparedness, and trusted religious institutions to convey these messages. In contexts where religious institutions are trusted, fruitful partnerships for training local religious leaders on these matters should therefore be considered. Furthermore, far from being static, religion is in a constant state of evolution and flux: aid organizations

can thus work with religious institutions to help move them toward a position that maximizes risk reduction.

The Sendai Framework has been criticized for taking a top-down view of risk reduction that treats communities as inputs[14]. Furthermore, the aid world has been critiqued as operating from a secular worldview[15] and certain aid organizations may be reticent to incorporate religion into programming; however, issues that communities view as critical – including religion – must be considered in programming for resilience work to be truly inclusive and supportive. This case study thus supports calls for greater bottom-up approaches to DRR that reflect community needs, rather than localized approaches that operationalize communities for their own goals. A more locally reflective approach is therefore imperative for reducing risk in a sustainable manner.

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[14] Poterie, Arielle Tozier de la, and Marie-Ange Baudoin. "From Yokohama to Sendai: Approaches to Participation in International Disaster Risk Reduction Frameworks." *International Journal of Disaster Risk Science* 6.2 (2015): 128–139.

[15] Ager, Alastair, and Joey Ager. *Faith, Secularism, and Humanitarian Engagement: Finding the Place of Religion in the Support of Displaced Communities*. New York: Palgrave Macmillan, 2015

**Understanding and improving critical infrastructure resilience: essential to achieving global agreements**

Heather Murdock[1,2,3], Supriya Krishnan[4,5,6]

Email Address: murdo1@unesco-ihe.org
[1] UNESCO-IHE Institute for Water Education and Research
[2] Deltares, The Netherlands
[3] The Water Youth Network
[4] Delft University of Technology, the Netherlands
[5] Delta Urbanism Research group
[6] Urban Thinkers Campus Team TU Delft

## Abstract

Urban resilience is understood as the ability of a city to resist and respond to a shock. Critical infrastructure (CI) plays a key role in the functioning of a city and can strongly enhance overall urban resilience. The functioning of CI increases the coping capacity and rate of recovery of urban environments following a disaster. Understanding the links between systems helps to protect overall network functioning. While network operators typically understand their own systems well, the interdependencies are often not well understood. Many of the global agreements mention the need to protect and increase the resilience of CI but there are many challenges to overcome in order to achieve this especially given the interdependencies. Understanding CI risk exposure and increasing CI resilience should be integrated into action plans for disaster risk reduction (DRR) and the implementation of the Sendai Framework. Furthermore, CI system considerations are also not often integrated into long term planning but could help to improve disaster response over the long term.

## Introduction

Urban environments in the 21st century survive under the veil of an impending disaster. Manifestations of climate change are becoming pronounced with the increasing frequency of acute disasters (such as floods and earthquakes) and chronically rising hazards (such as rises in sea level and global temperature). In addition, a growing proportion of the world's population lives in urban environments and, according to the New Urban Agenda, the world urban population is expected to nearly double by 2050 [1].

The intensifying urbanisation will see a large percentage of urban 'poor' who will be vulnerable to fluctuating supply of services offered by critical infrastructure (CI) essential for survival[2].

CI networks refer to the electricity

[1] HABITAT III NEW, URBAN AGENDA. "Draft outcome document for adoption in Quito, October 2016." (2016).

[2] UNISDR. "Poorly planned and managed urban development" http://www.preventionweb.net/risk/poorly-planned-managed-urban-development (2015).

provision, transportation networks, water supply, wastewater systems, hospital facilities and other systems which are essential to maintaining a satisfactory level of functioning in an urban environment. These man-made networks are often privately owned and "function collaboratively and synergistically to produce and distribute a continuous flow of essential goods and services"[3]. They are often affected during extreme weather events or other disasters and the restoration of their services is needed for recovery.

## What is Urban Resilience?

Households depend on power for cooking, businesses need telecommunications to complete transactions and hospitals need water and wastewater systems to maintain a hygienic environment. All of these are examples of the dependence of a city on CI. The resilience of these systems services greatly affects the functioning of the city. There are several definitions and types of resilience, however, a commonly accepted definition refers to the ability of a system to respond to and recover from a shock[4]. Furthermore, the resilient city index outlines seven characteristics of resilient cities which are aligned with this definition[5] as shown in Fig. 1.

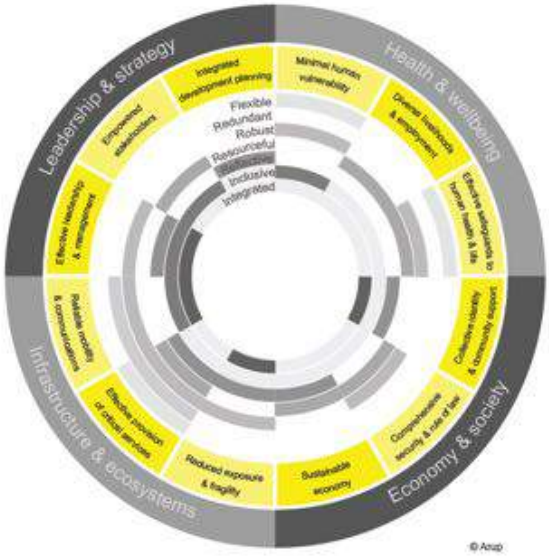


**Figure 1**. Resilient Cities Index[6]

This framework specifies that resilient cities need:

- Reflectiveness
- Resourcefulness
- Robustness
- Redundancy
- Flexibility
- Inclusiveness
- Integration[7]

Properties such as robustness refer to a city's ability to resist a shock and others such as redundancy and flexibility mean that aspects of the system can recover more quickly because of alternative configurations.

## CI and Urban Resilience

In Mocoa, Columbia the April 2017 flood and landslide resulted in severe damage and more than 300 casualties over only a few hours. As that area recovered it was reported that it would take two weeks to restore energy to the affected area and survivors were also without gas,

[3] President's Commission on Critical Infrastructure Protection www.ciao.gov

[4] Holling, Crawford Stanley. "Engineering resilience versus ecological resilience." Engineering within ecological constraints 31.1996 (1996): 32.

[5] ARUP, T. R. F. "City Resilience Framework" The Rockefeller Foundation and ARUP. (2014)

[6] ibid (same as 4)

[7] ibid (same as 4)

telephone service or much clean water[8]. The duration of the impacts are thus closely tied to the recovery rate of CI services.

Additionally in Canada during the Southern Alberta Floods of 2013, the city of Calgary experienced power outages due to the flooding of a substation[9] and the community of Black Diamond was without multiple CI services when a utility bridge was washed away[10]. These indirect effects are important contributing factors to the total disruption caused by a disaster.

Failures can also propagate through CI networks due to interdependencies, resulting in secondary effects and higher order cascades. A power outage in Italy[11] in 2003 illustrates this. A short circuit caused by a tree falling on one transmission line led to a series of blackouts on the Swiss–Italian border affecting 56 million as this failure cascaded through the nodes of contact in the power and communication system[12].

These factors such as impacts larger in time and spatial scale that the original event and higher order impacts due to network dependencies are important considerations for understanding the role of CI for disaster risk reduction. They can affect the total damage and overall recovery rate.

## Understanding CI

While system operators often have a good understanding of their own systems, other stakeholders typically do not. CI systems are technically and logistically complex entities which is a barrier to mutual understanding. Furthermore, data regarding CI systems is often private due to competition and security concerns

Collaborative modelling tools, workshops, and event visualisation can support better understanding. With the collaborative modelling approach, the modelling process directly involves the stakeholders where they are given the tools to shape the modelling exercise[13]. Tools such as CIrcle[14] support this and organize CI dependency information in a workshop setting. A diagram like the one shown in Fig. 2 is developed and with it the relations and importance can be seen and experts can judge if this fits with their experience[15].

[8] Brodzinsky, Sibylla. "Colombia Landslide" The Guardian. https://www.theguardian.com/world/2017/apr/01/colombia-landslide-mocoa-putumayo-heavy-rains (2017)

[9] Williams, Nia. "Power outages in Calgary could last for months after floods" http://www.reuters.com/article/canada-floods-calgary-idUSL2N0EZ06M20130623 (2013)

[10] Glass, A. 2014. Black Diamond, Turner Valley forged union through flood. Calgary Herald. Published on June 16 2014 retrieved on April 07 2017

[11] Andersson, G., et al. "Causes of the 2003 major grid blackouts in North America and Europe, and recommended means to improve system dynamic performance." IEEE Transactions on Power Systems 20.4 (2005): 1922-1928.

[12] Buldyrev, Sergey V., et al. "Catastrophic cascade of failures in interdependent networks." Nature 464.7291 (2010): 1025-1028.

[13] Basco-Carrera, L., Warren, A., van Beek, E., Jonoski, A., & Giardino, A. (2017). Collaborative modelling or participatory modelling? A framework for water resources management. Environmental Modelling & Software, 91, 95-110.

[14] Deltares "Circle Software". www.deltares.nl/en/software/circle-critical-infrastructures-relations-and-consequences-for-life-and-environment-2/ (2017)

[15] ibid (same as 13)

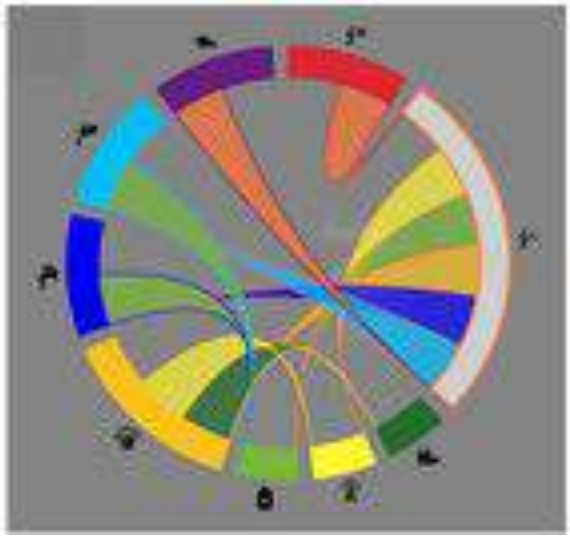

**Figure 2**. CIrcle tool visualization[16]

Then visualisations of event timing with impacts help to feed these inputs back into the storyline of an extreme event to help support decision making[17].

## The Age of Interconnectivity

We are entering a new era of a 'globally networked society'[18] representing increasing interdependency, interconnectivity and complexity. The interconnectedness has scaled positively across sectors for more accurate outputs, however, this interconnectivity can also increase the vulnerability of the system.
The transition from a 'component' based approach to a 'system' based approach to understanding CI will be essential for integrated practices[19]. These systems can be modelled as interconnected layers as shown in Fig.3.

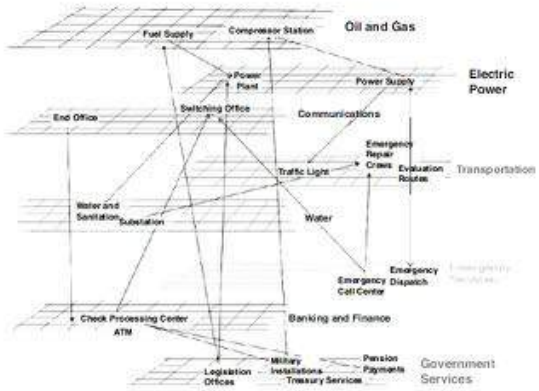


**Figure 3**. Interconnected infrastructure layers[20]

It is often too costly to protect all parts of the system but targeting certain areas for increased robustness and perhaps adding redundancies elsewhere for example can increase system resilience.

## The Planning Approach

In a recent paper that discusses 'Mainstreaming risk reduction in urban planning', some interviewees suggested that the easiest way to integrate risk reduction and urban planning is 'to wait for the next earthquake, let the city fall down and start again'.[21] One of the main culprits for this attitude can be attributed to the principles of conventional urban planning that are largely based on quantifying the problem based on given parameters and then identifying a clear

[16] ibid (same as 13)
[17] De Bruijn, K. M., et al. "The storyline approach: a new way to analyse and improve flood event management." Natural Hazards 81.1 (2016): 99-121.
[18] Castells, Manuel. The rise of the network society: The information age: Economy, society, and culture. Vol. 1. John Wiley & Sons, 2011.
[19] European Union "Cascading Effects Conference" (2017) http://www.cascadingeffects.eu/
[20] Wilbanks, Thomas J., and Steven Fernandez. Climate Change and Infrastructure, Urban Systems, and Vulnerabilities: Technical Report for the US Department of Energy in Support of the National Climate Assessment. Island Press, 2014.
[21] Wamsler, Christine. "Mainstreaming risk reduction in urban planning and housing: a challenge for international aid organisations." Disasters 30.2 (2006).

objective. The room for flexibility is often limited. Ironically, the Global Risks Perception Survey by the World Economic forum also ranks 'failure of urban planning' as having the least impact in the global risk landscape[22].

In the debate to find a common ground between 'risk reduction' and 'urban development', the historical separation results in different working priorities, concepts and terminologies that further foster the gulf between different professionals[23].

## Relation to urban poor

The problem of urban resilience has many lenses an important consideration is the often disproportionate effect of acute shocks on the urban poor. Disruption of CI services affects social and economic activity and the health and quality of life of the people themselves[24]. Studies have shown that in the case of a natural hazard, people of underprivileged socio-economic demographics are often the most impacted during these events as they have limited capacity to fill in the gaps of service continuity through alternate means. The basic critical services offered by the critical infrastructure networks assume a greater role in reducing damages to the poor thus alleviating their overall suffering even under non-crisis circumstances**.**

## Relevance to global agreements

The major global development frameworks highlight the 'opportunity of urbanization' for directing sustainable and inclusive development while acknowledging the role of CI resilience.

The Paris Agreement establishes the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change.[25] Additionally the UN Sustainable Development Goals 11 (Sustainable Cities and Communities), 13 (Climate Action) and 17 (Partnerships for the Goals) all rely on resilient CI for cities. Finally, CI is also specifically mentioned within the Sendai Framework's seventh global target which is to "*Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030*"[26]. The case can be made, therefore, that if action is not taken to address the challenges to increasing CI resilience there will be a missing piece in implementing the Sendai framework as well as also other global agreements.

## Conclusion

"Cities are no longer regarded as being disordered systems. Beneath the apparent chaos and diversity of physical form, there is strong order and a pattern that emerges from the myriad of decisions and processes required for a city to develop and expand physically."[27]

[22] WEF 2016. The Global Risks Report. 11 ed.: World Economic Forum

[23] ibid (same as 18)

[24] Wilbanks, T., Fernandez, S., Backus, G., Garcia, P., Jonietz, K., Kirshen, P., Savonis, M., Solecki, W., Toole, L. and Allen, M. "Climate change and infrastructure, urban systems and vulnerabilities", Technical Report for the US Department of Energy in Support of the National Climate Assessment (2012).

[25] Agreement, Paris. "United nations framework convention on climate change." Paris, France (2015).

[26] Ibid (same as 2)

[27] Batty, Michael. "The size, scale, and shape of cities." science 319.5864 (2008): 769-771.

Analysing interdependencies between networks and their impacts on space could reveal underlying behavioural patterns to generate an inventory that can inform better optimised decisions for contingency plans. Furthermore, CI resilience is essential to city resilience but it is a challenging domain to comprehend in entirety. Tools and approaches have been developed to foster understanding. These should be better developed and applied in addition to partnerships and data sharing which will be paramount for resilient future landscapes. In addition, facilitating 'trust' will become a crucial barrier to be overcome and maintained.

**Acknowledgments**

Thank you to the organizers of the EU INTACT[28] conference who connected the authors of this paper and created a forum for researchers and practitioners with an interest in the resilience of critical infrastructure to extreme weather to connect.

[28] http://www.intact-project.eu/

# DISASTER Risk Reduction

## Disaster Response, Relief & Recovery

UN Major Group for Children and Youth
the space for children and youth in the United Nations

**Assessment of Coordination Mechanism in 2015 Nepal Earthquake, Kathmandu District**

Serena Amatya [1], Dr. Indrajit Pal [2], Ranit Chatterjee [3]

Email Address: indrajit-pal@ait.asia
[1]Intern, International Centre for Integrated Mountain Development, Kathmandu, Nepal.
[2]Assistant Professor, Disaster Preparedness Mitigation and Management, Asian Institute of Technology, Thailand.
[3]Research Student, Graduate School of Global Environmental Studies, Kyoto University, Japan.

## Abstract

2015 Gorkha earthquake of 7.8M caused huge destruction in terms of lives and property. Immediately after the earthquake, emergency response was carried out by local, national and international organizations. The primary focus of this research was to assess coordination mechanism during response and relief operations in aftermath of catastrophic earthquake. Various plans, policies, acts and guidelines were reviewed to understand the disaster management system and develop specific recommendation to aid future relief operations. In relief operation, coordination plays a vital role for smooth operation and cooperation among stakeholders involved. There was coordination gap initially among different humanitarian responders. Delay in coordination leading to subsequent delay in the rescue and relief operation can be attributed to limited policies, strategies and acts regarding disaster management in Nepal. The result of the research indicated unstable and weak governance, lack of local government staffs, ambiguity in authority and revision of plans and policies after the disaster causing delay in proper coordination and relief efforts.

## Introduction

Emergency response comprises of individuals working in formal establishments to meet various needs through their actions and interactions, which is self-motivated arrangements of cooperation to manage the complexity of response[1]. Such interventions are developed to meet the immediate and short term needs of affected population and seldom for longer-term strategic actions[2]. Emergency relief is dependent on the government structure and level of preparedness and hence can go on for a very long time or can end fairly quickly as have been experienced in case of 2011 Japan Tsunami and 2010 Haiti earthquake respectively. Often faced with constraints of limited information and human resources an effective coordination and management between emergency responders and the government is essential.

[1] Cohen, Michael D., and Robert Axelrod. *Harnessing Complexity: Organizational Implications of a Scientific Frontier*. Simon and Schuster, 2000.

[2] Dovers, Stephen, and John Handmer. *The Handbook of Disaster and Emergency Policies and Institutions*. Routledge, 2012.

## 2015 Nepal Earthquake Impacts

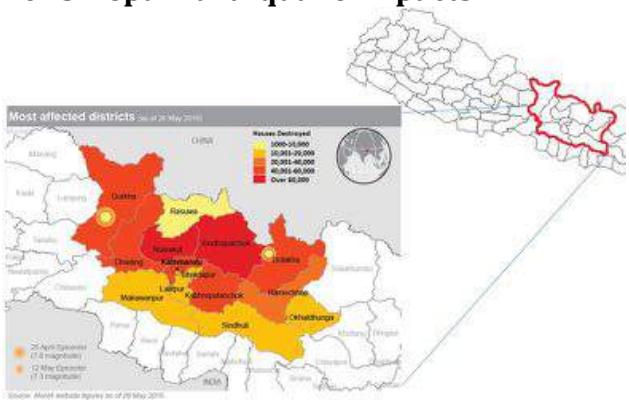


**Figure 1.** Nepal Earthquake and most affected districts [3]

The Gorkha or Nepal Earthquake of 7.8M occurred on April 25, 2015 at 11:56 NST having epicenter 77 km northwest of Kathmandu and at a depth of 15 km. This was followed by another earthquake on 12th May 2015 of 7.2 magnitude affecting the eastern part of Nepal. Aftershocks were continuously felt for several months after the disaster. 14 out of 75 districts were severely affected by the earthquake in terms of rescue and relief priority [4]. Secondary disasters like landslides, flash floods and avalanches in mountainous areas were triggered by the earthquakes. In Kathmandu, soil liquefaction occurred in different parts of the district [5]. Furthermore, most of the connecting roads to rural areas were damaged. Also, the need for effective coordination was high with monsoon season following soon and provision of shelter for all the affected people became necessary (Fig. 1).

## Emergency Response

Prioritization of information sharing and decision making is critical for disaster response [6]. For effective and smooth coordination, emergency response plan is a must for any organization. In extreme events like earthquake, the first 72 hours are critical for search and rescue efforts [7]. Earthquake response and rescue (ERR) is still a global challenge specifically in developing countries. Various factors contribute to this namely absence of professional relief agencies, inadequate aid materials and storage space, appropriate rescue equipment which highlights the level of preparedness and inadequacy present in the system [8,9]. On the other hand multiagency collaboration, optimal resource management, and local knowledge are significant for effective response [10]. Various research has

[3] OCHA. "Situation Report no. 1-18". *Nepal Earthquake 2015* (2015): 7.

[4] GON. "Disaster Report 2015". *Government of Nepal*. http://drrportal.gov.np/uploads/document/329.pdf. Web. 2015.

[5] Goda, K., Kiyota, T., Pokhrel, R. M., and Wilkinson, S. (2015) "The 2015 Gorkha Nepal Earthquake: Insights from Earthquake Damage Survey." *Frontiers in Built Environment* 1 (2015): 8.

[6] Chen, A. Y., Peña-Mora, F., Plans, A., and Aziz, Z., (2012), "Supporting Urban Search and Rescue with Digital Assessments of Structures and Requests of Response Resources." *Advanced Engineering Informatics* 26(4), 833–845.

[7] Ochoa, Sergio F., and Rodrigo Santos. "Human-Centric Wireless Sensor Networks to Improve Information Availability during Urban Search and Rescue Activities." *Information Fusion* 22 (2015): 71–84.

[8] Doyle, John C. "Improving Performance in Emergency Management." *Disaster Prevention and Management: An International Journal* 5.3 (1996): 32–46.

[9] Lu, Yi, and Jiuping Xu. "The Progress of Emergency Response and Rescue in China: A Comparative Analysis of Wenchuan and Lushan Earthquakes." *Natural hazards* 74.2 (2014): 421–444.

[10] Gopalakrishnan, C., and Norio, O. (2007), "Designing New Institutions for Implementing Integrated Disaster Risk Management: Key

reported time, inter-organizational coordination and relief mobilization as three critical rescue and response indicators[11]. However, the incompetence of developing countries coupled with scale of the disaster leads to increased dependency on international agencies for response.

## Role of Coordination in Disasters

Coordination has been defined as a planned response to tasks within an organization or among actors where they are dependent on one another for best results[12]. Two types of coordination system have been derived based upon the actors involved: horizontal and vertical coordination. Vertical coordination involves hierarchies of national and local government, suppliers, humanitarian actors and customers whereas, horizontal coordination consists of external and internal organizations along with their competitors[13]. Through clusters, organizations have profited from cooperation as well as competition for better provision of information, relief resources and services [14]. However, lack of coordination among different clusters when supplying relief from international to local level has also been noted and considered a key challenge for better relief operation. For the success of coordination during a crisis situation, strategy should be formed to handle the problems tactically [15].

## Methods

This research study consists of key observations immediately during emergency response and during research period. Qualitative data has been collected from local authorities, government personnel and international stakeholders using semi-structured interviews and focus group discussions.
Various disaster management strategies, guidelines, policies and acts were analysed vis-a-vis operational activities during emergency response, organizational hierarchy and coordination mechanism.

## Discussion

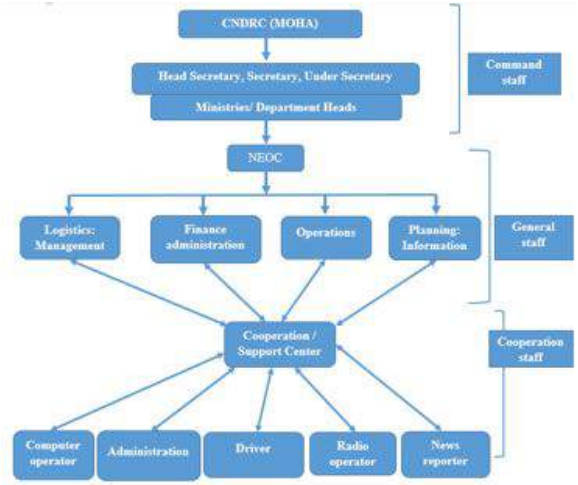


**Figure 2.** Central Organizational Char[16]

The Central Organizational System (COS) during disasters has been divided into

Elements and Future Directions." *Disasters* 31(4): 353–372.

[11] ibid (9)

[12] Tatham, P., Pettit, S., Jahre, M., & Jensen, L.-M. (2010). Coordination in humanitarian logistics through clusters. *International Journal of Physical Distribution & Logistics Management, 40*(8/9), 657-674.

[13] Balcik, Burcu et al. "Coordination in Humanitarian Relief Chains: Practices, Challenges and Opportunities." *International Journal of Production Economics* 126.1 (2010): 22–34.

[14] ibid (12).

[15] ibid (12).

[16] ibid same as (4).

three tiers: incident commander, command and general staff under the Ministry of Home Affairs, Nepal (MOHA) (Fig.2). COS commands and controls the situation of disaster through Central Disaster Relief Committee (CNDRC) with the authority to command other ministries and departments to coordinate and cooperate by providing obligatory support from the departments. COS lies above National Emergency Operation Center (NEOC), which is the main body to formulate policy and strategy required for NEOC. It does not mention anything about the Incident commander whether it is the Prime Minister or the President of Nepal. However, the document describes in detail on standard operating procedures carried out immediately after a disaster. Nepal Army (NA), Nepal Police (NP) and Armed Police Force (APF) coordinate immediately with CNDRC or the nearest District Disaster Relief (DDRC) for response during a disaster. Some of the activities done were search and rescue, relief distribution, camp coordination, treatment of injured and so on. They follow the Commander in Chief for response and rescue in absence of local authority [17].

Although, there is presence of different standards for disaster management in Nepal, but serious implementation gap was there mostly due to the incapability of the government[18]. Most of the documents related to disaster risk management has been drafted without must detailed roles and responsibility. For instance, the activities to be carried out by cooperation staff does not discuss the detail task of each section (Fig.3).

[17] ibid same as (4).

[18] EMI. "M7.6 Gorkha Earthquake Response and Early Recovery Case Study". www.emi-megacities.org. Web. 2015.

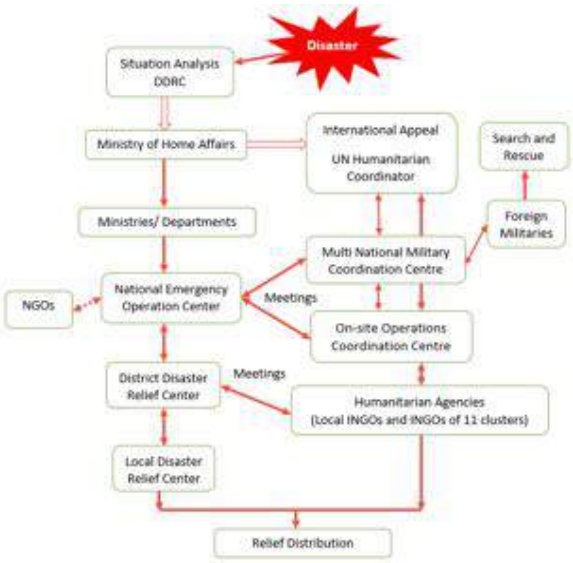


**Figure 3.** Coordination Mechanism of Nepal [19]

Coordination mechanism of Nepal illustrated the coordination between Government Organisations (GOs) and INGOs. It clearly indicates horizontal coordination between CNDRC and UN where they coordinate with each other to respond better in a disaster. However, they follow their own working mandates to effectively provide relief operation. Severe challenges observed in coordination between DDRC and humanitarian agencies were due to weak command system, where, the local offices had less staff and ineffectiveness in guiding numerous relief organizations on field. With recruitment of new staffs in the second week of the earthquake, the coordination started improving with systematic commands from the central to local level.

It was found that the first week of disaster was dedicated to setting up of coordination system within GOs as well as with UN and international responders. In

[19] National Disaster Response Framework, Government of Nepal Ministry of Home Affairs March 2013

the second week, the officials start relief distribution and announced one window policy. One window policy has both advantages and disadvantages. The advantage of one window policy was that people located in remote and inaccessible areas also receive the relief through government channel. The disadvantage of the policy was the delay in relief distribution in almost all the places in order to streamline relief operation.

The execution of present policy structures immediately after the earthquake could have made the relief operation and coordination efficient without delays. Post disaster assessments carried out also had some delays in initial assessments with lack of authoritative power seen within the government [20]. Individual assessments without coordination caused redundancy of information which eventually led the GON to cease such assessments. However, the initial assessments from their side was very slow paced. The initial rapid assessments were carried out for more than 72 hours which led to delay in other assessments[21]. There was gradual improvement in coordination with time and leading role of NEOC after some days of delay. Lack of inter-cluster mandate caused misunderstanding between GOs and international responders which created delay in coordination and relief operation. As weeks passed, the organizations kept aside their differences and focused on their goal of helping affected population which ultimately led them to coordinate together.

[20] ibid (19).

[21] Ministry of Home Affairs. "Nepal Earthquake 2072: Situation Update as of 11th May".www.drrportal.gov.np. Web. 2015.

## Conclusion

Following the earthquakes, humanitarian responders were very quick to react to the news of disaster and deployed for response. But, the influx of many humanitarian actors could not be utilized properly since the government was not sufficiently equipped to provide necessary information and guidance to the responders in the first week of disaster. At the later stage, NEOC controlled relief distribution through one-window policy which requires large amount of manpower within the country to provide relief to multiple places simultaneously without delays. The relief operation's start was slow in the first few weeks which gradually improved with the improvement in coordination. Conversely, affected population and providing relief should have been the main priority. This shortcoming existed due to lack of well-planned contingency plan, lack of detailed relief standards, not enough expertise at national level, lack of manpower in local government due to absence of local election for last 20 years created disconnected between the local and national government. For smooth coordination, new temporary officials replaced the local offices which resulted in delay of implementation of existing standards and strategies.

Coordination is one of the most important task to maintain during post-disasters but at the same time, it is challenging process to achieve perfect coordination system. Improving the system for better coordination helps to avoid misunderstandings and focus on response smoothly. Some of the problem regarding coordination are unavoidable however, better coordination can be achieved following pre-formulated strategies and inter-agency cooperation.

## Recommendations

1. Policy improvement detailed on responsibility of each organization.
2. Government organizations should be clear on their roles and take leadership to instruct other organizations for smooth coordination.
3. Pre-planned assessment tools should be used to identify affected population and provide immediate assistance.

## Acknowledgements

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**Brazil legal framework for post-disasters displacements**

Giulia Manccini Pinheiro[1]

Email Address: giuliamanccini@gmail.com
[1]Paulistana Foundation of Education, Technology and Culture. City of São Paulo.

## Abstract

The number of post-disaster people displacement in Brazil is growing exponentially due to climate-change and environment degradation. This paper aims to investigate the laws and policies to protect this population and identifies the main advantages and point of improvements of the covered legal framework.

## Introduction

With global climate change, the occurrence of extreme weather events and disasters is becoming more common and Brazil is one of the most affected countries in terms of disasters. According with the Germanwatch report[1], in a length of 20 years, 1610 people died in natural disasters and more than U$ 1,7 trillion has been spent with losses.

Due to its continental territorial extension, issues like floods, windstorms, cyclones, landslides, soil erosion, fluvial erosion, woodland fires, droughts and deforestation have caused thousands of people to move, seeking for a safer place to live, according to the Brazilian Atlas of National Disasters[2].

Having this in mind, this paper aims to identify Brazil's legal framework that protects post-disaster displaced people and to critically analyze its benefits and flaws towards this population. The main contribution will be the coordination from spread laws to be used as support for lawyers and the civil society in people's protection and for inspiring worldwide legislations. For this purpose, this paper considers the national laws and international commitments that

[1] Germanwatch: *Global Climate risk Index 2016*. (Briefing Paper) 23.

[2] Centro Universitário de Estudos e Pesquisas sobre Desastres (CEPED). *Atlas Brasileiro de Desastres Naturais 1991 a 2010* (volume Brasil. UFSC 2012) 13

bind Brazil in the matter of people's movement protection.

The methodology is to examine each law's scope of protection and investigate whether it is sufficient or not for protecting post-disaster people displacement. The term "displacement" has been chose to emphasize that the environment fact had a pushing role in the decision to move. According with the Internal Displacement Monitoring Centre, "displacement is a more reactive measure of last resort or a survival response to severe and immediate threats"[3].

## Discussion

Although the majority of researches insist, based on their consistent empirical works, that post-disaster displacement is likely to be internal, rather than across international borders, most of their discussion is circumscribed to international migration.[4] Therefore, this paper will consider the causes of internal displacement and Brazilian laws about it.

It is well known by the scientific community that global climate change is indeed occurring. The numbers are so alarming that the Intergovernmental Panel on Climate Change (IPCC)[5] stated that the "warming of the climate system is unequivocal as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level".

Furthermore, the Panel[6] reached the conclusion that the anthropogenic drivers of climate change performed an important role in the past years warming; highlighting that the global greenhouse gasses emissions increased by 70% between 1970 and 2004.

Amongst the big five reasons for concern about climate change listed by the Panel in the Third Assessment Report, and updated in the Assessment Report 4, we can find the *risk of extreme weather events*. In consonance with the 2007 Report, it was determined by the most recent study a much higher confidence in the projected increase of floods, heat waves, droughts and their adverse impacts, which may include adverse health impacts and damage to infrastructure that impulse people to move.[7]

As stated by Carvalho[8], despite the existence of scientific doubts, it is even clearer that climate change has been affecting considerably the intensification of these climate extremes and its consequences in the last few decades.

More specifically in Brazil, as reported by the University Centre for Studies and Research on Disasters[9] (CEPED, in Portuguese), the number of disasters

[3] Internal Displacement Monitoring Centre. *Global Estimates 2015* 14

[4] MAYER, Benoît. "Climate Change and International Law in the Grim Days". *The European Journal Of International Law* (July 2013: 947-970) 953

[5] Intergovernmental Panel on Climate Change IPCC. (*2007 Synthesis Report*: Summary for Policy Makers. Cambridge University Press 2007) 30

[6] Intergovernmental Panel on Climate Change IPCC. (*2007 Synthesis Report*: Summary for Policy Makers. Cambridge University Press 2007) 36

[7] Intergovernmental Panel on Climate Change IPCC. (*2007 Synthesis Report*: Summary for Policy Makers. Cambridge University Press 2007) 65

[8] Carvalho, D. W. "As mudanças climáticas e a formação do direito dos desastres". *Novos Estudos Jurídicos* (2013) 398

[9] Centro Universitário de Estudos e Pesquisas sobre Desastres (CEPED). *Atlas Brasileiro de Desastres Naturais 1991 a 2010* (volume Brasil. UFSC 2012 28

occurred has risen from 8,671, in the decade of 1990, to 22,238, in the decade of 2,000.

Considering the total amount of people affected by disasters within the period comprehended between 1991 and 2010, which is equivalent to 96,220,879 people. We can observe that intense droughts and sudden floods are the types of disasters that affect Brazilian population the most. The first is responsible for 50.34% of the amount of affected people, while the second corresponds to 29.56%[10].

The Swiss insurance company – *Swiss Re* published a report stating that natural disaster will likely become more frequent in Brazil and also more costly in terms of human lives and government expenditures[11].

After this brief overview, we can notice that coherent policies and legislations in the Country are essential to address the problematic of these so-called 'natural' disasters in the global climate change era, not only to deal with the consequences of the disasters, but also to prevent the occurrence of such events.

Before 2012, when the National Policy for Protection and Civil Defence (Federal Law No 12,608)[12] was released establishing a new legal structure to disasters in Brazil's Law, two major legal instruments used to regulate the subject: the Decree No. 7,257 (2010)[13] and the Federal Law No. 12,340 (2010)[14].

The first one concerns the necessary requirements to declare state of emergency and state of calamity, and its related matters, such as transference of monetary resources to rebuild devastated places. It also defines *disaste*r as the result of adverse events, natural or caused by human activity, on a fragile ecosystem resulting in human, physical or environmental damages and, consequently economic and social injuries.

The second one originally regulated the transference of monetary resources to the rescue activities; to provide assistance for the injured; to the reestablishment of essential services; to rebuild devastated areas; and to the Special Fund for Public Calamities. Since 2013, when a revision occurred in the legal text, this law has also included in its provisions measures towards the execution of preventive actions in areas with a high disaster risk.

We can therefore observe that our national legislation primordially focused its main attention on giving response to disastrous events and on the reparation of injured sites, dealing directly with the concrete damages arising from disasters rather than taking preventative approaches to avoid their occurrence.

However, this situation has changed when in 2012 the National Policy for Protection and Civil Defence was enacted. This policy was established by the law No. 12,608, which also created the *National System of Protection and Civil Defence*, the *National Council of Protection and Civil Defence*[15], and a

[10] Centro Universitário de Estudos e Pesquisas sobre Desastres (CEPED). *Atlas Brasileiro de Desastres Naturais 1991 a 2010* (volume Brasil. UFSC 2012 29

[11] Brazil has traditionally had a very low exposure to natural disaster, but during the last five years the frequency of events such as heavy rains, floods and avalanches has increased (…)." RINDEBRO, U. Natural Disasters Likely to Become More Frequent, Costly – Swiss Re – Brazil. ( Business News Americas. 2011)

[12] BRAZIL. Federal Law No 12,608. 10th April 2012.

[13] BRAZIL. Decree No. 7,257. 4th August 2010.

[14] BRAZIL. Federal Law No 12,340. 1st December 2010.

[15] The main Guidelines were established for the National System of Protection and Civil Defense and the National Council of Protection and Civil

national system for monitoring disasters.

In its second article, this law sets as an obligation, for all of Brazil's Federal Entities[16], to adopt all the necessary measures to reduce the disaster risk in the Country, which may be adopted in a cooperation scheme involving the public and the private sector. Besides that, the second paragraph of this article goes further and adopts a *precautionary* approach, when it states that "the uncertainty related to the disaster risk shall not constitute an obstacle to the adoption of preventative and mitigation measures for risk situations".

Moreover, it is important to highlight that the increase in the occurrence of disasters due to climate change is recognized in our legislation because the article No 3 establishes that the post-disaster policy must be integrated with the National Policy on Climate Change (Law No. 12.187)[17]. Thus, we can notice that Disaster Law is deeply related to Climate Change Law.

Besides the new focus in preventing disaster and building resilience in community, the Law No 12.187 only covered the help immediately post disaster and it did not consider the situation of displaced people. The answer for these people can be found in the Law No. 8036 about the Guarantee Fund of Length of Service – Brazilian pension funds (FGTS in Portuguese). The article 20 of this law allows withdraw the FGTS in case of natural disasters, after a decree of major natural calamite or emergency by the municipality or State affected.

However, it is important to notice that only in case of natural disasters displaced people have the right to use the Social Fund money. What means that displaced people in case of human-made disasters or that were expropriate and relocated have no access to this tool.

In the international level, it is possible to state that the NPPC Law has most of the Sendai Framework recommendations and goes towards the same direction of prevention and building resilience to communities. In addition, Brazil has been a great supporter of the Sendai Framework implementation, having done actions within the BRICS[18] and MERCOSUL[19] meetings. However, there has not been much change in the national actions or increasing budget towards disaster risk prevention.

Concerning the Guiding Principles of Internal Displacement, Brazilian Constitution guarantees most of the provisions to internally displaced people, with a strong exception of article 9[20]. However, the Guiding Principles are not binding and will not be object of a further analysis in this paper.

## Conclusion

Brazil is a country highly affected by environmental disasters and has a high level of internal displacement. Despite the Law for Disaster has been improved

Defense in this Law. However, its execution is being done gradually, usually in a responsive form. Carvalho, D. W. "As mudanças climáticas e a formação do direito dos desastres". *Novos Estudos Jurídicos* (2013) 345

[16] Which are the Union, States, Federal District and Municipalities.

[17] Carvalho, D. W. "As mudanças climáticas e a formação do direito dos desastres". *Novos Estudos Jurídicos* (2013) 401

[18] McElroy, Andy. "BRICS boost for Sendai Framework." 23 Aug. 2016. Web. 01 Apr. 2017.

[19] Itamaraty. "Mercosul supports Sendai Framework". 20 Aug. 2016. 01 Apr. 2017.

[20] "Principle 9 – States are under a particular obligation to protect against the displacement of indigenous peoples, minorities, peasants, pastoralists and other groups with a special dependency on or attachment to their lands". United Nations. Guiding Principles on Internal Displacement. 1997.

in 2012, there is still no coverture to post disaster movement.

It is possible to conclude that only people displaced by natural disaster can have immediate help from the government, but not in case of slow-onset disasters or human-made disasters. Therefore, there is still a large amount of Brazilians that fill in a legal gap.

Finally, the good will to participate in international agreements about disaster and integrate it Disaster Policies with Climate Change policies shows that there is an evolution towards further protection for post-disaster displaced people.

**Does creative destruction exist?**

Andrea Garcia Tapia[1]

Email Address: agarciat@stevens.edu
[1]PhD student/Stevens Institute of Technology

## Abstract

Disasters do not foster growth per se; it's the recovery process that foster growth. This policy brief presents the main findings of two theses[1] [2] that explore what is the effect in the medium and long term of natural disasters in Mexico´s economic growth and the variables that trigger the Mexican disaster relief allocation process.

## Introduction

As a story pulled out of Garcia Marquez book, every year disaster's news come out as a *Chronicle of a Disaster Foretold*. Disasters are the after-effect of economic development faults, triggered by natural or human-induced phenomenon. Due to climate change we can expect in increase of extreme events[3] and as a consequence an increase in the economic losses.

But could we turn around this undesirable situation? Could we foster economic growth after a disruption? In economic theory, when the reconstruction process generates more growth than previous scenario is known as Schumpeterian *creative destruction* or fertilization effect[4]. This concept was used in context of technological change in industrial production, but is worth it, extend it to the reconstruction process after a disaster.

All countries must strengthen their existing mechanisms for generating economic development, including disaster risk management and adaptation to climate change as key components of its

[1] García, A. & Muñoz Piña, "Desastres Naturales: destrucción creativa?", Economics Bachelor Thesis ITAM, 2014

[2] García, A. " Importancia de Factores Socioeconómicos en la clasificación de desastres hidrometeorológicos". Data Science Master Thesis, ITAM, 2015

[3] Field, Christopher B (2012). "Managing the risks of extreme events and disasters to advance climate change adaptation: special report of the intergovernmental panel on climate change" Cambridge University Press.

[4] Schumpeter, Joseph A. Capitalism, socialism and democracy. Routledge, 2013.

development process[5].
From the five steps of disaster risk management: Response, Recovery, Review, Prevention & protection and preparedness, this research focus on recovery phase and the impact of risk transfer instruments such as national funds for disaster relief.

## Disaster´s Dynamics

When a disaster occurs, it disrupt all the systems around our livelihood (political, human, social, natural, financial, physical, among others)[6]. These systems are complex and interlinked and the recovery of each one varies case specific. Given its nature the after-effects can slowly emerge long time after the disaster has occurred or even unleash a chain reaction of other disruptions[7], such as food shortages or pests.
After the emergency has passed, the research focus on the effect on the long run and how the disaster relief allocation processes affect this effect.

## Resource Allocation Process[8]

The Mexican government has two mechanisms to financially cope with disasters: the Catastrophe Bond (CATBOND) and the Natural Disaster Relief Fund (FONDEN). FONDEN is mainly used to reconstruct government infrastructure. When a disaster happens, the municipality and state ask the federal government the instalment of the damage assessment committee followed by a request for a declaration of disaster by the head of state government (Ministry of Interior). A Disaster Declaration means the state can access federal resources in the reconstruction process. If the event is not declared disaster, then the state and municipality will have to use their own resources.
Mexican Civil Protection Law defines disasters as: *"The result of the occurrence of one or more disturbing severe or extreme events, concatenated or not, of natural origin, of the human activity or those from the exterior space, which when they happen in certain time and space, resulting in damages and which for its magnitude exceed the capacity of response of the affected community[9];*
However there are not clear metrics on how to measure the level of disturbance. Figure 1 shows the damages in US dollars[10] versus the affected population by declared and non-declared events for 2003-2013.

[5] Garcia, A. & Muñoz Piña "Impacts of Natural Disasters on Mexico`s Economic Growth and Climate Change Implications", LACEEP Working Paper 201468.
[6] Zapata-Marti, (2006) "Disaster's Impact: Understanding and Attributing Trends and Projections of Damage and Losses. The ELAC Perspective", in Workshop on Climate change and Disaster losses, Center for Science and Technology Policy Research, Boulder, CO, USA
[7] CEPAL, PUBLICACION. "Manual para la Evaluación del Impacto Socioeconómico y Ambiental de los desastres." Santiago de Chile (2003).

[8] World Bank, "FONDEN: Mexico's Natural Disaster Fund-A Review, Washington D.C. World Bank Publications.

[9] Mexican Civil Protection Law Article 2 fraction XVI
[10] Exchange rate (1 USD /dollar = 17 MXN)

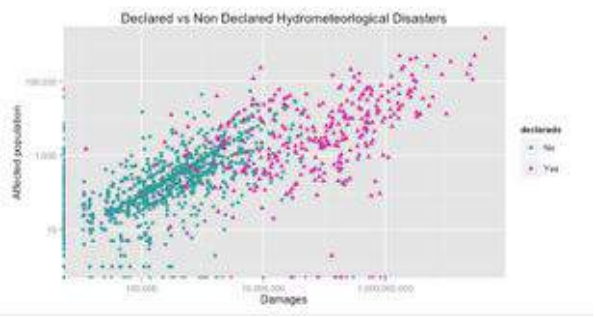


**Figure 1.** Damages and Affected population per disaster

Figure 1 shows the relationship between damages and affected population. It can be appreciated that disasters with low damages and low affected population are non-declared events, meanwhile events with higher damages and higher affected population are declared. The problem is in the cloud of points in the middle where is not clear why some events with similar characteristics (damages and affected population) have different outcomes in the declaration process.

## Important Variables [5]

The thesis "Identification of the Importance of Socioeconomic Factors in Hydro Meteorological Disaster Classification" focused on answering the question: What were the underlying variables affecting the outcome of the Mexican resource allocation process? For answering this question supervised machine learning approach was used[11] with political, socio-economic and meteorological data.
The results show that the main determinants for FONDEN resource allocation are: net damages, level of rain, type of event (e.g. heavy rain, floods, hurricanes, etc.), affected crops, and small and medium enterprises("Pequeña y Mediana Empresas"-PyMES) default rate.

## Disaster´s Economic Growth Impact [4]

The working paper "*Impacts of Natural Disasters on Mexico`s Economic Growth and Climate Change Implications"*[5] focused on answering the following questions: "What are the effects of natural disasters on economic growth in the medium[12] and long[13] term?" and "Does the country's national disaster relief system (FONDEN) make a difference in the final effects of a given event?"
For solving these questions we used an endogenous growth model with panel data for 32 Mexican states for the period 2002-2007.
The results show a difference between disaster magnitude (declared and non-declared). Declared disasters have a negative impact on economic growth in the short term, but this effect is lost in the medium term (2 years after the event). For the period of analysis, we cannot conclude if this effect sustains in the long term period[14] However, it was found a positive effect on growth of small and frequent disasters (mainly floods) in the first year after its occurrence, this effect persist till the second year; supporting the hypothesis of creative destruction" effect. This effect decreases as the intensity of the disaster increases (measured on population affected).

## Conclusion

This result ask the question if undeclared disasters received more assistance (government or private), will recovery

[11] Tree based classifiers, such as: tree, random forest, ada boosting ,and linear classifiers such as logit regression. Lasso regularization was used.

[12] Two to three years.

[13] More than five years.

[14] A bigger dataset is need.

boost this effect of creative destruction?
Further research should be done to analyze FONDEN effectiveness, the work done on the disaster's economic impact gives a glance that for catastrophic events the Mexican resource allocation process (FONDEN) works. And if the FONDEN rules should include a trigger mechanism such as the parametric insurance have to help decision makers speed up the resource allocation process.
A special mention of the work recently done by the World Bank [15] on evaluating the effectiveness of FONDEN. They conclude that access to disaster funding boosts local economic activity in the following year of the disaster.
There is a big challenge when analyzing big communities, since they are vulnerable to multiple kinds of events added to the amount of actors and resources. Further research should explore resilience metrics and visualization tools for helping decision makers. Data quality and alternative sources will be a critical point to develop this research area.

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[15] de Janvry, Alain, Alejandro del Valle, and Elisabeth Sadoulet. "Insuring growth: the impact of disaster funds on economic reconstruction in Mexico." (2016).

**Mapping (self-) recovery: reflections on people's trajectories, perceptions and aspirations of recovery in the Philippines**

Luisa Miranda Morel[1]

Email Address: MirandaMorel@careinternational.org
[1]CARE International UK

**Abstract**

This article discusses self-recovery drawing on existing literature and some initial reflections resulting from primary qualitative research carried out in the Philippines. It seeks to advocate for the fundamental role that disaster affected communities have in informing and leading recovery and DRR program design and implementation.

## Introduction

The interest in 'self-recovery' comes from the understanding within the humanitarian shelter sector that whether assistance reaches families or not, they will be the first to prepare and respond, and will always make an effort to recover after a disaster[1]. Granted, they will have different levels of initiative based on their capacity, resources and knowledge, but they will take steps to recover nonetheless.

Self-recovery is a pathway that the majority of disaster-affected populations take, as has been observed in the shelter sector[2]. Yet in disaster relief, recovery and risk reduction those most immediately affected by disasters can often become invisible in informing decisions for policy design, implementation and practice. Most of what informs policy and practice can be sourced back to evaluations, reports and data collection focused on specific sector-based humanitarian interventions rather than people's holistic processes and pathways of recovery and development[3].

[1] Parrack, C., Flinn, B. & Passey, M. "Getting the Message Across for Safer Self-Recovery in Post-Disaster Shelter", *Open House International*, 39 (3), (2014)
[2]Ibid.

[3] See for example Practical Action "Policy Position Paper on DRR" (n.d), ECHO "Thematic Policy Document No.5 on Disaster Risk

In light of this, the *Overseas Development Institute (ODI)*, the *British Geological Survey (BGS)*, the *EPICentre* at University College London and *CARE International UK* have initiated a multidisciplinary research pilot project on the Philippines and Nepal to understand *how individuals and communities self-recover from disasters.*
The following discussion explores what one method of this research - timeline mapping - has shown about self-recovery in the Philippines. This work gives some initial reflections on understanding such process that may contribute to considerations under the Sendai Framework for Disaster Risk Reduction[4].

## Mapping (self-) recovery

The Philippines research included visiting rural communities that had been assisted by CARE Philippines and other organisations after Super Typhoons Haiyan (locally known as 'Yolanda') in 2013 and Haima (locally known as 'Lawin') in 2016. In each community we met with leaders, carried out transect walks, facilitated focus group discussions, interviews and building surveys. A total of 14 rural communities were studied over a period of two weeks in the islands of Leyte and Luzon.
Timeline mapping was used in each community to build a picture of people's experiences explored through different disciplinary lenses (including the physical and social sciences).

**Figure 1**. Mapping trajectories in Leyte. Source: VS, 2017

Overall, the method involved three steps:

(1) Hazard mapping: these discussions began with a recollection of the typhoons, followed by discussing any other forms of local natural hazards and how the landscape, their livelihoods, homes, transport links and any other relevant aspects were affected.

(2) Community response: residents were invited to describe what they did before, during and after the typhoon. This included discussing the strategies they used in preparedness, construction and repair of their homes and community.

(3) Hopes for the future: this

Reduction" (2013), "Shelter Projects" (2008 , 2015-2016)
[4]SFDRR *Sendai Framework for Disaster Risk Reduction 2015 – 2030,* UNISDRR (2015)

discussion focused on understanding their future plans and how they hoped to achieve them based on their existing circumstances.

## Perceptions of risk

Of the fourteen communities, eight had been affected by Yolanda and six by Lawin. Although both were major typhoons, they were considerably different in their level and type of impact. Yolanda seemed characterised by the rain, flooding and storm surge it caused, whereas Lawin was characterised by strong winds. Furthermore, while Leyte's communities were living on low-lying areas, the communities studied in northern Luzon lived on higher land or were surrounded by mountains that moderated the winds of Lawin. People demonstrated awareness about these environmental factors and related them to their different choices in evacuating, preparing and rebuilding.

Timing also differed. While Yolanda struck during planting season, Lawin struck before the harvest. We often heard comments from those affected by Yolanda that they "did not expect it to be 'that bad' because the day was beautiful and they were used to having typhoons". The same communities affected by Typhoon Ruby one year later expressed that they evacuated immediately and were desperately scared that they risked the same impact as Yolanda. Some Lawin-affected communities discussed what they had heard about Yolanda and how this made them wary, so they evacuated.

The timelines and the discussions that accompanied them also demonstrated that, while these disasters did affect residents significantly, many are living in contexts of severe poverty, multiple hazards and had communal organizational structures, collective and individual priorities existing prior to the disaster. The Philippines is, after all, a country where all forms of natural hazards form the 'fabric of everyday life'[5]. Furthermore, many rural communities living in northern Luzon are tenant farmers who discussed the impact of the introduction of the reaper to farming systems (a mechanised harvester). Their labour was replaced with machinery pushing them into more challenging working conditions and the accumulation of debt. Some residents went as far as identifying the reaper as a hazard within the timeline, forming their own interpretation of the term. After Lawin, they explained, the assistance they received was for shelter but either way they could not recover because they had already been 'drowning in debt' before the disaster. Their perception of the impact of the hazard was significantly connected to conditions of debt prior to it.

These discussions also enabled the probing for information on how residents had rebuilt their homes and whether they had followed any of the 'build back safer' (BBS) messages promoted by the Shelter Cluster[6]. Decisions about how strictly to follow these messages appeared to come down to resources and materials available, priorities between aesthetics and safety, and technical knowledge and understanding. However, while residents were aware of the BBS messages and understood reasoning for them, the timelines demonstrated

[5]Field, J. "A Culture Clash? Exploring 'appropriateness' and 'relevance' in the response to Typhoon Haiyan/Yolanda*", Save the Children and the Humanitarian and Conflict Response Institute* (2016): p.57

[6]Shelter Cluster "Response to Typhoon Haiyan (Yolanda)" 19th June 2014, https://www.humanitarianresponse.info/; (2014)

choices that did not follow such rationale. For example, some residents explained that they had changed the design of their houses from one to two floors after the typhoon. Despite being aware of this risk, they justified it by reasoning that during flooding they could move their belongings to the top floor. Flooding is a much more common occurrence than a super typhoon, which an observer might think would be a much higher priority.

Understanding people's perceptions of risk requires deep engagement with the contexts, processes and systems in which they experience a disaster. Perceptions of risk are constantly shifting, responding to the circumstances in which communities find themselves at specific points in time. Furthermore, external points of view on the conceptualisation of 'hazard' and 'risk' may differ considerably from that of an affected resident. As a result, external generalisations on such perceptions and the 'impact of disasters' can be highly constraining in their effect on informing policy, governance and disaster management and reconstruction[7]. For example, generalisations about two typhoons of the same category, affecting islands, within the same country; this is often the level of generalisation that may inform the quick decisions humanitarians are forced to make in contexts of emergency.

Although there has been a drive toward greater community participation in response mechanisms and design (to varying degrees[8]), literary discussions and evidence suggests this may still not be enough for practice. Increasing advocacy for affected communities to have leadership, implementation and decision-making power in these processes pushes for greater investment in actions of empowerment, knowledge and ownership transfer over risk management and recovery processes.

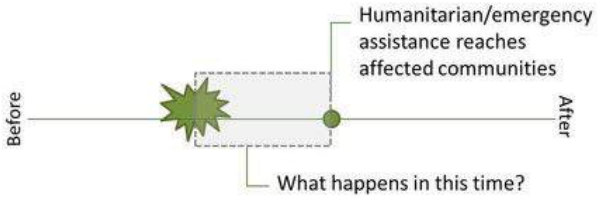


**Figure 2**. We know little about what happens prior to the arrival of assistance
Source: L. Miranda Morel, 2017

## From self-recovery to DRR

A clear message from community residents was that self-recovery starts before a disaster, with preparedness. Communities often shared knowledge of their neighbourhood, knowing who to seek aid from and which houses were stronger than others. They also provided examples of how they had strengthened their homes, how they had cut down trees, carried out seed banking and harvested what they could before the typhoon. These were all actions taken prior or during the event.

As first responders, disaster affected communities shared experiences on having to walk for miles in search of food and potable water; having to ring family members to send money and tools to them; having to salvage materials from the remains of the destruction and working together to rebuild temporary shelters and fix rooves within hours of the typhoon.

[7]Twigg, J. "Disaster Risk Reduction" *Good Practice Review 9*, Humanitarian Policy Group, Overseas Development Institute, (2015)

[8]Davidson, C.H., et al. "Truths and myths about community participation in post-disaster housing projects" *Habitat International* (2006)

Most explained that the first external assistance appeared after a month, sometimes later. These discussions highlighted the little we know about what happens prior to the arrival of assistance (see image 2).

Whilst many were thankful for the assistance received, they demonstrated that at different moments, prior to, during, immediately after, one to two months later and today, their needs and priorities had changed and shifted frequently. Whether the assistance they received was flexible enough to respond to these needs at different moments and truly contribute to their effective recovery is more questionable. While some residents expressed that they were still waiting for government assistance, others expressed that the government assistance they had received was unnecessary or inadequate. One man discussed having received shelter cash when in fact they needed livelihood assistance to repair their irrigation canals, which had been damaged by landslides.

Similarly, whilst the BBS messages had reached communities and were among the first thing we saw upon entering them; many explained that they had already rebuilt their house by the time this assistance and information had arrived. They had spent their resources on materials and were mainly making alterations and prioritising their children's education, their livelihood or repaying debts, over the strength of their home. Others demonstrated prioritising aesthetics at the level of the home and beyond[9] over building back safer. Residents were proud to show their homes. For instance, one lady explained she had invested in the room at the front of the house before her kitchen because it was the first thing people saw as they came in, even if the back of her house was not finished yet.

Gaining a better understanding of how people act upon, and react to, disasters on their own (hence, self-recover) may inform how shifting needs, existing knowledge, opportunities, availability of resources and information are already at play by the time any external intervention takes place; and how these come into play during preparedness and long-term risk reduction. Creating mechanisms to bridge this knowledge gap, understanding existing dynamics and empowering communities to communicate them in real time should be a priority in DRR and development.

## Conclusion

People are not passive and are the first to respond. Their perceptions, needs and priorities constantly vary depending on type and level of disaster impact, timeliness and existing circumstances. Yet, they have the capacity to understand their environment and transfer resilience and knowledge to future generations better than any external intervention or actor. This presents an unmissable opportunity to work in closer collaboration with them. Their ownership of preparedness, response, safer reconstruction and rehabilitation is therefore fundamentally necessary in DRR.

This article has sought to support this argument by sharing some initial insights into understanding people's experiences in recovery and risk perception. It seeks to highlight a clear drive for disaster-affected communities to have more control over their process of recovery and for responders, policy

[9]Field, J. discusses the importance of 'pampering' for recovery as effective humanitarian assistance in "A Culture Clash? Exploring 'appropriateness' and 'relevance' in the response to Typhoon Haiyan/Yolanda" (2016)

makers and other relevant stakeholders to invest further in opening up accessible communication and collaboration channels between those recovering from disasters and those seeking to assist them.

# Training disaster medicine trainers

Andreia Oliveira[1,2], Marian Sedlak[1,3] , Isabel Jiménez [1,4]

Email Address:neiamlvr@gmail.com
[1] International Federation of Medical Students' Associations (IFMSA)
[2] Faculty of Medicine, University of Porto
[3] Pavol Jozef Safarik University in Kosice, Faculty of medicine
[4] Faculty of Medicine, University of Salamanca

## Abstract

During the Third United Nations (UN) World Conference on Disaster Risk Reduction (DRR) in 2015, the Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted, urgently calling the international community to take action on DRR all around the world. Throughout the whole disaster cycle, health has always been heavily present, being both sensitive and crucial to disaster preparedness, response and recovery. However, in the medical curricula, Disaster Medicine is barely covered, giving rise to a generation of young practitioners lacking the knowledge and skills to act in these situations. Training disaster medicine Trainers (TdmT) aims to fill this gap in the education of medical students, creating a resilient generation of future health care practitioners, well equipped to face and contribute to disaster risk reduction.

## Introduction

Over the last century, the number of disasters has increased at a remarkable pace[1], indicating a highly possible future in which generations of physicians will be called upon to provide mass-casualty treatment to an even greater extent than before. A number of studies point to the lack of adequate training in the medical management of disaster response – a deficiency that has become dramatically apparent in the recent past. In every major emergency situations, there would always be a significant amount of aid personnel who lack the essential skills which positively lead to many government agents and scientific institutions to agree that disaster medicine education should be included in the standard medical curriculum.[2][3][4] The

[1] World heading for catastrophe over natural disasters, risk expert warns
, consulted at https://www.theguardian.com/global-development/2016/apr/24/world-heading-for-catastrophe-over-natural-disasters-risk-expert-warns on April 2017.

[2] Jared Smith, Matthew J. Levy, Elbert B. Hsu, J. Lee levy. Disaster Curricula in Medical Education: Pilot SUrvey. Prehosp Disaster Med. 2012;27(5):492-494

[3] Issam Barrimah, Ishag Adam & Abdulrahman Al-Mohaimeed. Disaster medicine education for medical students: It is a real need? Med Teach. 2016;38

[4] Amy H. Kaji, Wendy Coates, Cha-Chi Fung. A Disaster medicine curriculum for medical students. Teach Learn Med. 2010 Apr;22(2):116-22

importance of enhancing education and training in disaster medicine has been widely agreed upon by medical students. Thus, they have decided to take a step forward in taking the lead on the response to public health emergencies and disasters. However, recent studies have shown that only a small percentage of medical schools worldwide have included disaster medicine education into their study programs. Therefore, training medical students to obtain competencies for becoming humanitarian health professionals is certainly needed.

As the Sendai Framework for Disaster Risk Reduction says, there is an urgent need to ''*enhance the resilience of national health systems, including by integrating disaster risk management into primary, secondary and tertiary health care, especi*[5]*ally at the local level''*[5]*.* This means that a greater emphasis needs to be placed on developing the capacity building of health workers in understanding disaster risk and implementing disaster risk reduction approaches in health care work. It has also been recognized that promoting and enhancing the training capacities in the field of disaster medicine as well as supporting and training community health groups in disaster risk reduction approaches is crucial for strengthening health systems and making them resilient in front of disasters. At the same time, there is a need for stronger collaboration among different sectors, as well as in the implementation of the International Health Regulations (2005) of the World Health Organization''.[1]

As mentioned previously, unfortunately the topic remains poorly represented in various medical curricula, especially in countries that are often stricken by disasters, whether it be natural, biological, technological or man made origin. We believe, as future health care professionals, that it is imperative that we take the lead and advocate for better disaster preparedness within the health systems. Hospital safety as well as health professionals endangerment while responding on the frontlines is an enormous problem where reports of such attacks have been received at an alarming rate, especially after the events in Afghanistan[6], once again underlining the fact that there is still much work to be done in the awareness and implementation of the International Humanitarian Law.

A study involving Italian medical students confirmed a certain level of awareness of Disaster Management (DM) but little to no curriculum coverage[7]. In the European Union DM training programs are mostly masters level, targeting emergency responders, and without external funding available to students[8]. In the United States DM training focuses primarily on pandemic influenza and hazards planning[9].

As a result, after realizing the lack of knowledge in disaster medicine amongst medical students, a group of medical students from 4 different countries - Sweden, Germany, Poland and USA -

[5] Sendai Framework for Disaster Risk Resilience 2015 - 2030. (UNISDR) Available online here: http://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf

[6] Kuduz Hospital airstrike. 2015 (MSF) Available online at: http://www.msf.org/topics/kunduz-hospital-airstrike

[7] Ragazzoni L mfl. Italian medical students and disaster medicine: awareness and formative needs. Am J Disaster Med. 2013 Spring; 8(2):127-36. Doi: 10.5055/ajdm. 2013.0119

[8] Ingrassia PL mfl. Education and training initiatives for crisis management in the European Union: a web-based analysis of available programs. Prehops Disaster Med. 2014;29(2):1-12

[9] Smith J mfl. Disaster curricula in medical education: pilot survey. Prehops Disaster Med. 2012; 27(5):492-494.

started to deliver short peer-to-peer trainings after pursuing self-learning in disaster medicine. These activities took place through the platform of the International Federation of Medical Students' Associations (IFMSA)[10]. IFMSA received support in delivering of these basic courses from expert groups, such as the Research Center in Emergency and Disaster Medicine (CRIMEDIM[7]). Due to increasing demands to deliver basic courses to medical students around the world, IFMSA and CRIMEDIM created the Training disasters medicine Trainers (TdmT) course.

Since 2008 the CRIMEDIM and the Segretariato Italiano Studenti in Medicina - SISM (a National Member Organization of IFMSA) have been consistent in their success to deliver a nationwide disaster medicine program to provide theoretical knowledge and basic skills in this field, training twenty Italian disaster medicine trainers and indirectly, more than 1500 medical students every year.

The TdmT is an innovative international course which aims to create international train-the-trainers class of medical students. Medical students from all over the world are trained by disaster medicine experts to become trainers for their peers and deliver introductory courses/workshops in Disaster Medicine.

## Methods

Training disaster medicine Trainers (TdmT) takes the format of an informal education course, where medical students are engaged in a learning-conducive environment with theory, simulations and immediate feedback. TdmT consists of a Massive Open Online Course, followed by a face to face residential course.

The teaching methodologies vary through a wide range of approaches, including conventional lectures and innovative teaching methods, such as case studies and discussions, problem based learning, simulations (table top simulations, virtual reality simulations and computer based simulations), debates, trainings and the preparation of assignments throughout the course.

The summer course covers all the major topics in the Disaster Risk Management field, with daily classes and trainings. Through this residential course and the online training, participants gain skills and extensive knowledge on the following topics:

- Disaster governance and operational structure;
- Prehospital disaster management;
- Hospital disaster preparedness and response;
- Health response in conflict;
- Risk assessment;
- Communication in disasters;
- Health consequences of disasters;
- Psychological first aid;
- Disaster bioethics;
- Disaster management and legal framework;
- Disaster medicine research and data collection;
- Teaching methodology;
- Presentation skills;
- Leadership;
- Adult learning theory;

Lectures and simulations are mainly held in SIMNOVA, the Simulation Center of the Università del Piemonte Orientale, with some on-ground experiences in the

[10] [The IFMSA is the oldest (1951) and largest (132 NMOs & 124 countries) independent organization representing associations of medical students internationally . Available online at: https://ifmsa.org/

[7] The Research Center in Emergency and Disaster Medicine, CRIMEDIM is a university-wide academic centre that conducts research, education and training in the field of disaster medicine. Available online at: http://www.crimedim.uniupo.it

dispatch center of Novara and in a training center of a canine rescue team.

## Results

Since 2014, two international courses were conducted: the first course was delivered in 2015/2016 with 10 participants and the second course in 2016/2017 with 17 participants. Residential phases of both courses were held in Novara, Italy, followed by a 3 month period of online learning. The third edition of TdmT is starting in April 2017.

In 2016 and 2017, more than 15 follow up activities were hosted by graduate students, several International Trainings on Disaster Medicine (ITDM) workshops were conducted, as well as independently organized workshops and trainings in students' communities or during international events (e.g. YoFest! 2017 in Maastricht). After all activities and lectures, proper feedback and evaluation are taken in order to appraise and improve the quality of activities.
Overall, more than 170 medical students around the world are influenced by International Trainings on Disaster Medicine (ITDM) delivered by TdmT graduates and at least 380 students have been involved in other related educational activities done by TdmT graduates.

## Discussion

TdmT aims to fill the gap in disaster risk reduction education in the medical curricula, aspiring to have a substantial impact on communities due to the responsibilities of medical personnel in disaster risk reduction. Education and training for a wide spectrum of health care professionals, including medical students, are very progressive and promising tools to improve resilience of communities towards disasters.
The key objective of this initiative is to create a wide and sustainable capacity building network for medical students around the globe. Trainers graduated from this course are able to deliver local, national and international disaster medicine trainings, which aim to widen the spectrum of medical students with disaster risk reduction knowledge. By these means they contribute to development of communities which are sensitized and prepared to engage in disaster management and disaster risk reduction initiatives.
Above all, TdmT envisions the world in which communities are empowered and ready to engage in prevention and response to disasters. We believe that medical students can play a central role in such activities, therefore, the further we reach with our initiative, the greater impact TdmT will have, month after month, year after year.

## Acknowledgements

We would like to thank the CRIMEDIM (The Research Center in Emergency and Disaster Medicine) for their constant support, assistance and encouragement for our DRR activities. We also want to thank the IFMSA and its national member organizations for their consistent and tireless attention and engagement in DRR activities.

**Youth in disaster response in Bangladesh: exploring the experience, opportunity and challenge**

Khalid Md. Bahauddin[1], Swe Zin Linn Phyu[2], Asif Iftakhar[1]

Email Address: khalid.bahauddin@gmail.com
[1]Youth Environmental and Social Service, Bangladesh
[2] American Intercon Institute, Cambodia

## Abstract

Bangladesh is one of the most climate-vulnerable countries in the world. Over the last thirty years, Bangladesh has experienced nearly 200 climate-related disasters accounting for damage of assets, property and, livelihoods and thousands of deaths. Engaging youth is critical in order to make the disaster management system operative in an effective and efficient manner. Bangladesh should utilize its youth population as 30 percent of the total people are young (according to National Youth Policy of Bangladesh, 2017, population in the age group of 15-30 years has been defined as youth[1]).
. A better understanding of the roles and responsibilities of youth in disaster management system is long overdue. This paper explores the role of Bangladeshi youth in disaster response, gaining experience, finding opportunities and face challenges related to disaster response activities. This study found that the youth of Bangladesh has huge interest and motivation in engaging themselves in disaster response activities but some factors encumber them to participate such as lack of training, lack of availability of safety instruments and insurance, lack of coordination and information sharing, lack of recognition and good internal work environment and, gender inequality. Policy makers and relevant stakeholders of Bangladesh should consider the findings of this study so that more youth of Bangladesh will be motivated to participate in disaster response activities.

## Introduction

Bangladesh has experienced over 200 climate change-induced disasters since 1980, leaving a total death toll of approximately 200,000 people and causing economic loss worth nearly $17 billion[2]. Every year, Bangladesh loses 1.8 percent of GDP to natural disasters. It is estimated that 14 percent of our GDP is vulnerable to disasters[3]. In order to make

[1] National Youth Policy, 2017, Bangladesh ( 2017). https://www.google.com/url?q=http://goo.gl/Cpk6bk&sa=D&ust=1495140467210000&usg=AFQjCNGDlmWt8zHD9udfYAc-UCL_NI4JcA

[2] Rahman, A. and Alam, M. (2014). 'Mainstreaming Adaptation to Climate Change in Least Developed Countries (LDCs): Bangladesh Country Case Study'. IIED Working Paper, (2).

[3] World Bank. (2009). 'Bangladesh: Economics of Adaptation to Climate Change Study'. http://documents.worldbank.org/curated/en/84191

the disaster management system operative in an effective and efficient manner, Bangladesh can utilize its youth population as 30 percent of the total people in Bangladesh are youth[3]. History says that when disaster strikes anywhere in Bangladesh the local youth are the first ones to respond. They take on roles and responsibilities and take action – including life-saving decisions. They respond spontaneously and take part in planned relief and recovery action. This includes them protecting lives, providing health care, distributing relief, caring for children and adults, and offering a hand in psychosocial support, health and hygiene education, reconstruction, planning and evaluating emergency relief work[4]. This paper looks at the role of the youth of Bangladesh in disaster response by exploring their experiences, opportunities, and challenges they face during disaster response activities.

## Methods

This work is qualitative in nature and involves 30 youths (15 male and 15 female participants) aged 20-26 who study at different Universities in Dhaka city and have been purposively selected in order to explore their experiences, perceptions and challenges regarding disaster response activities in Bangladesh. It should be noted that these 30 youths participated in different natural disaster response activities such as Cyclone Sidr, 2007; Cyclone Aila, 2009 and Cyclone Roanu, 2016. They were selected by formal and non-formal organizations to participate in this emergency response activity. Data were collected through focus group discussion (FGD) and in-depth individual interview (IDI).

## Discussion

Based on FGD and IDI, youth said that they participated in disaster response activities on their own interest and motivation. They believed that sharing time and effort change lives: that's the one strongest and simplest reason for them participating in emergency response work. Most of the studied participants thought that by giving time and effort to do something practical for affected people in the community they can enrich their lives so they can stay active, independent and continue to contribute to society. One interviewed participant expressed "if you spend at least a couple of hours with affected people in the community it will make you feel great; it just takes one visit, one conversation, one laugh from someone who's spent a few days alone, or one heartfelt thank you. And it's also a fact that people who share their time and efforts with others live longer!".

Most of the participants said "I participated in disaster response activities for affected people because I find something incredibly satisfying about acting in a way that is consistent with my principles. Being able to say I changed something in the world, in the lives of others, gives meaning to my being here beyond simply looking after myself. For me, it changes my life from being purely self-centered to being something with meaning for others, too."

1468331803769/Main-report

[4] IDMC » Bangladesh: Comprehensive response required to complex displacement crisis. (2014). Retrieved March 13, 2017, from http://www.internal-displacement.org/south-and-south-east-asia/bangladesh/2015/bangladesh-comprehensive-response-required-to-complex-displacement-crisis

According to participants it is an exceptional feeling that cannot be expressed in words. By being a volunteer for emergency response they are able to work directly with the affected people. All expressed that it is highly rewarding when the support saves someone's life or change someone's life for the better.

The studied participants highlighted the significance of training and orientation before sending them to the affected areas. They experienced that proper training is decisive for this kind of activity. They felt that it is important to get advanced training and life saving techniques. Based on participants' interviews, there is lack of adequate personal protection equipment (PPE) and insurance for emergency response personnel. They said with concern that PPE should be provided for all personnel because it is important to protect them as well as enable them to be able to work properly. Most of the studied participants said "We go for emergency response related work, not to become victims, however there are always risks including life, injury and psychological harms. We were worried that we do not have life insurance".

All the interviewed respondents expressed that it is always imperative to have recognition and respect but they did not actually get it. They thought if this continues, youth will be unmotivated to engage with emergency response work. They said that by raising awareness people will understand the importance of their work. There should be more media coverage to let people know about their contribution to communities and the country. Almost all respondents urged that formal and non-formal organizations who assign personnel should inform their families about the nature of work, risks and opportunities but they do not do this, they only inform the personnel themselves. They should engage families of activists so that families allow them to be involved in this type of work.

Some respondents cited that there is lack of coordination, nepotism, negative attitude, and inequality in the work among higher managements which hinder them to work freely and make them demoralized in response activities. Some respondents expressed that in many cases tasks allocated to the youth are not suited to their interests, skills and experience, these factors need to be carefully considered by the organization.

In addition, respondents revealed that poor information sharing and coordination cause difficulties for youth personnel in emergency response activities. It is noted that most of the female respondents revealed that there is an evidence of gender inequality in disaster response work, organizations prefer males to females. One female respondent expressed "like other social and cultural problems, there is still inequality between male and female youth in the selection process conducted by the organizations. Organizations think that males perform better than females with heavy and risky disaster response activities".

## Conclusion

Bangladesh youth is now taking an active role in climate change adaptation and local disaster programs strengthening their spirit of volunteerism and unleashing their potential in helping build disaster-resilient communities[5]. This

[5] Cumming, Ayden. "A research report on "Motivations for young People Volunteering in Urban Slums of Freetown, Sierra Leone" Y Care International, 2015, p10-12

study found that the youth of Bangladesh has huge interest and motivation in engaging themselves in disaster response activities but some factors hinder them to participate in this kind of work such as lack of training, lack of availability of safety instruments and insurance, lack of coordination and information sharing, lack of recognition and good internal work environment and, gender inequality. Engaging youth is critical for the success of overall disaster management, the findings of this study should be considered by policy makers and relevant stakeholders in Bangladesh so that more youth of Bangladesh will be motivated to participate in disaster response activities as Bangladesh is one of the most vulnerable countries in the world to climatic disasters.

# DISASTER Risk Reduction

## Disaster Risk Reduction & Cross-Cutting Issues

UN Major Group for Children and Youth
the space for children and youth in the United Nations

**Business recovery after Gorkha earthquake 2015 in Nepal**

Suraj Gautam[1], Ranit Chatterjee[2], Basanta Raj Adhikari[1]

Email Address: suraj.kinetic@gmail.com
[1]Department of Civil Engineering, Pulchowk Campus, Institute of Engineering, Tribhuvan University, Nepal
[2]Graduate school of Global Environmental Studies, Kyoto University, Japan

## Abstract

The Gorkha earthquake of 2015 had significant impact on the private sector in Nepal. The study takes a mixed approach to considers recovery process of manufacturing sector in Kathmandu valley and how is the impact on the resilience based on the Sendai framework of action for disaster risk reduction. The findings suggest three areas of importance for resilience building namely; insurance, reconstruction and repair and awareness generation.

## Introduction

The Sendai Framework for Disaster Risk Reduction (SFDRR) has paved a new direction for the post 2015 development agenda and acknowledged private sector as a major stakeholder in disaster risk reduction. Further the science and technology group acknowledged that easy access of scientific knowledge and networking among various stakeholders is necessary to reduce losses[1]. Chatterjee et al. suggests a need for an all-inclusive approach to integrate science and technology with DRR policies in the light of the high economic losses in the Asian region in the recent years[2]. Furthermore, Shaw et al. has stressed the need for evidence-based models for resilience building through recovery and resettlement

[1] UNISDR (United Nations International Strategy for Disaster Reduction)." Sendai Framework for Disaster Risk Reduction" 2015–2030 United Nations; (2015).

[2] Chatterjee, R., Shiwaku, K., Das Gupta, R. Nakano G. and Shaw R.. "Bangkok to Sendai and Beyond: Implications for Disaster Risk Reduction in Asia"; Int J Disaster Risk Sci (2015) 6: 177. doi:10.1007/s13753-015-0055-4.

processes[3].

Post Sendai Conference, Gorkha Earthquake-2015, of Nepal was the first major disaster and as a result, the earthquake recovery and subsequent risk reduction activities is on the crosshair of international community to comprehend its implementation and implications. Along with loss of life and property, the private sector specifically the manufacturing sector suffered extensive damage.

This article is based on the fieldwork done in Balaju Industrial District (BID) and Patan Industrial Estate (PIE) of the Kathmandu valley between 2016 and 2017 to understand the recovery process of the manufacturing sector and how various factors stated in the SFDRR influences the private sector recovery and future resilience. In addition in-depth interview with the industrial management board and national reconstruction committee members were conducted. Qualitative analysis of field level data leads to identification of gaps between global and national polices and ground implementations. The findings are consolidated to develop a set of recommendations for private sector recovery in disaster.

## Role of Private Sector in Sendai Framework

The private sector has significant impact on the economy after a disaster. The private sector roles became important for disaster risk reduction in Asia after 2012 AMCDRR conference. These priorities for private sector are encompassed strengthening collaboration, capacity building and promote standards and reporting of resilience[4]. The SFDRR highlighted the need for the private sector, academia and civil society to work together and disseminate good practices globally. Specifically business houses need to mainstream DRR in their daily activities. Promoting disaster risk transfer and insurance, risk-sharing and retention and financial protection and mainstream risk reduction in business continuity planning were deemed essential.

The outcomes of SFDRR relied heavily on the mutual collaborative efforts between private sector and national government and underplayed the role of regional organizations and regulatory bodies. Further in the SFDRR, the commitments came mainly from the large-scale private enterprises[5].

## Private Sector Recovery in Nepal

Shortly after the earthquake the Government of Nepal had conducted the Post Disaster Need Assessment (PDNA), which highlighted that commerce and Industry sector were

[3] Shaw, R., Izumi, T. and Shi, P. "Perspectives of Science and Technology in Disaster Risk Reduction of Asia"; International Journal of Disaster Risk Science (2016); 7: 329. doi:10.1007/s13753-016-0104-7

[4] Statement of Private Sector on Disaster Risk Reduction at the Fifth Asian Ministerial Conference on Disaster Risk Reduction Yogyakarta Declaration Annex 09- 24 October 2012.

[5] ibid (same as 2)

second most affected sector after social housing. The PDNA identified physical damage, disruption of trade, infrastructure loss and labour problems as effects of the earthquake on the manufacturing industry.

The overall damage and loss was highest in Kathmandu valley for the industry sector and majority of the need was for reconstruction and replacement of assets mainly in the first 2 years from the earthquake[6].

The Post Disaster Recovery Framework (PDRF) took a holistic approach to address physical, socio-economic and institutional recovery[7]. But considering the long history of unstable government and disconnect between community and national government and not addressing the existing vulnerabilities made the implementation a difficult task. As a part of this study two industrial clusters namely BID and PIE in Kathmandu are selected (Fig-1). There are 97 and 102 functional units employing 3500 and 1800 people respectively in BID and PIE.


**Figure 1.** Location map of Balaju and Patan Industrial Area[8]

## Methodology

The first two years are crucial for business recovery and manufacturing and service sector among other sectors is more likely to prepare for disasters as was studied for Northridge earthquake[9]. The present study focus on manufacturing units in BID and PIE. The first phase of the questionnaire survey and interviews with the owners was conducted in Balaju in February 2016 with 18 samples selected randomly. In the second phase in November 2016 10 more samples were collected from Balaju area. The third phase of survey was done in Patan in March 2017 and 30 sample were collected. For this study, data relating to physical repair/ reconstruction, insurance and preparedness are used. In addition to this, in-depth interviews were done with Members of Balaju Industrial District Management and

[6]Government of Nepal "Post Disaster Need Assessment" (PDNA), Nepal". National Planning Commission, (2015) page (101-114).

[7] Post Disaster Recovery Framework 2016-2020 (2016). National Reconstruction Authority, accessed online at http://reliefweb.int/sites/reliefweb.int/files/resources/PDRF%20Report_FINAL10May.pdf

[8]"Souvenir" Industrial District Management Limited (2012). (Hard copy available with author)

[9] Dahlhamer J M. and Reshaur L. (1996). Businesses and the 1994 Northridge earthquake: an analysis of pre-and post-disaster preparedness;(1996)

National Reconstruction Authority. Comparative trend analysis is used for the collected data from questionnaire survey while narrative analysis is used for the in-depth interviews.

## Findings from the Balaju and Patan Industrial Area

The highest damage and loss to the industry and commerce in financial terms was in the Kathmandu valley. The impact of earthquake were of varying magnitude in Balaju and Patan industrial area. The buildings in Balaju were majorly load bearing where as in Patan were majorly framed structures. This can be related to the local municipal guidelines, or nature of ownership. In Balaju, majority of units are on lease or rent while in Patan majority of them were owned which gives them freedom to select the type of structure. The nature of damage was more severe in BID in comparison to PIE. In both areas the damages were repaired within 2 years of the earthquake.

Insurance in Balaju were mainly taken up property or machinery while in Patan majority of the insurance were accidental insurance and vehicular insurance. Only insurances related to business were considered and individual insurance policies were not considered for the study. Only one of the owner reported settlement of claims for damage to the company car. Further, the Manufacturing units in both Balaju and Patan depend both on local and international market for raw materials but their customer base is only within Nepal mostly in the local markets in the valley region. A summary of data collected is given in table 1.

**Table 1**. Summary of data collected from BID and PIE

| Factors | BID | PIE |
|---|---|---|
| Total surveyed units | 28 | 30 |
| **Recovery Time** | | |
| <2 yrs | 9 | 28 |
| >2- <3 yrs | 17 | 0 |
| >3 yrs | 2 | 2 |
| **Scale of business** | | |
| Large | 2 | 2 |
| Medium | 11 | 7 |
| Small | 15 | 21 |
| Type of physical damaged | Major-7<br>Minor- 13 | Major-3<br>Minor-12 |
| Status of repair/reconstruction | Repaired-17<br>Under repair-0<br>Not repaired-3 | Repaired-9<br>Under repair-1<br>Not repaired-5 |
| Insurance available | 23 had insurance | 25 had insurance |
| Insurance claimed | 0 | 1 |
| Preparedness | Fire extinguisher-17<br>Smoke detector- 0<br>First aid kit-10 | Fire extinguisher - 24<br>Smoke detector- 1<br>First aid kit-26 |

Further none of the units in Balaju and Patan have prepared Business Continuity Planning (BCP).

## Discussion

Economic recovery after a disaster aids the physical recovery and hence

should complement each other. But in case of Nepal the economic recovery has taken a backseat with housing reconstruction taking the center stage. The first two to three years are crucial for the business recovery as is seen in case of manufacturing units in Balaju and Patan where majority of the business would recovery by 3 years hence the business recovery framework needs to optimize the recovery process.

The building codes have come into act in Nepal in 1994 considering that majority of the buildings were built before that, as a result there is low compliance to the codes. The buildings in BID and PIE were built mostly after 1960 and 1964 with further modification by the owners. The municipal building permit process does not account for the compliance of NBC and there was lack of necessary level of experience of implementing, supporting and/or enforcing design rules[10]. Further it is seen that most business units repair and reconstruct early in the recovery period on their own. In this regard chatterjee et al.[11] finds that such repair works do not follow the minimum standards and hence leads to increase in physical vulnerability. Non availability of insurance claims also is a factor for low budget repair works. The insurance sector in Nepal has started in late 1940's but till date has only one government insurance agency rest others being private agencies. The BSIB report suggest lack of expert surveyors, limited insurance products and low market penetration in Nepal in normal situations[12]. As result, most of the companies failed to deliver effectively in the post-earthquake scenario. Further the delay in process of settling claims forced the companies to invest their own money to for repair and reconstruction work. As per the Balaju industrial district management members, the effectiveness of property insurance in case of insurance companies settling the claims is also negligible as only 10 to 20% of the cost of the damage could be claimed. Mere investing in insurance do not assure speedy recovery but bettering insurance infrastructure and available expertise is an important factor for settling insurance claims. The preparedness and awareness on disaster management is an important factor for building resilience. The first phase of the survey showed most units in Balaju area had no provision for fire safety and first aid kits available. But in the subsequent phase of data collection due to fire safety audits and awareness generation done by the fire brigade, all units in Balaju and more than 80% of the units in Patan reported to have fire safety

[10] Parjuli Y.K., Bothara J.K., Dixit a. M., Pradhan J.P. and d Sharpe R." Nepal building code - need, development philosophy and means of implementation". 12 World Conference in Earthquake Engineering, Auckland. (2000).

[11] Chatterjee R, Okazaki K., and Shaw R. "Understanding Recovery Process of Small and Medium Scale Enterprises (SMEs)"; After 2015 Nepal Earthquake and Impact on Resilience Building, (In press)

[12] BSIB report. "Existing Scenario of Nepalese Insurance Industry" (2012).

equipment and first aid kits. This highlights the needs for institutionalization of the safety audits and awareness to be accepted by the business houses.

## Conclusion

Understanding recovery patterns and differences based on ground data and customizing recovery plans as per the local needs is the key to an effective recovery leading to resilience. The role of science and technology is to identify the implementation gaps in the SFDRR and help in preparing an implementation plan. Specific learning from this study are:

1. 'Build Back Better' needs take into the reconstruction and repairing of industrial buildings and support them through technical knowledge from the local government and NGOs.
2. Disaster risk insurance is only effective risk transfer needs to build on the insurance infrastructure and expertise for effective recovery.
3. The preparedness measures and awareness generation activities are effective when institutionalized.

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# The role of microfinance sector in disaster risk reduction in India

Shambhavi Srivastava[1], Rupika Singh [1]

Email Address: shambhavi.srivastava@ifmr.ac.in
[1] Project Manager /IFMR LEAD, India

## Abstract

Microfinance Institutions (MFIs) largely cater to poor and near-poor populations. Not only are MFI clients excluded from the formal financial system, they are highly vulnerable to external shocks such as disasters, which puts them at greater risk. At the same time, many MFIs in India operate in communities and regions which are predictably hit by disasters year after year, while others work in more stable yet disaster-prone areas. Disasters hinder the ability of microfinance clients to repay loans efficiently by impacting their livelihood and productive assets. Given the demographic section that MFIs cater to, MFIs have a responsibility to and a vested interest in addressing the issue of disaster management within their "curricular" to ensure both their own institutional sustainability, as well as the resiliency of their clients. Through DRR-related products, greater awareness of client needs and internal risk management procedures, MFIs can play a key role in continuing to support populations most affected by disasters. Promoting such activities would not only increase the ability of poor households to cope with different kinds of crises, but also in turn protect the MFIs' portfolios.

## Introduction

The frequency and impact of disasters across the globe has grown exponentially over the past several decades. In the past 20 years, 90 percent of major disasters have been caused by 6,457 recorded floods, storms, heat waves, droughts and other weather events. India is among the top five countries hit by the highest number of disasters, along with the United States and China.[1] Beyond the immediate physical devastation of disasters, there are long-term negative social and economic consequences, particularly for vulnerable communities that are the most severely affected. Along with this India is also exposed to multiple social and political disaster situations because of its vulnerability to complex communal and religious dynamics. In the past there have been many large scale riots where thousands have lost their lives[2] but very little has been done to manage such situations at the national level. While the initial humanitarian and emergency response to crisis is crucial, there is a growing recognition of the value of disaster risk reduction (DRR) strategies in preparing for, and thus

[1] United Nations International Strategy for Disaster Reduction (UNISDR), 2015, "The Human Cost of Weather Related Disasters 1995–2015," https://www.unisdr.org/we/inform/publications/46796.

[2] Rajeshwari B,IPSC Research Paper 2004, Communal Riots in IndiaA Chronology (1947-2003)

reducing, socio-economic losses associated with disasters. This is especially true for developing countries where poverty is a fundamental cause of vulnerability. Microfinance institutions (MFIs) largely cater to poor and near-poor populations. Not only are MFI clients excluded from the formal financial system, but they are also highly vulnerable to external shocks such as disasters, which puts them at greater risk.[3]

Given the demographic section they serve, MFIs have both a responsibility and a vested interest in addressing the issue of disaster management to ensure their own institutional sustainability, as well as the resiliency of their clients. Through DRR-related products, greater awareness of client needs and internal risk management procedures, MFIs can play a key role in continuing to support populations most affected by disasters. Promoting such activities would not only increase the ability of poor households to cope with different kinds of crises, but also, in turn, protect the MFIs' portfolios.

Greater preparedness will require MFIs to participate in all phases of DRR, from pre-disaster to post-disaster management. Within the phases of disaster planning and response, a number of opportunities for collaboration exist between MFIs and state-sponsored disaster management agencies. These include contributions to disaster management plans, risk mapping, communication of early warnings, mutual awareness-raising, disaster relief and disaster assessments.

## Methodology

The objective of the study[4] conducted by IFMR Lead was to understand the existing DRR practices of MFIs in the Indian market and to map out the disaster-related vulnerabilities of clients affected by crisis in order to assess gaps for more effective disaster preparedness. The pan-India study was conducted using primary and secondary data. Desk research was undertaken to understand the global and Indian disaster risk management context and the MFI sector's role in disaster management practices. Secondary data was also used to select the geographical locations for the study, isolating areas where high and medium-impact disasters have taken place in India over the last five years. To keep the study representative of India's overall disaster management initiatives, in-depth interviews were conducted with MFIs and NGO–MFIs [5]of varying size and range from different parts of the country. Based on the information about the microfinance market that was reported and collected in this study, the organizations interviewed cover approximately 32 percent of the customer base.[6]

Interviews followed the disaster management cycle—which consists of three phases: pre-disaster management, disaster occurrence management, and post-disaster management—to understand the roles that MFIs, NGOMFIs

[3] Microfinance India: State of the Sector Report(2016)

[4] This study was undertaken as part of the SEEP Disaster Risk Reduction Project, financed by the Citi Foundation.

[5] By NGO MFIs we mean the philanthropic wing of the MFIs which were not directly involved in the lending business

[6] According to the "Bharat Microfinance Report 2016" (Sa-Dhan, the Association of Community Development Finance Institutions), total microfinance clients in India equal 40 million. https://www.microfinancegateway.org/sites/default/files/publication_files/the_bharat_microfinance_report_2016-min.pdf

and government play in the disaster management process. In addition to mapping MFI roles to DRR, the study also mapped disaster-related vulnerabilities through a client assessment (by conducting focus group discussions).

**Key Findings: Current Practices**

The study found that the Indian microfinance sector is in a very nascent stage of development with regards to disaster risk reduction. Though MFIs have the potential to play a significant support role, overall there is very little awareness and knowledge on the disaster management and planning practices and hence no organizational policy or protocol is in place for DRR. Currently MFIs offer only limited support during response and recovery phases. There are few innovative financial products and services in the MFI sector in general, and limited use of emergency loans (small value pre-approved loans), micro insurance, or agent networks. MFIs do, however, capture client risk exposure at the loan application stage and many use technology platforms to collect real time data on cash collection and loan disbursements. Since these processes are existing steps in the current lending process, there is an opportunity for the information collected to be used to identify and categorize clients and geographies in vulnerable groups.

In general, MFIs have participated in very limited relief efforts. In the post-disaster situation, they have contributed to annual philanthropic work, such as setting up of health camps, providing education, training support, loan rescheduling, disbursing house repair/reconstruction loans. However, these efforts are often ad hoc and MFIs lack standard organizational practices or protocols to handle disaster response. Interestingly, there is widespread evidence of robust operational and financial risk mitigation mandates and practices within MFIs. This indicates that these institutions would be capable of scaling this to the disaster context, provided there is capacity building and orientation from the perspective of disaster preparedness.

The microfinance sector has evolved over the years and is taking bold steps towards financial inclusion. One of the reasons for the gaps in DRR is very weak stakeholder engagement on the agenda of disaster. Though the institutions abide by the regulatory body guidelines and are committed to poverty reduction, there remains a lack of a concrete vision in their role for disaster management.

**Recommendations**

The research found that microfinance institutions are as vulnerable to the impact of disaster as their clients. This underscores the importance of risk mitigation and the need to shift from post-disaster support to pre-disaster preparedness. Based on the observations, it is recommended that an overall stakeholder engagement be launched to develop a disaster mitigation and management strategy for the microfinance sector. This should entail a facilitated dialogue and discussion between the various key players involved in the sector, including: aggregators, sector experts, financial institutions, and government bodies. Such an exercise can lead towards the development of successful partnerships between different organizations who can pool their resources and skills to design resilient models for disaster management. This also needs to be supported by more policy advocacy, research and evaluation of

other global models that can be replicated in the Indian context.

The specific recommendations are detailed as follows:

- **Proactive Role of Aggregators**: Aggregators, like MFIN and Sa-Dhan, should play a more proactive role in bringing together stakeholders and pooling resources to develop an industry level strategy to mitigate disaster risks.
- **Needs Assessment**: The microfinance industry should work together to assess the disaster prone areas, the volume of business, and the need for microfinance support during pre and post disaster phases.
- **Awareness Generation**: There should be a sustained dialogue between the MFI sector and the recognized bodies on disaster management planning to ensure better coordination.
- **Partnership Development**: Partnerships between MFIs and stakeholders (e.g. government, investors) are needed to develop robust disaster management strategies.
- **Moving towards preparedness**: MFIs should set up, review and regularly test organizational level policies and disaster management plans to better prepare for unforeseen disasters.
- **Promotion of savings**: MFIs should create awareness about the role of savings in increasing resilience and consider serving as Business Correspondents for the banks, as some do, to promote this product with their clients.
- **Incentivizing work in disaster areas**: The majority of MFIs are not pro-actively operating in highly disaster prone or affected areas, which leads to exclusion of the most vulnerable people. Donors and government can create incentives for MFIs, like early warning intimations, communications, product invocations etc. that could encourage more MFIs to work more in these areas.
- **Disaster Finance Fund**: Liquidity for the MFIs during disaster is limited. An Emergency Fund /Disaster Support Fund could help to ensure financial support in disaster situations.

**Conclusion**

It is important that the MFIs are well informed about the consequences of the disaster at the three levels – customer, enterprise and sector. We see that the microfinance sector is relatively more prone to disaster risks because of the high vulnerability of poorer clients. MFIs should also be made aware of the importance of their role not only in activities related to disaster response and recovery, but also in disaster management and preparedness.

It is also important for the government, regulators and aggregators to understand the important role that the microfinance industry can play in the area of disaster management. With increasing risk exposure to disaster, it also becomes the responsibility of the sector to both ensure its operations are protected and to support its vulnerable clients from slipping further into poverty. This can only happen if all the ecosystem actors come together to develop a strategy around a common vision for disaster risk reduction with clear roles and responsibilities to ensure its implementation.

**Using 'Swiss Cheese' to understand slow DRR progress**

Dennis J. Sullivan[1]

Email Address: dennisjosephsullivan@gmail.com
[1]Network on Humanitarian Action (NOHA) Ruhr University- Bochum, Germany

## Abstract

This policy brief examines DRR as a complex system. It uses Dr. James Reason's Swiss Cheese Model as a tool to understand how problems develop and aggregate, causing slow progress for community resiliency and preparedness initiatives. The two issues discussed under this lens are the complexity of the system and public outrage. These topics are examined, with the former looking at the entirety of the system and the latter using Japan and Nepal as examples. Recommendations are given for DRR practitioners moving forward with the Sendai Framework.

## Introduction

Disaster Risk Reduction (DRR) has been a benchmark of resilience building for decades, yet is still not a panacea for counteracting hazard risk. DRR has been frequently limited to the action of merely counteracting the effects of a repetitious roulette of root causes while preparedness initiatives and resilience building take a supporting role[1]. The Sendai Framework is the latest example signifying industry priorities trending within the sector including: building resilience in vulnerable communities, promoting the use of localized solutions, and fostering the inclusion of the most vulnerable members of a society[2]. It would be difficult to argue against the implementation of any of these priorities, which begs the question as to why DRR has been consistently slow towards reaching these goals.

In order to understand the sector's limitations, this brief borrows a concept from organizational studies: The Swiss Cheese Model, a tool for understanding accidents. Applying the Swiss Cheese

[1] Blaikie, Piers, et al. *At risk: natural hazards, people's vulnerability and disasters*. Routledge, 2014.

[2] Staal, Thomas H. "From Hyogo to Sendai: A New Action Plan for Resilience." Written Blog. *USAID Impact Blog.* USAID. 20 March 2015. Web. 1 April 2017.

Model to DRR helps understand how a complex set of factors inhibit, while also pointing to how an increase in localized participation can create an uptick in the amount DRR progress.

## The Swiss Cheese Model

Psychologist and human error researcher Dr. James Reason published the 'Swiss Cheese Model' to explain how accidents occur despite having safety protocol systems in place[3]. The model, which has become a quintessential paradigm for analyzing errors in the medical field, can be seen in Figure 1. Reason described the holes within a system as similar to those within a slice

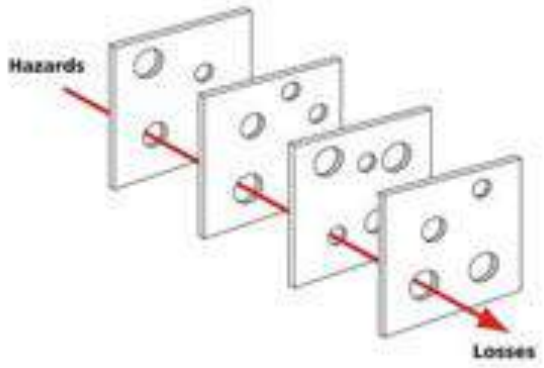


**Figure 1.** Reason's Swiss Cheese Model[4].

of Swiss cheese. The different safety measures would be the individual slices, while the pitfalls of a system are represented by the holes. The individual pieces are symbolized by different safety measures, while the holes signify pitfalls of that measure. If a system and its safety measures are effective, the holes will not line up and a problem will be diverted, meaning that they will not cause failures. However, holes can align in a way where a situation can fall through an unexpected series of holes and become a problem. This model is living and frequently shifting as organizational measures and countermeasures are constantly changing in shape and purpose (i.e.- the holes on the slices are moving), thereby further obstructing potential solutions[5]. These gaps can even develop on multiple levels and remain undetected until a disaster.

When looking at DRR, the 'Swiss cheese slices' would be the initiatives completed in the name of preparedness. This includes education, safety measures, reinforcing buildings, etc. Holes can develop in these systems quite easily, such as an individual being sick and missing important training, or, as a more notable example, safety measures failing such as the New Orleans levees breaking during Hurricane Katrina in 2004. Even with safety measures in place to mitigate the hazard risk, the potential for increased hazard risk had formed unbeknownst to safety professionals and went unnoticed until an even greater hazard risk had already generated.

As an application of this model, consider two distinct holes that have appeared within DRR: system complexity and a lack of public outrage. The former exemplifies a consistent hole across the sector, while the latter represents holes with a case-specific impact.

## Complexity as a Hindrance

Participating in DRR is both morally sound, and can yield up to a 700% return

[3] Reason, James. *Managing the risks of organizational accidents*. Routledge, 2016.

[4] Wikipedia contributors. "Swiss cheese model." *Wikipedia, The Free Encyclopedia*. Wikipedia, The Free Encyclopedia, 13 Apr. 2017. Web. 8 May. 2017.

[5] Reason, James. "Human error: models and management." *Western Journal of Medicine* 172.6 (2000): 393.

on every dollar spent[6]. These factors have culminated an ever-expanding DRR system, but this overabundance has ironically caused slower progress rather than the expected improvements[7].

Some of the crawl can be attributed to the increasingly globalized and interconnected status of the international aid system. Events transpiring in one nation have far-reaching political, social, and economic ramifications throughout the world, including in the field of international aid[8]. This has lead to the common practice of providing moral and political partners with foreign aid during times of crisis[9]. These good intentions have resulted in large and complex systems in order to participate in the giving or receiving of aid. Policy makers and practitioners must navigate through an intricate and oftentimes labyrinthine network that is routinely undergoing transformation as political tides shift. This complexity has even led to questioning whether the state alone is able to effectively carry out all necessary actions towards creating resiliency[10]. This aligns with research which claims that "systems" where complexity increases end up becoming unmanageable due to their vast size[11].

A side-effect of a large system is the normalization of deviance, which increases the amount of hazard risk an entity was designed to control. Small forays into improper functioning within the system are common, yet become considered acceptable risks as they produce no immediate large-scale hazards. However, these deviances can spill over into a larger problem than before, allowing holes in the model to align. Hazard risk is oftentimes viewed as a standalone issue that can be cured with a direct remedy. This disincentivizes using holistic approaches to fix overarching circumstances, thereby resulting in preparedness measures that address only a fraction of the problem. Although it defies logic, this method of designing preparedness initiatives may, in some cases, allow more opportunities for hazard risk instead of slowing systemic risk progression[12].

**Risk Assessment via Public Outrage**

Understanding the derivation of hazard risk is critical when designing remedies. This is a complicated process, as risks themselves can form an intricate network of causes and effects[13]. In contrast to the more stable holes created by system complexity, the holes created by public

[6] UNDP, "*Putting Resilience at the Heart of Development: Investing in Prevention and Resilient Recovery*", UNDP Representative Office in Japan, June 2012.

[7] Centeno, Miguel A., et al. "The Emergence of Global Systemic Risk." *Annual Review of Sociology* 41.1 (2015): 65-85. Print.

[8] Dallaire, Roméo. *The golden fleece: Manipulation and independence in humanitarian action*. Ed. Antonio Donini. Sterling, VA: Kumarian Press, 2012.

[9] Same as 7: Centeno, Miguel A., et al. "The Emergence of Global Systemic Risk." *Annual Review of Sociology* 41.1 (2015): 65-85. Print.

[10] Bourcart, Léo. "'The State Can't Do Everything Any More': Understanding the Evolution of Civil Defence Policies in France." *Resilience* 3.1 (2015): 40-54. Print.

[11] Le Coze, Jean-Christophe. "1984-2014. Normal Accidents. Was Charles Perrow Right for the Wrong Reasons?" *Journal of Contingencies and Crisis Management* 23.4 (2015): 275-286. Print.

[12] Same as 7: Centeno, Miguel A., et al. "The Emergence of Global Systemic Risk." *Annual Review of Sociology* 41.1 (2015): 65-85. Print.

[13] Clark-Ginsberg A. "Participatory Risk Network Analysis: A Tool for Disaster Reduction Practitioners." *International Journal of Disaster Risk Reduction* 21 (2017): 430-437. Print.

outrage can vary in size and severity on a case-by-case basis.

In response, many scholars are attempting to quantify hazard risk as an evaluation tool in order to gauge impact and increase decision-making effectiveness. A common method of is the following equation:

*Risk = threat x vulnerability x consequence*

This method takes a threat (i.e.- earthquake), the vulnerability (i.e.- preparedness levels), and the consequence (i.e.- likely damage to human and economic capitals) to determine the level of risk in a given situation[14].

There are some limitations to this model though, as it is difficult to assign numbers to a system that does not have a standardized method for determining variable assessment[15]. Each situation is unique and requires the vast majority of variables to be redefined. However, an important point that can be drawn from this model is the purpose of *consequence* in the decision-making process. In addition to physical consequences, disasters can also result in political and social repercussions. The threat of these ramifications are more personal and can lead to more holes within the system. It has even been found that the threat of outrage can influence a decision more than the threat of the hazard alone[16].

The impact of public outrage can be clearly seen in Japan, which has made huge strides in terms of DRR over the previous decades[17]. Their success can be attributed to a change in public attitude, which caused policymakers to overlook the complexities of DRR and begin working within that system. This occurred after the Great Hanshin-Awaji Earthquake of 1995. The disaster saw over 6,000 lives lost, over 300,000 buildings destroyed, and disrupted most major transportation lanes in and out of Kobe. However, this event instilled a sense of outrage amongst the Japanese people and, as a result, the government of Japan began to increase their resiliency and preparedness efforts to counter future hazard risks[18].

In other words, the outcry to a subpar response was far too risky for a government looking to stay in the public's good graces[19]. What this means is that a change in DRR is actually a change in cultural and political norms.

The significance of a public outrage hole manifesting is largely contextually dependent. While public outrage can be beneficial in some aspects, as evidenced in Japan, other situations conversely reveal the negative repercussions. Nepal's earthquake in 2015 serves as a counterpoint. Over 8,000 individuals were killed, and the delivery of aid was slow. A lack of resiliency education lead to recovery expectations that were higher

[14] Cox Jr, Louis Anthony Tony. "Some limitations of "Risk= Threat× Vulnerability× Consequence" for risk analysis of terrorist attacks." *Risk Analysis* 28.6 (2008): 1749-1761.

[15] Shreve C.M., and Kelman I. "Does Mitigation Save? Reviewing Cost-Benefit Analyses of Disaster Risk Reduction." *International Journal of Disaster Risk Reduction* 10.PA (2014): 213-235. Print.

[16] Sandman, Peter M., et al. "Agency Communication, Community Outrage, and Perception of Risk: Three Simulation Experiments." *Risk Analysis* 13.6 (1993): 585-598. Print.

[17] Ibid. Same as 16.

[18] Ranghieri, Federica, and Mikio Ishiwatari, eds. *Learning from mega disasters: lessons from the Great East Japan Earthquake*. World Bank Publications, 2014.

[19] Ibid. Same as 18.

than the resources available[20]. For a country that already struggles with political stability and legitimacy[21], the impact of outrage directed at DRR is overshadowed by other issues impacting decision-makers.

## Conclusion

There are an endless number of holes that can be discovered or examined, but the goal of DRR remains the same: to ensure that the holes in the slices do not align, thereby avoiding compounded complications. By using just the two holes from this brief as an example, it becomes clear how a situation can quickly deteriorate. Policy makers are de-incentivized from participating due to the complicated nature of the system, while a public's lack of outrage towards non-participation deems this inaction correct even if financial reasoning claims otherwise. This combination has the ability to impede progress exponentially.

The Sendai Framework gives specific goals to encourage actors towards minimizing these risks, including placing an increased importance on localized practices. This specific goal may help increase global knowledge on the importance of DRR. International pressure derived from agreements such as the Sendai Framework are a step in the right direction, but the voluntary nature of the agreement creates a hole that needs to be filled. Public outrage could be that filler in some instances, but the promotion of outrage is itself a risky action if improperly handled. Other holes, such as political instability and corruption, may need to be filled prior to advocating for increasing public outrage.

In an effort to mitigate the effects of both holes, DRR practitioners should continue increasing the use of localized solutions and educating on the importance of community resiliency. It would be easier for communities to navigate their own resiliency plans than that of the large DRR system. Education on the topic will lead to better knowledge. With better knowledge, communities will understand how this process should function and appropriate levels of outrage can result. These actions will make it easier for policymakers to participate and it will incentivize action prior to a disaster. Even better, these actions will fill the holes without adding another slice of 'Swiss cheese,' thereby lessening the amount of hazard risk within the system.

[20] Hall M.L, et al. "The 2015 Nepal Earthquake Disaster: Lessons Learned One Year On." *Public Health*, vol. 145, 2017, pp. 39–44.

[21] Fisk, Kylie, and Adrian Cherney. "Pathways to Institutional Legitimacy in Post conflict Societies: Perceptions of Process and Performance in Nepal." *Governance*, vol. 30, no. 2, 2017, pp. 263–281.


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