

A Re-Energized Scientific approach for Governance of Disasters due to Climate Change for Sustainable Development

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Introduction

The United Nations' (UN's) Sendai Framework for Disaster Risk Reduction 2015-2030 recommends the strengthening of disaster risk modelling, assessment, mapping, monitoring and multi-hazards early warning systems; as well as the promotion of comprehensive surveys on multi-hazard disaster risks [1]. In the same time, equitable disaster risk reduction and resilience (DR3) is a core component of sustainable development, relating to 25 targets across 10 of the 17 sustainable development goals (SDGs) [2]. The urgent need for states and stakeholders to work together towards equitable (DR3) was reinforced in the UN's 2030 Agenda for Sustainable Development, with a pledge that "no one will be left behind" [3]. The success of the SDGs and the Sendai Framework will thus, in part, be measured by the progress in implementing disaster risk reduction in rational and inclusive ways to build equitable resilience.

Currently DR³ measures are often managed in isolation from broader sustainability efforts, challenging the overall progress of SDGs. Unfortunately, the increasing complexity of pre- and post-disaster risks raise many uncertainties about socio-economic advances and ecological integrity in countries around the world. Since 1980, weather-related hazards have accounted for 74% (US\$2.6 trillion) of total reported losses, 87% (18,200) of total disasters, and 61% (1.4 million) of total lives lost [2]. The number of weather-related hazards such as droughts, floods and heat waves has tripled, and their frequency and intensity are expected to continue increasing, adding greater pressure on resource availability. These risks are amplified by climate variability and change and made more complex by changing patterns of human activity.

The weather-related hazards have increased significantly and expected by 2030 more people to be exposed to the full range of natural hazards and climate extremes. We have to mention that coastal cities and islands are highly vulnerable to extreme events, and some have highest concentration of people and infrastructure and at the frontline of the effects of climate change.

Statistics shows that by 2030 there could be 325 million people exposed to the full range of natural hazards and climate extremes [4]. Global average annual losses from disasters are forecast to increase from US\$260 billion in 2015 to US\$415 billion by 2030 [5]. Furthermore, global supply chains are increasingly interconnected so that when a disaster occurs, the impacts ripple across countries and regions [6]. Achieving equitable DR³ therefore means creating governance tools and processes that support sustainable and equitable disaster risk-sharing, retention and financial protection across global supply chains.

For these reasons it is fundamental to Re-Energize governance for equitable DR3 through transdisciplinary research combining quantitative and qualitative approaches. This chapter summarizes a Collaborative Research Action and consortium, initiated, developed and lead by the author entitled "Re-Energize Governance of Disaster Risk Reduction and Resilience for

Sustainable Development (Re-Energize DR3)” [7] awarded by the Belmont Forum [8]. Next section summarizes the approach undertaken together with the methods considered.

Exploratory Science for Multi-Level Governance Bringing Equity at The Centre Of Decision

The author put together an international scientific research agenda and team of researchers and academics from 11 universities, 4 continents, 7 countries (UK, USA, Qatar, Japan, Ghana, Mauritius, Italy) to address the interactions between disasters and sustainable development for effective disaster risk management and develop innovative and implementable strategies and technologies to help reduce disaster risk and enhance societal coping capabilities. Re-Energize Governance of Disaster Risk Reduction and Resilience for Sustainable Development project emphasizes the importance of community involvement in disaster risk management planning and the role of legal principles and institutions in reducing asymmetries in knowledge and power within a society. In conditions of post-normal science, where facts and indicators are uncertain and values are disputed, there is need for a normative-institutional approach involving diverse stakeholders and the ponderation of legal principles. The project team members have different skills and backgrounds, underpinning different disciplines: social science, computer science, environmental, law, engineering, climate. The purpose is to provide exploratory research regarding multi-level governance approaches for prioritizing disaster planning and recovery, strategies for equitable distribution of resources to vulnerable people for disaster planning and recovery with primary focus on flood, heatwave, and drought disaster types. One key aspect we consider is the distribution of resources and powers among different institutions and sectors. With respect to this, legislation plays a key role in managing risks and increasing future resilience of disasters, by setting out the norms (rules and principles). Of great importance is the integration and coordination at multi levels and the regulated risk-related decisions, actions and responsibilities and their laws.

We developed an innovative analytical framework, through a mixed of quantitative and qualitative methods and approaches. We collected data from a variety of sources, conducted our own empirical research, verify the output statements generated from the empirical work with relevant experts and practitioners through interviews and workshops. We use the key governance principles of commitment, participation, horizontal and vertical coordination, knowledge, monitoring, continuity. We link them with the 2030 Agenda and principles of universality, partnerships, interconnectedness and inclusion by leaving no one behind.

Through the state-of-the art in the assessment, monitoring and management of DR3 analytical phase, we concluded that conventionally, policy makers develop risk assessments and response plans through unsystematic processes and focus on a limited number of indicators. In risk assessment and planning, indicators typically include technical measures of weather patterns, infrastructure status and demographics, while social indicators for community resilience (such as social capital) are overlooked. In the post-disaster allocation of resources, indicators tend to focus on costs and benefits while neglecting process measures of the democratic legitimacy of decisions, justice and human rights [9,10]. As such, conventional government approaches to the use of indicators for DR3 lack transdisciplinary expertise [11], with challenges being even greater in developing countries [12]. What we need is resilience indicators related to distributive and procedural justice concerns in disaster management. Furthermore, most of the laws focus more on the response and recovery strategies and lack recognition of risk reduction strategies. The Hyogo

and Sendai Framework as well as IFRC define the inclusion of risk reduction activities and strategies in legislative documents through themes that include the provisions of early warning system, provision of community education and public awareness, improving building codes, law use planning, land tenure and informal settlement, provision of risk-sharing and insurance, improving public participation in DR3 activities. The literature on resilience underlines the need for a resilience theory that enables decision makers to engage with questions of equity. Key elements of equitable resilience building developed in [13] are based on recognizing subjectivities, inclusion and representation, working across scales and transformative change.

In our project, we use a mixed-methods survey of researchers and stakeholders with elicit expert views on the existing use of disaster indicators in different locations around the world. We focus specifically on the priorities and values for decision-makers to reduce risks and enhance resilience, manage the effects and drivers of these risks, and more importantly reduce exposure of vulnerable communities. This phase will reveal the strengths and weaknesses of these indicators from different perspectives. Follow-on interviews will reveal the experts' underlying reasoning, bringing attention to disciplinary, institutional and geographical differences in their assumptions, judgements and problem framings. In terms of stakeholders' identification, we sample and select them in strategic and logic ways, according to their relevance to the research goals, questions we address in the research and methodological approach. From review, informal conversations and engagement, previous relevant scientific documents, we identified relevant stakeholders with legitimate interest in DR3 policy and governance, adapted from the framework suggested in [14] using a venn diagram to categorize stakeholders based on their power, legitimacy and urgency. For the engagement process, a number of methods including Policy Delphi, Q method, Balanced Scorecard, engage with stakeholders through interviews and focus groups, to identify the indicators identified in line with the three areas identified: type of respondent (categorized according to power, legitimacy and urgency), category (finance, process, beneficiaries, learning and innovation) and disaster phase management (anticipation, assessment, prevention, response and recovery).

This will help to overcome 'silo' thinking for disaster prevention and response, providing the first step towards an integrated process. Furthermore, will inform and input into the integrated modelling platform development phase, which includes a number of well-established and developed tools and here I particularly mentioned two of them:

- The Resource Allocation tool for Disasters Assessment and Resilience due to Climate Change (RA.DAR) which was developed at UCL Islands Laboratory [15] for optimal pathways of resource use in case of a disaster considering different groups within society and their needs. It covers the resource nexus concept and the trade-offs between use of resources (water, energy, land, food) under different climatic conditions [16]. Integrating equity principles for resource allocation into the tool will allow us to more accurately reduce risks by putting the most vulnerable neighborhoods on the map.
- The Artificial Intelligence for Digital Response (AIDR) tools which was developed by HBKU-QCRI [17] an open source software platform built to filter and classify social media messages related to emergencies, disasters, and humanitarian crises; data which can be then ready for use in dashboards, maps or other analytical programs. Combining data from satellite imagery, seismometers, with location-tagged social media will provide an understanding of early warnings and verify reports in real-time.

The translation of evidence into a modelling tool is inevitably selective and contestable, as interpretations of the evidence differ between experts and practitioner communities [18, 19].

The survey and in-depth interviews for end-user will be applied and tested for participants from governmental and non-governmental organizations to identify how the legal principles in the field of disaster law under the legal framework of end-user is being operated by its institutional structures and if there are procedures for systematized and rational balancing of principles in ways that include multiple views of different stakeholders for legitimacy of decision-making. Community engagement, ownership, participation and indigenous/local knowledge are frequently stressed in the reviewed literature of resilience [20-22]. Furthermore, recent literature underlines the need for a resilience theory that enables decision makers to engage with questions of equity. A key insight is that there are four elements to equitable resilience-building [23]: recognizing subjectivities, inclusion and representation, working across scales and promoting systems transformation beyond adaptation. While each issue is critical, the recognition and addressing of all four under our methodology, and their interactions, aims to promote equity in resilience practice.

Intellectual Merit

This research emphasizes the central role of communities in the governance of DR3, bringing in equity as a core element of DR3. As global supply chains are increasingly interconnected so that when a disaster, of course, now impacts ripple across countries and regions as well. So we should think globally and act locally and leaving no one behind us. So to do that, we need to gather some evidence based strategies to avert, minimize and address loss and damage. So research primary focus in climate action is to prevent negative climate impacts with the fact the island states or coastal cities and so on. So, for example, climate justice is an area of research that frames climate change as a political and ethical issue, but not solely as a problem underlying environmental change. There are many complexities and uncertainties as we are ready to deal with.

From the analysis there are three main areas, where decision makers need to pay more attention and efforts:

- First, inclusive governance, by creating governance processes and tools that support sustainability and equitable disaster, risk sharing, retention and financial protection across global supply chains.
- Second one is the normative institutional approach, which involves diverse stakeholders and with one direction of legal principles. In other words, we need to adopt current resilience plans because none of the sector security and resilience plan seems to account for equality and justice aspects.
- The third one is to establish equitable, resilient standards by frame it from the perspective of equity.

In terms of research and methods, there are three things that require support from the research communities. One of them is related to indicators. Current indicators that value resilience don't really account for vulnerabilities. So, the integration between disaster risk reduction, resilience, ethics agenda, climate change agenda entails reassessment the indicators currently considered. We need to define indicators that value resilience adequately and to drive mitigation in ways that

accounts for vulnerabilities. Another key aspect is the lack of disaggregated data. Data does not support the understanding of a full impact on vulnerable groups and inequalities in resource allocation for response, preparedness for recovery of disasters. And the third thing is we need to adopt the more necklacing for methodological approach.

So in our case, we combine quantitative and qualitative research dimensions, by using artificial intelligence (AI), machine learning (ML), natural language processing (NLP), resource nexus (RN) type of quantitative research methods with qualitative methods (surveys, in-depth interviews, workshops) and deontological approach (values and principles) and transmission of research agenda via stakeholders and international advisory board, with the aim to transform the qualitative and quantitative data into more actionable insights [20]. We address the simultaneous interaction between climate related natural disasters and development for disaster risk management. We acknowledge the role of community involvement in disaster risk management planning and the role of legal principles and institutions in reducing these asymmetries in knowledge and power within the society. Within that framework depends on the progress in implementing the equitable disaster risk reduction resilience. And that involves this complex data processes and stakeholder engagement across all the governments levels. Generating real-time maps highlighting vulnerable areas and communities by incorporating different indicators learned from various sources such as ground-truth data, sensors, social media and combining ML, AI, NLP will enable their users to ask specific targeted questions and receive answers drawn from messy, real-world datasets. The application phase of the integrated toolbox and adaptive governance solutions for selected disasters type (floods, droughts, heatwaves) into frameworks of action and implementation at end-user level (selected islands, coastal cities) will reveal that it can be adapted and adopted to other locations globally with the support from key global organizations.

By crossing disciplinary, institutional and geographical boundaries, this research will be a valuable addition to planning capability because it will:

- (i) Enable effective collaboration to ensure discussion leads to action;
- (ii) Provide the means for a holistic view comprising economic, environmental and social aspects of alternative options;
- (iii) Create adaptive governance approaches which is imperative for equitable DR3
- (iv) It will enable dynamic interaction and learning across the research partners and stakeholders.

The transdisciplinary outputs and guidelines will thus support decision-makers and communities to advance equitable disaster risk reduction through effective management of pre- and post-disaster risks placing vulnerable communities at the centre of all efforts.

Furthermore, we expect the main beneficiaries to be communities, cities and islands themselves., key decision makers, operators, businesses, and wider society. We expect short-term, mid-term and long-term impacts. Short -term impacts arising from the research outputs and engagement with stakeholders, collaboration and partnerships; mid-term impacts will come from the use and application of our tool, methods and techniques along with other partners; and wider applicability, with appropriate training and dissemination; and long-term will emerge from capacity generated through partnerships.

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<https://www.belmontforum.org/news/newest-belmont-forum-awardees-address-resilience-and-risk-in-disaster-scenarios/>

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