UNISDR Science and Technology Conference
on the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030

Launching UNISDR Science and Technology Partnership and the Science and Technology Road Map to 2030

To promote and support the availability and application of science and technology to decision-making in Disaster Risk Reduction

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Short concept note: Work Stream 4, Working Group 1

Leveraging Science

1) Overview

Almost fifteen years ago, hazard researchers explicitly stated that improved knowledge was not sufficient by itself to reverse the upward trend in disaster losses, and called into question how knowledge is used (White 2001). Despite an immense expansion of risk-related knowledge systems including special research programs and institutes, specialised journals, advanced technology and increased financial resources, converting research findings into concrete applications for Disaster Risk Reduction (DRR) and management (DRM) remains a challenge. (Weichselgartner 2015). This has raised questions about barriers in the science–policy–practice nexus that hinder the effective use of existing knowledge to make it useful, usable and used (Aitsi-Selmi et al 2015)

Among the recommendations of the Sendai Framework is a call "*to promote and improve dialogue and cooperation among scientific and technological communities, other relevant stakeholders and policymakers in order to facilitate a science-policy interface for effective decision-making in disaster risk management"* particularly at local and national level where scientific evidence is not systematically embedded into decision-making.

This call reflects the emphasis throughout the negotiation process of the Sendai Framework on the need to integrate science and technology into decision-making, as heard in statements from Member States, Intergovernmental Organisations (IGOs) and thematic Major Groups (UNISDR 2015).

The need to reconnect science with policy and practice is considered by some to be among the first tasks in implementing the Sendai Framework (Pearson 2015). An implementation plan underpinned by scientific evidence has the potential to target investment more accurately, contribute to greater resilience over the coming decades and save lives (Calkins 2015).

However, important challenges exist for those tasked with translating evidence into information for decision making. Because research and applied activities often have fundamentally disparate purposes and respond to the needs of very different audiences they can lead to different world views and can make translation and uptake of evidence difficult (Quarantelli 1993). Furthermore, The Sendai Framework promotes an all-hazards approach that encompasses natural and man-made hazards (such as technological hazards) which requires integrated across science, policy and practice. Technological hazards that can cascade as a result of interdependence demonstrate the need for cooperation that transcends physical, conceptual and imagined boundaries.

Proposals to overcome these challenges and increase the relevance of science for decision-makers in policy and practice include streamlining DRR into capacity building, policy development and evaluation at different scales, knowledge integration across disciplines as well as engagement of the full range of stakeholders and societal actors. Well-targeted incentives and political support will help to achieve these aims and improve the coherence, coordination for DRR (Weichselgartner 2015).

This Working Group will explore options and activities for strengthening the science-policy-practice nexus (leveraging science) to inform the S&T Road Map in the implementation phase of the Sendai Framework with a view to achieving its expected outcome through the generation of knowledge that is useful, usable and used that informs DRR policy and practice.

2) Stock taking

Over the Hyogo Framework implementation period, and spurred by the terrible Indian Ocean Tsunami of 2004 which resulted in over 220,000 deaths, improvements in hazard monitoring and early warning systems have saved many thousands of lives and together are a global success story, indicating what can be achieved when science and policy are integrated effectively (Pearson 2015). However, increases in exposure without decreasing vulnerability may have driven rising disaster losses despite these advances (IPCC 2014) – see Work Stream 2 Working Group 2 on Exposure and Vulnerability for a complementary discussion.

The widening of the breadth of dimensions of disaster risk that needs to be addressed for effective DRR is highlighted in the Sendai Framework as: "*policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions of* ***vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment****. Such knowledge can be leveraged for the purpose of pre-disaster risk assessment, for prevention and mitigation and for the development and implementation of appropriate preparedness and effective response to disasters.*" This enhancement of DRR science and understanding has the potential to make a different to people's lives and their societies if knowledge is generated and used effectively.

The Global Facility for Disaster Reduction and Recovery (GFDRR) published a series of case studies in a report (OECD 2014) to illustrate emerging best practices in natural disaster risk assessment and highlighting the role of advanced modelling and capacity building in transferring science into DRR. The report included a review of whether tsunami preparedness has improved since the course-changing event of the 2004 Indian Ocean Tsunami. This event galvanised the Hyogo Framework 2005 implementation and triggered significant momentum to apply DRR science in low- and middle-income countries. As a result, tsunami warning and mitigation systems have been developed in the Indian Ocean following the 2004 tsunami.

The report notes, however, that while from a methodological perspective, important progress has been made in the last decade the new methodologies are not widely applied in practice. Hazard maps, for example, are often used only for establishing buffer zones when they could also aid in planning of construction and development and in determining evacuation routes. The report concluded that more work is needed to develop indicators and criteria that determine the use of vulnerability information in DRR, as well as to assess the effectiveness of key strategies and tools (like people-centred early warning systems) (OECD 2014).

Challenges in leveraging science

It is not entirely clear why the wealth of scientific findings does not find its way into policy. Is it because: (1) knowledge is incomplete; (2) knowledge is available but not used effectively; (3) knowledge is used effectively but takes a long time to take effect; or (4) knowledge is used effectively in some respects but is overwhelmed by increases in population vulnerability and size? It is likely to be a combination of the above. Specific barriers to leveraging science that are amenable to action are outlined below, followed by examples of recent success and opportunities available over the next 15 years.

Poor accessibility

Decision makers have raised the lack of accessibility of scientific findings to those outside the scientific community as a barrier to using science in policy and practice (Black, 2001). Scientists generally and DRR researchers communicate ideas mainly through technical communities that use complex vocabulary or technical knowledge. They also tend to have long research timelines and narrow academic specialisms (see below) (Trainor and Subbio, 2014). On the other hand, practitioners and public decision makers communicate with a broader public, use simpler vocabulary, respond to urgent needs and changing political imperatives (Buika et al, 2004: 2). Where resources are scarce, as in low- and middle-income countries, governments and other organisations may struggle to equip their technical officers and practitioners with the resources and networks to be able to translate new research into actions and clear policy recommendations.

Relationship barriers between science and policy and practice

Research, policy and practice can be closely aligned when they have reasons to work together (Trainor and Subbio, 2014). Therefore, dialogue is critical and establishing structures and mechanisms, such as intergovernmental processes, that create a space for exchange between theory and practice should be considered (Buika et al 2004: 2). An important potential area of relationship building would be to formally and informally recognise the links between DRR, development finance, sustainable development and climate change to support their respective communities of research, policy and practice to align scientific research with real problems faced by decision-makers and engage all scientists in producing evidence that is useful, usable and used to address the complex problems of the 21st Century (Carabine 2015).

Specialisms and silos in science

The integration of information across scientific domains is not a trivial task. Knowledge synthesis could assist in the use of science from all relevant disciplines and include the natural, environmental, social, economic, population health, and engineering sciences to achieve an all-hazards approach. Scientific training in the future should facilitate the development of skills of a scientific and technical nature that can integrate knowledge from different disciplines and produce holistic risk and impact information that addresses hazards, exposure and vulnerability/capacity (UNISDR 2013) (see Work Stream 4 Working Group 2 on Capacity Development; and Work Stream 2 Working Group 3 on Risk Assessment for complementary discussions).

Lack of incentives

Traditional systems for incentivising and evaluating academics are often incompatible with policy and practice needs. They can discourage the integration of research across disciplines, the use of non-traditional scientific information (for example, indigenous knowledge) and minimise engagement with decision-maker priorities. Academic success is often measured by the number of peer-reviewed journal article, while shorter non-technical outputs like policy briefs, blogs and other forms of grey literature are rarely recognised or rewarded. The standard model for communicating research to policy makers is through workshops where decision-makers are introduced to conceptual frameworks and receive guidance on the latest science, but this is a one-way knowledge sharing process that rarely results in practical change without financial incentives (Jones 2012; Trainor and Subbio, 2014).

Achievements in leveraging science

The Hyogo Framework implementation period saw a number of new initiatives and successes in translating science for policy and practice and supporting its application examples include:

- Data synthesis and presentation tools such as climate forecasting and sophisticated earth observation tools were developed;
- DRR information was centralised in online repositories for use by both decision-makers and researchers such as PreventionWeb;
- Online sources of evidence was made available online to facilitate the access to and use of evidence during humanitarian emergencies (such as Evidence Aid);
- Initiatives for mainstreaming disaster risk reduction (DDR) and climate change adaptation in country development strategies were established (such as the Global Facility for Disaster Reduction and Recovery (GFDRR)).

In seeking to further promote and share good practice where science has been used for DRR policy and practice, UNISDR published a number of case studies from around the world[1] and from different scientific disciplines. The case study format was kept in a simple format deliberately under four headings (the problem, the science, the application to policy and did it make a difference?) and limited to two-pages. More than 50 case studies are available online and include:

1. Flood Risk Reduction in the Netherlands: The "Room for the River" project (http://www.preventionweb.net/files/workspace/7935_casestudy6.pdf)
2. Building Resilience to Earthquakes in Chile (http://www.preventionweb.net/files/workspace/7935_casestudy10.pdf)
3. An Earthquake Early Warning for Japanese Bullet Trains (http://www.preventionweb.net/files/workspace/7935_casestudy4.pdf)
4. Tsunami Warning and Mitigation for the Indian Ocean Region (http://www.preventionweb.net/files/workspace/7935_casestudy1.pdf)

[1] http://www.unisdr.org/partners/academia-research/case-studies

5. Developing an aviation warning system for Icelandic Volcanic Eruptions (http://www.preventionweb.net/files/workspace/7935_haywoodetalvolcaniceruptions.pdf)
6. What are the best ways to teach children about bushfire risk? (http://www.preventionweb.net/files/workspace/7935_towerseducatingchildrenindrr.pdf)
7. Integrating Risk Assessment in Land-Use Planning – Mohéli (Comoros) (http://www.preventionweb.net/files/workspace/7935_leroiriskassessment.pdf)
8. Disaster risk reduction: plans to reduce human health impacts from heatwaves (http://www.preventionweb.net/files/workspace/7935_leonardiheatwavegl.pdf)
9. Integrating community and observatory based monitoring to reduce risk at volcán Tungurahua, Ecuador (http://www.preventionweb.net/files/workspace/7935_7935jstoneecuador.pdf)
10. Recognising and Understanding Collective Resilience in Crowds of Survivors, London, UK (http://www.preventionweb.net/files/workspace/7935_collectiveresilienceincrowdsofsurvi.pdf)

At international level, an example of successful intergovernmental evidence-translation that is interdisciplinary and brings together different communities of policy and practice is the IPCC. Key findings for DRR are presented in the Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). The report included a summary for policy makers on issues that ranged from the relationship between climate change and extreme weather events to the predicted implications of these events for society and sustainable development.

In terms of DRR practice, where conditions allow, providing resources for dedicated institutions and groups to develop (and update) practice guidelines, standards, protocols and tools that integrate the best available evidence can help to promote and disseminate good practice at all levels. This is particularly important at the local level where capacity for science uptake can be limited (See Work Stream 3 Working Group 1 - Sharing Standards, Protocols and Practices).

Important gains have been made in clarifying the implications of scientific findings and translating them into actionable guidelines for everyday practitioners using transparent, inclusive and participatory guideline development processes in the domain of health for example.[2] Similar initiatives in DRR should be identified, shared and evaluated for upscaling.

At national level, and in terms of championing the integration of new knowledge and technology into DRR, Japan has made significant efforts towards this by improving its earthquake preparedness systems including through building code reform. Many OECD countries are trying to integrate elements of anticipation in their risk management systems. One example is the UK's emphasis on futures research through the method of horizon scanning which aims to "anticipate and prepare for new risks and opportunities

[2] https://www.nice.org.uk/

through the systematic study of new developments in science and society." To achieve this institutional capacity to learn from past disasters and integrate this into future preparedness policy is needed. Examples of institutional bodies with a 'learning' capacity include the California Seismic Safety Commission, and the relatively recent Organisation for Technical Investigation in Japan (OECD 2006).

At local level, the Overseas Development Institute has a dedicated programme - Research and Policy in Development- to improve the integration of local knowledge and research-based evidence into policy-making by working with researchers, think tanks, civil society, donors and governments. Arguably, reformed incentive structures and innovative methods of capacity development (for both scientists and policy makers) are needed. In supporting decision-makers to use scientific findings, an alternative to workshops is to trial other forms of experiential learning, like 'policy-gaming' (CDKN 2012). Conversely, in encouraging researchers to respond to policy needs, applicants for research grants could be required to provide evidence that their research is in demand from decision-makers (Jones 2012).

Opportunities in leveraging science

In addressing some of the challenges above and defining the role of science in disaster risk reduction, six core activities for effective evidence translation are put forward by the Major Group on Science and Technology (S&T) outlined in the 2015 UNISDR STAG report (Aitsi-Selmi et al 2015):

(1) **Assessment** of the current state of data, scientific knowledge and technical knowledge on disaster risks and resilience (what is known, what is needed, what are the uncertainties, etc.);

(2) **Synthesis** of scientific evidence in a timely, accessible and policy-relevant manner;

(3) **Scientific advice** to decision-makers through close collaboration and dialogue;

(4) **Monitoring and review** of new scientific information and progress towards disaster risk reduction and resilience building;

(5) **Communication and engagement** among policy-makers, stakeholders in all sectors and in the science and technology domains themselves to ensure useful knowledge is identified and needs are met, and scientists are better equipped to provide evidence and advice;

(6) **Capacity development** to ensure that all countries can produce, have access to and effectively use scientific information.

These activities are built into the Science and Technology Road Map that is to be agreed at this conference. This group is invited to share existing and propose new initiatives and actions in these areas that show how science can be leveraged for effective policy and practice. (see Work Stream 3 Working Group 3 on Sharing Innovations to Improve Implementation and Reporting of Sendai Framework for complementary proposals).

3) The way forward?

This group will seek to discuss and identify specific mechanisms and actions and initiatives that exist or could be developed to leverage science and strengthen the science-policy-practice nexus. The outcome of the discussion will be to inform the draft S&T Road Map for S&T in implementing the Sendai Framework. Two of the relevant outcomes from the Road Map are shown below.

Priority for Action 1: Understanding Disaster Risk		
Expected Outcomes	**Key Actions**	**Review Progress and Needs**
1.2 Synthesize, produce and disseminate scientific evidence in a timely and accessible manner that responds to the knowledge needs from policy-makers and practitioners;	• Ensure the synthesis and use of traditional, indigenous and local knowledge and practices • Promote partnership between scientists, policy makers, private sectors and community leaders to establish, disseminate and share good practices and lessons learned. • Engage scientific focus on disaster risk factors and scenarios, including emerging disaster risks; •	• National and regional knowledge centres for disaster risk management. • Good practises on use of indigenous and local knowledge • Methods for tracking and reporting investments in research programmes focusing on DRR • Education guidance on DRR • Case studies on DRR through science and traditional, indigenous and local knowledge and practises • National and regional platforms for DRR
Priority For Action 2: Strengthening Disaster Risk Governance to Manage Disaster Risk		
Expected outcomes	**Key Actions**	**Review Progress and Needs**
2.1 Ensure a stronger involvement of science in policy- and decision-making at all levels	• Promote and improve dialogue to facilitate a science-policy interface for effective decision-making • Raise awareness and improve understanding of disaster risks and their impact on societies and their transboundary and global impact • Enhance cross-sectoral decision making • Support regional cooperation, including through common exercises and drills	• National and regional knowledge centres for disaster risk management • National and regional community of users and practitioners • Science and technology expertise for national and regional platforms for DRR • Information sharing of case studies of strong involvement of science in policy and decision-making to improve implementation

Can these proposals be strengthened further? Are there specific next steps to strengthen the science-policy interface at local, national, regional and global levels in DRR?

Participants in the conference are also invited to consider how the scientific community can continue working to address the above challenges and answer the call of the Sendai Framework. What specific initiatives and partnerships can be put in place, for example, in strengthening evidence use at the local level and standardising scientific outputs at national and international level?

As an example, the structure and function of UNISDR S&T Partnership, to be launched at this conference, has been designed to be as inclusive and as participatory as possible in order to contribute to building trust in new and existing scientific institutions at local, national, regional and global levels – **what would be priorities for action of this Partnership in the next two years?** What are the top three priority areas of investment needed in this area?

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Annex: Key statements in the Sendai Framework for Disaster Risk Reduction

Under Priority 1 - Understanding Disaster Risk

National and local
24 (h) To promote and improve dialogue and cooperation among scientific and technological communities, other relevant stakeholders and policymakers in order to facilitate a science-policy interface for effective decision-making in disaster risk management;

23 - Policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be leveraged for the purpose of pre-disaster risk assessment, for prevention and mitigation and for the development and implementation of appropriate preparedness and effective response to disasters.

25g - To enhance the scientific and technical work on disaster risk reduction and its mobilization through the coordination of existing networks and scientific research institutions at all levels and in all regions, with the support of the United Nations Office for Disaster Risk Reduction Scientific and Technical Advisory Group, in order to strengthen the evidence-base in support of the implementation of the present Framework; promote scientific research on disaster risk patterns, causes and effects; disseminate risk information with the best use of geospatial information technology; provide guidance on methodologies and standards for risk assessments, disaster risk modelling and the use of data; identify research and technology gaps and set recommendations for research priority areas in disaster risk reduction; promote and support the availability and application of science and technology to decision-making; contribute to the update of the publication entitled "2009 UNISDR Terminology on Disaster Risk Reduction"; use post-disaster reviews as opportunities to enhance learning and public policy; and disseminate studies;

Under the role of Stakeholders
36 (b) Academia, scientific and research entities and networks to focus on the disaster risk factors and scenarios, including emerging disaster risks, in the medium and long term; increase research for regional, national and local application; support action by local communities and authorities; and support the interface between policy and science for decision-making;