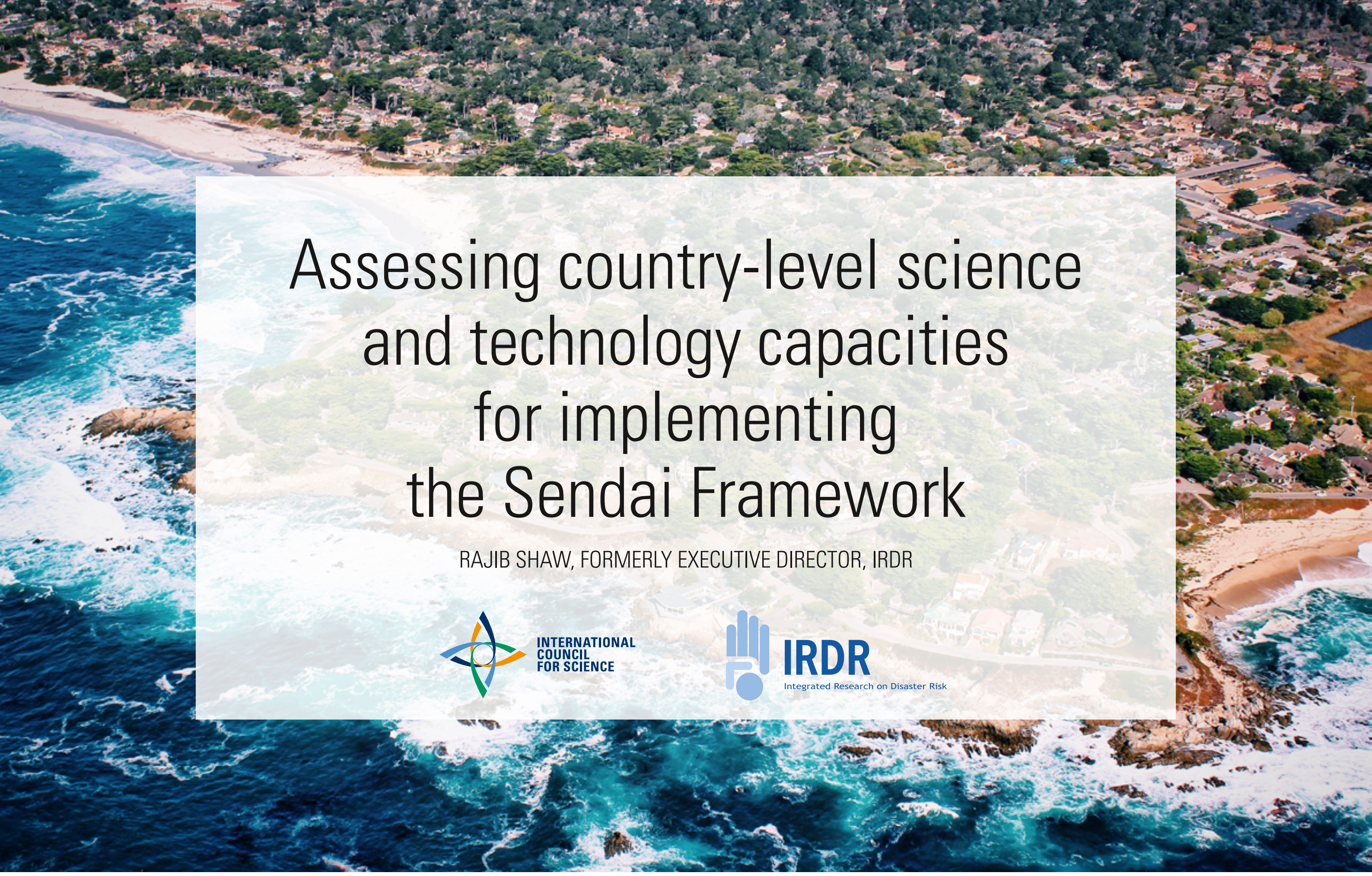

Assessing country-level science and technology capacities for implementing the Sendai Framework

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POLICY RECOMMENDATIONS

Establish national science, technology and academia advisory groups:
At country level, such advisory groups need to be established to ensure: (1) support for governments in science-based decision-making; (2) strengthening of the science and technology academic communities; and (3) enhanced networking across the science and research communities with other stakeholders. Such groups will provide advisory oversight on the implementation of SFDRR through a science lens.

Undertake periodic reviews of the country's science and technology status:
To understand the level of S&T capacities at the country level, a semi-qualitative, index-based framework is proposed that will map relative status and importance of different aspects of S&T in implementing the Sendai Framework for Disaster Risk Reduction (SFDRR). The framework has the following attributes: (1) S&T in decision-making; (2) investment in S&T; and (3) S&T's link to people. For the first attribute, decision-making is a function of an available governance system employing a mix of tools and specific methodologies. Therefore, the first three indicators describe the disaster risk reduction system, especially the role of the S&T community. The following five indicators describe how science is used in national level risk assessment, early warning systems, data collection capabilities, infrastructure design, and building codes and standards. The second attribute is investment in S&T, in terms of financial and human resources, as well as science infrastructure. The third attribute area is the link between science and society. Several indicators are examined, including the availability of science-based risk assessments to non-specialists; participation of the scientific community in community consultations; and the validation of indigenous knowledge. It is recommended that the values of the indicators be agreed via a consultation process.

Develop a national science and technology plan and highlight priority actions:
Based on the above analysis, a S&T plan and actions need to be developed to highlight the emphasis on implementing SFDRR through the lens of science. This would be a periodic yardstick to measure the progress of S&T in the respective countries.

Undertake periodic monitoring:
While having the broader science and technology plan for implementing SFDRR at the country level, the short- and medium-term goals need to be prioritized, and needs to be monitored periodically with the above-mentioned indicators and sub-indicators.

Organize national science conference:
There needs to be a periodic science and technology conference at the national level to discuss the progress and challenges of implementing SFDRR. This conference needs to have multi-stakeholder participation to discuss good practices and challenges, and agree on the collective short- and medium-term priorities.

Context

Science and technology play an important and crucial role in disaster risk reduction (DRR) in all countries. Through scientific research progress, disaster risk reduction has benefitted, especially in terms of risk assessment and early warning systems that identify risk at various spatial and temporal scales. Science and technology have also developed construction techniques that strengthen the resilience of buildings and infrastructures to different types of hazards, among many other examples. In terms of S&T application in SFDRR, Aitsi-Selmi et al. (2016) have made important suggestions, for example, on how to improve communication between scientists and decision-makers, reform incentive systems, and promote multidisciplinary and multi-sectoral approaches. To achieve better evidence-based decision-making they also suggest: (1) better data standards; (2) development of holistic risk models; (3) improved risk information and sharing; and (4) increased capacities across all sectors.

Figure 1 shows the relative roles of science and technology community engagements (Shaw et al. 2016a). The estimation of the role of science and technology in the Sendai Framework is a qualitative evaluation based on the mention of S&T in the framework and the importance provided in the priority areas.

A literature review pointed out that there exist no clear indicators by which to determine the status of S&T at a regional or country level. Shaw et al. (2016 a, b) made the first attempt to apply a framework to measure the science and technology capacities in 11 Asian countries along with the UNISDR Asia Science, Technology and Academia Advisory Group (ASTAAG).

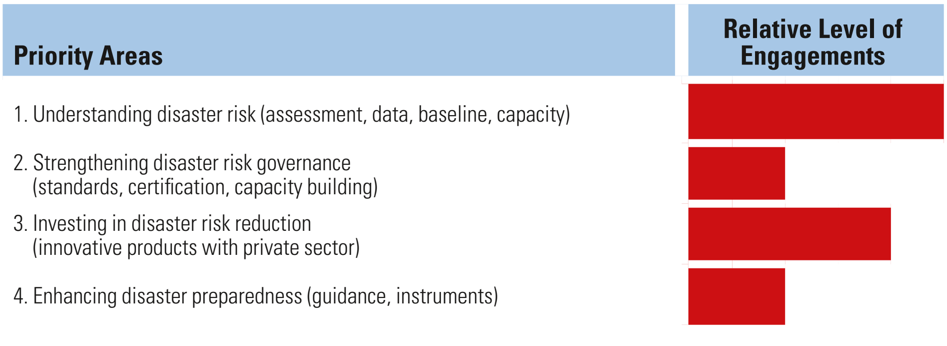

Figure 1
Relative level of engagement of S&T in the Sendai Framework priority areas. Source: Shaw et al. (2016 a)

Example of application of framework in Asian countries

Table 1 shows the relative score against different indicators, with the score of 1 to 5 indicated. A normalized score out of 100 is also presented at the bottom of the table. Some interesting observations can be made here. The purpose of the analysis is not to compare countries; nonetheless, the overall score appears to show that China tops the list of 11 participating countries, followed by Japan and Indonesia. When the sub-attributes are considered, China is substantially ahead of other countries in terms of both incorporating S&T into decision-making and in investment in science and technology. However, how science links with people is a weak link, and needs more attention. By contrast, although Indonesia does not score high for science-based decision-making, its investment in S&T is quite high. Arguably the most significant part is the link between science and people, where Indonesia ranks tops among all 11 countries, along with Japan. Japan's score is a balanced one, with a relatively good performance in all three sub-attributes. Yet certain levels of improvement are still required in order to strengthen the science link to people. Overall then, the analysis is helpful for developing a country-based strategy to strengthen different aspects of S&T with implications for increased disaster risk reduction.

A comparison of the initial three categories, show Category 1: "Science and technology in decision making" to have the highest score - an average 63 of the total possible scores of each indicator under the category. This indicates that decision-making based on S&T is well-managed compared with Category 2: "Investment in science and technology" and Category 3: "Link of science and technology to people". The science community clearly needs to make further efforts to strengthen the link of S&T to people as it often appears that the messages and results from academic and scientific researchers are difficult to understand and these data require translation into user-friendly terms.

In a similar comparison of each indicator, the highest normalized score (average 78) is received by indicator 1.5, "Existence of early warning system and mechanism with science and technology knowledge and tools". The lowest normalized score (average 27) is indicator 3.2: "Scientific validation of indigenous knowledge". This low figure implies that most of the 11 countries have not carried out

ATTRIBUTES OF SCIENCE AND TECHNOLOGY TO DDR

		Bangladesh	China	India	Indonesia	Iran	Japan	Malaysia	Myanmar	Pakistan	Philippines	Vietnam	Average Normalized Score (out of 100)
1	**Science and Technology in Decision Making (normalized score out of 100)**	**45**	**90**	**70**	**68**	**63**	**85**	**70**	**48**	**50**	**53**	**53**	**63**
1.1	Presence of science and technology advisory group to disaster risk reduction (DDR) nodal ministry and/or related ministries	2	5	4	3	2	4	4	2	2	3	2	60
1.2	Presence of science and technology group in DDR national platform	2	5	3	4	3	4	4	2	3	3	1	62
1.3	Existence of inter-ministerial discussion/dialogue on science related issues	1	4	2	3	2	3	4	3	2	2	2	51
1.4	Implementation of risk, needs and damage assessment with involvement of science and technology group	2	4	4	3	3	5	2	1	2	3	2	56
1.5	Existence of early warning system and mechanism with science and techology knowledge and tools	3	5	5	4	4	4	4	4	3	4	3	78
1.6	Availability of disaster data/statistics on damage and impacts and its data collection mechanism	3	4	3	3	2	4	2	2	3	2	4	58
1.7	Involvement of science and technology group in infrastructure design	3	5	3	3	4	5	4	3	2	1	3	65
1.8	Scientific revision/updating of regulations, policies, and guideline for DRR including building code, disaster response, and preparedness plan etc.	2	4	4	4	5	5	4	2	3	3	4	73
2	**Investment in Science and Technology (normalized score out of 100)**	**33**	**87**	**53**	**77**	**60**	**73**	**70**	**40**	**47**	**40**	**60**	**58**
2.1	Existence of grant support by the national government to researchers in disaster related topics that focus on science and technology	1	5	3	5	2	4	4	1	3	3	3	62
2.2	Establishment of disaster related courses in higher education	3	5	3	4	5	3	4	2	2	2	2	64
2.3	Presence of national research institute and organization for disasters	3	5	3	4	4	4	3	2	2	1	4	64
2.4	Investment/support by the national government in national/international conferences and events on disasters for knowledge sharing	1	5	3	3	3	4	4	3	2	3	4	64
2.5	Support to collaboration with academia and the private sector for developing innovative technical solutions	1	3	2	3	2	4	3	1	2	1	2	44
2.6	Support to collaboration with academia and civil society for developing innovative social solutions	1	3	2	4	2	3	3	3	3	2	3	53
3	**Link of Science and Technology to People (normalized score out of 100)**	**34**	**57**	**57**	**69**	**51**	**69**	**51**	**40**	**40**	**43**	**37**	**50**
3.1	Availability of a hazard map to people, developed based on scientific knowledge	1	3	3	2	1	4	2	1	2	3	2	44
3.2	Scientific validation of indigenous knowledge	1	2	1	2	1	2	1	1	1	1	2	27
3.3	Involvement of science and technology group in developing program for evacuation drills	2	3	2	4	4	4	2	2	2	3	1	53
3.4	Availability and participation of science and technology group in community discussion as facilitator or advisor/commentator	2	1	3	4	3	3	3	2	2	2	3	51
3.5	Dissemination of science-based early warning and forecast to people	3	3	5	5	3	4	3	3	3	3	2	67
3.6	Involvement of science and technology group in developing disaster related education curriculum	2	4	4	4	4	3	4	2	2	2	1	58
3.7	Existence of facilities such as museum and events such as expo to disseminate disaster knowledge and deepen understanding on disasters among citizens	1	4	2	3	2	4	3	3	2	1	2	49
Normalized Science and Technology Attribution Score (out of 100)		**38**	**78**	**60**	**71**	**58**	**76**	**64**	**43**	**46**	**45**	**50**	**57**

Table 1 Attributes of science and technology to DRR in 11 Asian countries. Source: Shaw et al. (2016 a)

the validation of indigenous knowledge that is required and that there is nearly universal room for further improvement. In some circumstances, science and cultural/religious beliefs are contradictory, and it is also a vital role of S&T to help understand this difference and its implication for DRR.

Key considerations for monitoring progress

The decision for each indicator needs to be agreed upon by a group of specialists in each country, in close cooperation with the disaster management office of the respective national government. This judgment needs to be supported by evidence in terms of documents as well as discussion with relevant government departments. It is suggested that annual assessments be made on the three attributes, along with discussions on the relative importance and emphasis of S&T in the SFDRR and decisions on short- and long-term actions required to enhance progress. Finally, the status analysis needs to include a note on the higher education system in each country.

Science and technology implementation in DRR cannot be carried out by scientists and academics alone; it needs multi-stakeholder collaboration, partnerships, and mutual ownership of both the problem and the solution. Periodic multi-stakeholder science conferences and S&T status assessment are important; at the national level, development of a S&T plan is crucial, and its implementation needs to be carried out both at the national and local levels.

IRDR's efforts

Following the adoption of the SFDRR in 2015, IRDR, along with its partners in the Asian region, especially the International Council for Science, UNISDR, ASTAAG and the IRDR International Centre of Excellence (ICoE) in Taipei, has undertaken the following activities in the region:

- Regional mapping of S&T status for DRR in 11 Asian countries in April–July, 2016

- Co-organized the first regional S&T conference in August 2016, hosted by the Government of Thailand

- Developed regional actions under the SFDRR four priority areas, and delivered them to the Asia Ministerial Conference for Disaster Risk Reduction (AMCDRR) in New Delhi in November 2016

- Facilitated the establishment of national S&T advisory groups in selected countries, and supported the development of national science and technology plans for the implementation of SFDRR in 11 Asian countries and one region (Pacific)

- Based on the Asian experience, IRDR and its partners are working with other regions (Africa and the Americas) to enhance similar processes of regional mapping, the organization of regional science conferences, and the promotion of national science and technology plans for the implementation of SFDRR. In this way, ICSU and IRDR have been seeking to jointly advocate a "science voice" into DRR, especially by helping in the implementation of the Sendai Framework at regional, national and local levels through a science lens.

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