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Contribution of the International Consortium on Landslides to the implementation of the Sendai Framework for Disaster Risk Reduction: engraining to the Science and Technology Roadmap

Abstract A year after the establishment of the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR), the science and technology community (STC) endorsed in Geneva the UNISDR Science and Technology Roadmap to Support the Implementation of the SFDRR 2015–2030 (STR-SFDRR). Conducted actions by the International Consortium on Landslides (ICL) reflect priorities and challenges at different scales with regard to the progress of multi-sectoral partnerships, recognising the key role of the STC for the implementation of the SFDRR. Central to such endeavour are the Sendai Landslide Partnerships 2015–2025 and the new-fangled Kyoto Landslide Commitment 2020. While the former was conceived as a strategy for global promotion of understanding and reducing landslide disaster risk, the latter is directed to advocate for harmonic cohesiveness between the Sendai Landslide Partnerships 2015–2025, and the SFDRR, the 2030 Agenda Sustainable Development Goals, the New Urban Agenda and the Paris Climate Agreement. By encompassing the linkages of the contributions of the ICL community to the expected outcomes of the STR-SFDRR, this paper provides valuable input to foster the SFDRR, and provides concrete information on the ongoing ICL initiatives, actions and deliverables for strengthening partnerships and science-informed public policies to reduce landslide disaster risk and to advance Integrated Landslide Disaster Risk Management at different scales.

Keywords ICL · Sendai Framework · Science and Technology Roadmap · Policy making · KCL2020 · ILDRiM

Introduction

In light of the mounting impact of disasters worldwide, it is becoming extremely difficult to ignore the need of promoting multi-scale partnerships for disaster risk reduction (DRR). Under this context, the underlying notion of the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR), inheritor of the Hyogo Framework for Action, is focused on disaster risk management in lieu of managing disasters.

The four priorities for action of the SFDRR include understanding disaster risk; strengthening disaster risk governance to manage disaster risk; investing in disaster risk reduction for resilience; and enhancing disaster preparedness for effective response and to “build back better” in recovery, rehabilitation and reconstruction (UNISDR 2015).

Owing to the work of individuals, STC teams and networks committed to DRR, collaborative efforts have been sought for advancing the evidence-based policy-making arena (Alcántara-Ayala et al. 2015, 2017a; Cutter et al. 2015; Trogrlić et al. 2017; Satake et al. 2018). In one way or another, such contributions by the STC have been bound up within the SFDRR. As such, the significance of sustained research on DRR was mirrored in the references made of the characteristic endeavours of the STC to contribute to the implementation of the SDRR (Table 1).

By way of illustration, among the thirteen guiding principles of the SFDRR, it has been recognised the substantial role of the STC and of the integrated research on DRR in enhancing sound decision-making and practice. Thereby, the involvement of scientists in combining disaster risk research with traditional knowledge and community-based approaches has also being valued and pursued (Table 1).

A year after the establishment of the SFDRR, during the Science and Technology Conference held in Geneva, it was agreed to launch the UNISDR Science and Technology Partnership for the implementation of the SFDRR and to discuss and endorse the UNISDR Science and Technology Road Map to Support the Implementation of the SFDRR (STR-SFDRR) (Aitsi-Selmi et al. 2016).

Comprising expected outcomes, actions and deliverables under each of the four priority of actions of the SFDRR in terms of assess and update data and knowledge; dissemination; monitoring and review and capacity building, the STR-SFDRR emerged as a call for the international STC to strengthening partnerships at global, regional, national, subnational and local scales (Aitsi-Selmi et al. 2016; UNISDR 2019).

The aim of this article is to provide an account of the contributions of the ICL community to the implementation of the SFDRR by virtue of the STR-SFDRR scheme and to offer some important insights into the future challenges with respect to Integrated Landslide Disaster Risk Management (ILDRiM). This paper begins by introducing the architecture and cardinal strategies of the ICL focused on DRR. It will then go on to consider the synergies between the Kyoto Landslide Commitment 2020 (KLC2020) and the STR-SFDRR. The purpose of the final section is to reflect on the extent to which ongoing and future contributions and challenges of the ICL could shed a light on landslide disaster risk policy making and practice.

The International Consortium on Landslides: efforts towards Disaster Risk Reduction

The ICL is an international, non-governmental and non-profit scientific organization committed to promote high-quality landslide research for the benefit of society and the environment (Sassa 2004a). The main cornerstone is international collaboration aimed at landslide disaster risk assessment and mitigation studies and capacity building according to specific contexts. The richness of its composition, including landslide experts from different countries and representatives from international parties associated with DRR, along with the support of international organizations and scientific associations, privilege the possibility to interact within the policy-making arena.

ICL portfolio of activities focuses on four domains: promoting and coordinating sound landslide research; capacity building; dissemination of landslide science; and science-based policy making. The major part of these substantial activities crosscut all these fields. Overall

Table 1 References made to the needed contributions of the STC towards the implementation of the SFDRR (UNISDR 2015)

Sendai Framework for Disaster Risk Reduction 2015–2030: synergies with the STC (UNISDR 2015)
III. Guiding principles
(g) “Disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge;” (p. 13)
Priority 1: understanding disaster risk
<i>National and local levels</i>
(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;” (p. 15)
<i>Global and regional levels</i>
(a) “To enhance the development and dissemination of science-based methodologies and tools to record and share disaster losses and relevant disaggregated data and statistics, as well as to strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems;” (p. 16)
(g) “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;” (p. 16)
V. Role of stakeholders
(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;” (p. 23)
VI. International cooperation and global partnership
<i>Means of implementation</i>
(b) “To enhance access of States, in particular developing countries, to finance, environmentally sound technology, science and inclusive innovation, as well as knowledge and information sharing through existing mechanisms, namely bilateral, regional and multilateral collaborative arrangements, including the United Nations and other relevant bodies;” (p. 25)
<i>Support from international organizations</i>
(c) “The United Nations Office for Disaster Risk Reduction, in particular, to support the implementation, follow-up and review of the present Framework by: preparing periodic reviews on progress, in particular for the Global Platform for Disaster Risk Reduction, and, as appropriate, in a timely manner, along with the follow-up process at the United Nations, supporting the development of coherent global and regional follow-up and indicators, and in coordination, as appropriate, with other relevant mechanisms for sustainable development and climate change, and updating the existing web-based Hyogo Framework for Action Monitor accordingly; participating actively in the work of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators; generating evidence-based and practical guidance for

implementation in close collaboration with States and through the mobilization of experts; reinforcing a culture of prevention among relevant stakeholders through supporting development of standards by experts and technical organizations, advocacy initiatives and dissemination of disaster risk information, policies and practices, as well as by providing education and training on disaster risk reduction through affiliated organizations; supporting countries, including through national platforms or their equivalent, in their development of national plans and monitoring trends and patterns in disaster risk, loss and impacts; convening the Global Platform for Disaster Risk Reduction and supporting the organization of regional platforms for disaster risk reduction in cooperation with regional organizations; leading the revision of the United Nations Plan of Action on Disaster Risk Reduction for Resilience; facilitating the enhancement of, and continuing to service, the United Nations Office for Disaster Risk Reduction Scientific and Technical Advisory Group in mobilizing science and technical work on disaster risk reduction; leading, in close coordination with States, the update of the publication entitled “2009 UNISDR Terminology on Disaster Risk Reduction”, in line with the terminology agreed upon by States; and maintaining the stakeholders’ commitment registry;” (p. 26)

strategic initiatives include the constitution of the University Twinning and Networking (UNITWIN), a Cooperation Programme on landslide risk mitigation for society and the environment with the UNESCO and Kyoto University; the establishment of the International Programme on Landslides (IPL) (Sassa 2004b); celebration of the World Landslide Forum (WLF) on triennial basis (Sassa 2009, 2017a; Sassa et al. 2012, 2015); Foundation of World Centres of Excellence on Landslide Risk Reduction (WCoEs) during each WLF; and the publication of the successful Journal *Landslides* (Fig. 1).

The five organized World Landslide Fora possess strong inter-relatedness to the International Agenda on DRR. Both, WLF1, celebrated in Tokyo, Japan, in 2008, and WLF2 “Putting science into practice”, held in Rome, Italy, in 2011, were related to the efforts of the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters. The 2008 Tokyo Declaration “Strengthening the International Program on Landslides (IPL) with UNISDR” was subscribed in the course of WLF1 (Sassa 2006). During the WLF3 “Towards a safer geoenvironment”, convened in Beijing, China, in 2014, the 2014 Beijing Declaration on “Landslide Risk Mitigation: Toward a Safer Geoenvironment” was endorsed and aimed at establishing the ISDR-ICL Sendai Partnerships (now called as the Sendai Landslide Partnerships 2015–2025, SP2015-2025) at the 2015 World Conference on Disaster Risk Reduction (WCDRR), Sendai, Japan, March 2015. Likewise, at the time of the WLF4 “Landslide research and risk reduction for advancing the culture of living with natural hazards” commemorated in Ljubljana, Slovenia, in 2017, the 2017 Ljubljana Declaration was sanctioned as a compromise of greater involvement by the global landslide community to the SFDRR (Alcántara-Ayala et al. 2017b; Sassa 2017b).

WLF5, postponed to 2021 due to the coronavirus-related global disaster, had been considered the main platform for the promulgation the KLC2020 (Sassa 2019, 2020). Nonetheless, owing to the ICL engagement in DRR and to the SFDRR, the KLC2020 declaration will not be delayed, and will take place virtually, as originally planned.

Given the aforementioned background, the ICL encourages access to reliable scientific information sources, capacity building and scientific development in the field of landslide basic and applied research to ensure the participation of an array of actors, experts, universities, specialized technical bodies, civil protection organizations and society in the development and implementation of strategies for DRR.

Fig 1 Timeline of the UN international strategies concerning DRR and the initiatives promoted by the ICL

Kyoto Landslide Commitment 2020

Fig 2 Actions involved in the Kyoto Landslide Commitment 2020

Table 2 Spheres of action with which the ICL is associated with the STR-SFDRR concerning Priority 1 Understanding disaster risk

Sendai Framework <i>Priority Action 1: Understanding disaster risk</i> Expected STR-SFDRR out-comes	
Assess and update data and knowledge	Promotion of integrated and multidisciplinary research through the establishment of regional and thematic networks: Adriatic-Balkan Network Latin America Network North-East Asia Network South-East Asian Network for Landslide Risk Management Capacity Development Network Landslides in Cold Regions Network Landslides and Cultural and Natural Heritage Network Landslide Monitoring and Warning Network Other relevant activities: Development of Landslide Dynamics: ISDR-ICL Landslide Interactive Teaching Tools for the promotion of landslide disaster risk. New landslide-classification terminology developed (Hung et al. 2014). Fostering integrated and multidisciplinary landslide research that bridges social and natural sciences. Publication of <i>Landslides</i> Journal
Dissemination	Development of partnerships between landslide science and technology community and disaster risk management institutes and agencies (number of institutions/country): Albania (1); Bosnia and Herzegovina (1); Brazil (1); Canada (2); China (8); Colombia (1); Croatia (3); Czech Republic (4); Egypt (1); Georgia (1); Germany (1); Honduras (1); India (3); Indonesia (3); Iran (1); Italy (7); Japan (2); Korea (5); Malaysia (1); Mexico (1); Nepal (2); Nigeria (1); Peru (1); Russia (3); Serbia (1); Slovakia (1); Slovenia (3); Sri Lanka (2); Chinese Taipei (2); Thailand (2); Ukraine (1); the USA (1); Vietnam (2). Other relevant activities: Best practices for landslide multi-hazards approach disseminated. Promoting the use of Landslide Dynamics: ISDR-ICL Landslide Interactive Teaching Tools for the promotion of landslide disaster risk. Publication of <i>Landslides</i> Journal
Monitoring and review	Kyoto Landslide Commitment 2020 (KLC2020) aimed at strengthening efforts to ensure coherence among the Sendai Landslide Partnerships 2015–2025, and the global post 2015 international landmarks Other relevant activities: Development of liaisons between the ICL and the DRR community
Capacity building	National and local capacity building for landslide disaster risk awareness and knowledge through regional and thematic networks and the establishment of the World Centres of Excellence (WCoEs) Capacity Development Network Dialogues with communities and citizen groups on landslide disaster risk that make science sensible to decision-makers and the general public Building capacity development in landslide disaster risk knowledge, management, innovation, research and technology.
KLC2020 Action 2 Landslides and multi-hazard mapping	
KLC2020 Action 3 Technologies for monitoring, testing and early warning	
KLC2020 Action 4 Landslide interactive teaching tools	
KLC2020 Action 9 New research frontiers	
KLC2020 Action 10 Progress Reports in Journal “Landslides”	

Synergies between the STR-SFDRR and the KLC2020

Science and Technology Roadmap to Support the Implementation of the SFDRR 2015–2030 and the Kyoto Landslide Commitment 2020

Owing to the complex interactions among landslide hazards, vulnerability and exposure, understanding and managing landslide disaster risk is not an easy endeavour. As well as considering matters of landslide disaster risk knowledge, ILDRiM should also contemplate preventing future landslide disaster risk, reducing the existing risk, preparing the response and rehabilitation and, recovering, relocating and/or rebuilding the affected areas. Thereupon, ILDRiM's complexity as a social process requires systematic and coherent efforts for the prevision, reduction and permanent control of landslide disaster risk factors

prioritising a harmonious and sustainable use of territories (Alcántara-Ayala 2021).

Accordingly, the efforts underway within the ICL seek to contribute to the development of mechanisms and initiatives to substantiate the implementation of the SFDRR that highlight the progressive recognition of transdisciplinary partnerships as well as conditions that favour or hinder effective ILDRiM.

Seeking a balanced scientific development at regional, national and community levels, the SP2015–2025 advocate for further engagement of professionals, practitioners and decision-makers in delineating policies and creating programmes designed for reducing landslide disaster risk (Sassa 2015, 2016, 2017c). As a complement, in the shape of ten specific actions, the KLC2020 commitment gears towards strengthening efforts to ensure

Table 3 Spheres of action with which the ICL is associated with the STR-SFDRR concerning Priority 2 Strengthening Disaster Risk Governance to Manage Disaster Risk

Sendai Framework <i>Priority Action 2: Strengthening Disaster Risk Governance to Manage Disaster Risk</i> Expected STR-SFDRR out-comes	
Assess and update data and knowledge	Establishment of National and regional World Centres of Excellence on Landslide Risk Reduction and interactions with policymakers and practitioners: Landslide Monitoring and Critical Infrastructure Scientific research for mitigation, preparedness and risk assessment of Landslides Formation mechanism research, disaster warning and universal education of landslides in permafrost regions Center for Applied Landslide Research (CALaR) Landslide risk assessment and development guidelines for effective risk reduction—continuation Enhancement of the existing Real-time Landslide Monitoring and Early warning System in Western Ghats and Himalayas, India Development of Community-based and Most Adaptive Technology for Landslide Risk Reduction ATLaS: Advanced Technologies for LandSlides Methods and tools for landslide forecasting and risk mitigation and adaptation strategies Landslide Hazards Mitigation Programs in the Korean Demilitarized Zone Landslide Quantitative Risk Analysis Study for Malaysia Landslides Integrated Research for Disaster Risk Reduction Characterizing past and planned activities: Klima 2050—innovational methods for risk reduction associated with hydro-meteorologically induced landslides Central Asia rockslide inventory. Compilation and analysis Harmonization of Landslide Data and Local Communities Capacity Building for Landslide Risk Reduction Landslides in Weathered Flysch: from activation to deposition Landslide risk reduction in Slovenia Model Policy Frameworks, Standards and Guidelines on Landslide Disaster Risk Reduction Characterizing past and planned activities: NBRO is the national focal point for landslide disaster risk management Implementation of National Slope Master Plan
Dissemination	Promoting dialogue and networking on Landslide DRR between scientists, academia, policymakers, civil society, media, business and private sectors at regional, national and subnational level during the World Landslide Fora and regional and national academic events.
Monitoring and review	Improving the engagement of landslide community in national coordination and implementation of ILDRiM at subnational and local level. Promoting ILDRiM in planning and development. Enhancing participatory monitoring mechanism involving civil society organization and local communities.
Capacity building	Advancing the dialogue and networking on Landslide DRR between scientists and policymakers, civil society and other relevant stakeholders during the World Landslide Fora and other meetings at national and subnational scales. Raising landslide disaster risk scientific awareness and understanding, including future risk.
KLC2020 Action 2 Landslides and multi-hazard mapping	
KLC2020 Action 3 Technologies for monitoring, testing and early warning	
KLC2020 Action 4 Landslide interactive teaching tools	
KLC2020 Action 5 Policies and strategies	
KLC2020 Action 6 Impact of climate change on landslides	
KLC2020 Action 9 New research frontiers	

coherence among the Sendai Landslide Partnerships 2015–2025, and the global post 2015 international landmarks (Fig. 2), including the Sendai Framework for Disaster Risk Reduction 2015–2030, the 2030 Agenda Sustainable Development Goals, the New Urban Agenda and the Paris Climate Agreement (Sassa 2020).

Tables 2, 3, 4 and 5 briefly explain the spheres of the ICL progress and KCL2020 goals with which it is associated with the STR-SFDRR.

Of particular relevance is the contribution of the ICL to the SFDRR *Priority 1 Understanding disaster risk*. Fostering integrated and multi-disciplinary landslide research that bridges social and natural sciences has been an ambitious initiative driven through the establishment of regional and thematic networks that has resulted in the development of partnerships between the landslide science and technology community and disaster risk management institutes and agencies. Also, within the sphere of improvements in the assessment and update of

data and knowledge, ICL members developed the use of landslide interactive teaching tools for the promotion of landslide disaster risk, contributed to the advance of landslide disaster risk understanding by publishing basic and applied research in the *Landslides* Journal and elaborated a new landslide-classification terminology (Hungr et al. 2014) (Table 2).

Building capacity development in landslide disaster risk knowledge, management, innovation, research and technology has always been a prerogative for the ICL. Therefore, national and local capacity building for landslide disaster risk awareness and knowledge has been enhanced systematically with the help of regional and thematic networks and the World Centres of Excellence (WCoEs). These efforts have allowed dialogues with communities and other relevant stakeholders on landslide disaster risk making science sensible to decision-makers and the general public (Table 2).

Table 4 Spheres of action with which the ICL is associated with the STR-SFDRR concerning Priority Action 3: Investing in Disaster Risk Reduction for Resilience

Sendai Framework <i>Priority Action 3: Investing in Disaster Risk Reduction for Resilience</i> Expected STR-SFDRR outcomes	ICL strategies and activities
Assess and update data and knowledge	Providing and seeking support for science and technology in landslide DRR to enhance knowledge, research, technology transfer. Conducting landslide research, develop tools, explore challenges in science and technology in DRR.
Dissemination	Promoting various means of multi-scale landslide disaster risk science communication for decision-making and policymakers. Increased shared information on landslide early warning systems, landslide hazard and risk maps.
Monitoring and review	Supporting innovations in landslide observation and geospatial data for risk profiling and decision-making.
Capacity building	Enhancing capacity of stakeholders in DRR to increase investment in science and technology.
KLC2020 Action 1 People centred early warning	
KLC2020 Action 5 Policies and strategies	
KLC2020 Action 8 Catastrophic mega-slide assessment	
KLC2020 Action 9 New research frontiers	
KLC2020 Action 10 Progress Reports in Journal "Landslides"	

Priority Action 2: Strengthening Disaster Risk Governance to Manage Disaster Risk presupposes high level interactions with governments and jurisdictional structures. In effect, there have been also other ICL convergences to strengthening national, sub-national and local landslide disaster risk-related policy-making endeavours. Raising landslide disaster risk scientific awareness and understanding, including future risk, has been considered a substantial approach to the longer-term significance of the interlinkages between science and policy making (Table 3).

One of the distinguishing contributions of the ICL is the establishment of National and regional World Centres of Excellence on Landslide Risk Reduction that privilege interactions with policymakers and practitioners. Addedly, promoting dialogue and networking on landslide DRR between scientists, academia, policymakers, civil society, media, business and private sectors during the World Landslide Fora and regional and national academic events has also been of significant impact to reinforce the engagement of landslide community

Table 5 Spheres of action with which the ICL is associated with the STR-SFDRR concerning Priority 4 Enhancing Disaster Preparedness for Effective Response, and to "Build Back Better" in Recovery, Rehabilitation and Reconstruction

Sendai Framework <i>Priority Action 4: Enhancing Disaster Preparedness for Effective Response, and to "Build Back Better" in Recovery, Rehabilitation and Reconstruction</i> Expected STR-SFDRR outcomes	ICL strategies and activities
Assess and update data and knowledge	Promoting landslide and multi-hazards early warning systems with improved climate information, aerial and spatial data, emergency response services and communication to end users. Developing and sharing landslide DRR best practices to inform preparedness planning. Identifying, collecting and analysing landslide case studies and assess options to strengthen recovery and rebuilding efforts.
Dissemination	Developing and disseminating information and practices on landslide disaster contingency planning and protection of critical infrastructure including the promotion of build back better approach in recovery, rehabilitation and reconstruction. Inform national landslide disaster risk reduction plans and strategies that focus on community preparedness and awareness.
Monitoring and review	Identifying and addressing the need for, and gaps in, landslide early warning systems in the least developed countries.
Capacity building	Promoting science-based decision-making for landslide disaster risk and landslide disaster-related resettlement processes. Generating and utilising landslide scientific information on post disaster actions.
KLC2020 Action 1 People centred early warning	
KLC2020 Action 2 Landslides and multi-hazard mapping	
KLC2020 Action 3 Technologies for monitoring, testing and early warning	
KLC2020 Action 5 Policies and strategies	
KLC2020 Action 6 Impact of climate change on landslides	
KLC2020 Action 7 Submarine landslides	

in national coordination and implementation of ILDRiM at subnational and local level (Table 3).

Owing to the nature of scientific research, defiant strategies and activities relate to *Priority Action 3: Investing in Disaster Risk Reduction for Resilience*. Very often, much-needed research on integrated landslide disaster risk is encountering major financial obstacles. This problem is not unique to developing countries. Nonetheless, by increasing shared information on landslide hazard and risk maps, landslide early warning systems, as well as promoting various means of multi-scale landslide disaster risk science communication for decision-making and policymakers initiation of new important alliances has been achieved (Table 4).

In the same vein, the ICL has been engaged in providing and seeking support for science and technology in landslide DRR to enhance knowledge, research and technology transfer. Thus, conducting landslide research, developing tools and exploring challenges in science and technology in DRR have also enhanced capacity of stakeholders in landslide DRR to increase investment in science and technology. In view of this, supporting innovations in landslide observation and geospatial data systems for risk profiling and decision-making on real time still represent a powerful undertaking of the ICL community (Table 4).

In recent times, a newer trend toward implementation of DRR strategies to build back better has emerged. *Priority Action 4, Enhancing Disaster Preparedness for Effective Response, and to “Build Back Better” in Recovery, Rehabilitation and Reconstruction* has been difficult in the past, and is even more so in the present. However, that may be, the ICL has been preoccupied for promoting landslide and multi-hazards early warning systems with improved climate information, aerial and spatial data, emergency response services and communication to end users (Table 5).

Crucial factors have also involved developing and sharing landslide DRR best practices to inform preparedness planning by identifying, collecting and analysing landslide case studies and assess options to strengthen recovery and rebuilding efforts. Looking to the future, developing and disseminating information and practices on landslide disaster contingency planning and protection of critical infrastructure including the promotion of build back better approach in recovery, rehabilitation and reconstruction have also been focus of major ICL efforts (Table 5).

Steps have been taken to discuss and agree with policymakers, scientists, society and other DRR actors that informed national landslide disaster risk reduction plans and strategies that focus on community preparedness and awareness should be considered in sustainable development. By the same token, identifying and addressing the need for, and gaps in, landslide early warning systems in the least developed countries and promoting science-based decision-making for landslide disaster risk and landslide disaster-related resettlement processes have offered valuable insights in producing and utilising landslide scientific information on post disaster actions (Table 5).

At the end of the day, like many other scientific endeavours in the developing and in developed worlds, in order to support avoidance of the construction of future landslide disaster risk, it has been recommended to comprehend that the importance of positive interactions between STC and policymakers are best exemplified by the implementation of ILDRiM at local level (Table 5).

Concluding remarks

In keeping with the implementation of the SFDRR, strategic decisions were made to adopt the Sendai Landslide Partnerships 2015–2025 and the KLC2020. The interaction between these dimensions makes possible to have complementary approaches to exploit developments in landslide basic and applied research to gain entrust of other landslide DRR major stakeholders.

In the international sphere, the conceptual, theoretical, technical and practical progress in understanding landslide disaster risk cannot be conceived without taking account of the influential contributions of the ICL:

- The ICL does provide a means by which a wide range of scientific communities involved in landslide research can participate in international scientific activities and global agendas.
- The ICL has always had a keen interest in promoting the share of landslide scientific knowledge and develop capacity building all over the world, and in particular to the developing countries.
- ICL members are best placed to interact with policymakers.
- ICL initiatives and ongoing commitments have a profound effect on bridging the gap between science and policy making.

In an era in which environmental and territorial responsibilities for sustainable development are practically ignored, a further step in the development of strategic alliances between STC and policy making is to pursue to build efforts and commitments that can be taken to the domain of praxis.

The importance of such partnerships lies not only in that they involve sound landslide hazard, vulnerability, exposure and risk evaluations, but ILDRiM in its crosscutting nature, which allows identification of the disaster risk governance strengths and weaknesses.

In spite of laws and regulations, overarching future directions to identify capture attainments at different scales that reflect the status of progress of ILDRiM in particular contexts will require to seek measuring the actual impact of government strategies, programmes and interventions based on science.

Members of the ICL will continue to be engaged and committed to the numerous and decisive actions, and the reporting of such progress in the understanding that the implementation of the SFDRR is embedded within a broader, more comprehensive and crosscutting process.

As well as considering practical matters of landslide disaster risk policy making and integrated management, future challenges highlight the need to support early career scientists, provide adequate access to public information for citizen participation and enhance transdisciplinary approaches. Attaining a comprehensive understanding of landslide disaster risk and advancing towards coherence across international agendas will provide a key step towards the fulfilment of the SFDRR with the incessant hope to reduce disaster risk.

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