

Local and Indigenous Knowledge and Practices (LINK), Coastal Storms, and Disaster Risk Reduction and Climate Change Adaptation in the Asia-Pacific

Ven Paolo Bruno Valenzuela, Cao Vu Quynh Anh, Chawadee Nguanson, Joshua John Jodoin, Zela Septikasari

Research question and Outcomes

AREA/FIELD OF RESEARCH:

Coastal communities in the Asia-Pacific Region are highly exposed to natural hazards, particularly hydro meteorological hazards in the form of typhoons and geological hazards in the form of earthquakes and tsunamis. On top of this challenge, the area is also one of the densest areas of human habitation in the world. This leads to more people exposed to potential disasters. Rapid urbanization, demographic change, and non-risk informed development are among the factors that drive and compound disaster risk (United Nations, 2015). Thus, there is a need to develop a culture of resilience in coastal communities in the region.

Cultures in this area have integrated this risk into local knowledge systems. In the case of the Philippines, a country predisposed to tropical cyclone, Gregory Bankoff (2003) describes this integration of risk into culture as a result of “living under a shadow of a volcano” as seen in migration patterns, sense of community rebuilding after an event, and architectural adaptation (Bankoff, 2003). Local and indigenous knowledge also played a huge role among the Smong people of Aceh as their intergenerational disaster knowledge transfer was able to prevent massive casualties during the 2004 Indian Ocean Tsunami (Gadeng, Maryani, & Rohmat, 2018; Rahman, Sakurai, & Munadi, 2017; Syafwina, 2014). Moreover, due to the Asia-Pacific region’s geographic disposition to natural hazards, cultures in this area have a way of understanding natural phenomena as means of life, especially those in the Small Islands Developing States (Mercer, Dominey-Howes, Kelman, & Lloyd, 2007). This shows that the traditional notion of vulnerability is a foreign concept to the locals due to hazards being part and parcel of the way of life (Bankoff, 2003).

When repeated exposure to natural hazards is a key part of the culture, local and indigenous knowledge systems develop around this. These local and indigenous knowledge systems form the bedrock of a community’s decision making, and are highly important for them in managing crises effectively (Hiwasaki et. al, 2014). Local and indigenous knowledge systems have been endorsed and advocated for in various global platforms including the Sendai Framework for Disaster Risk Reduction 2015-2030 and the Paris Agreement. In the Sendai Framework, it recognizes that there is a need to ensure that local and indigenous knowledge should complement scientific knowledge systems as part of the Priority Action 1: Understanding Disaster Risk (UN-General Assembly, 2015). However, the Intergovernmental Panel on Climate Change Working Group 2 5th Assessment Report states in its summary for policy

makers that while local and indigenous knowledge systems have a high confidence in contributing to climate change adaptation, these systems have never been used regularly in current disaster risk reduction practices of local communities (IPCC, 2014). Government agencies and multilateral organizations tend to develop their own methods to prevent disaster risk. However, while the knowledge is there, the challenge remains how to both preserve this knowledge for the next generation and to complement it with modern scientific knowledge systems (Cadag & Gaillard, 2012; Hiwasaki et al, 2015; Hiwasaki et al, 2014; Mercer et al., 2007).

STATEMENT OF THE PROBLEM:

In traditional approaches to Disaster Risk Reduction (DRR), a top-down approach is often utilized where government, governmental organizations, and non-governmental organizations (NGOs) come to the aid of a country after a disaster strikes (Reyers, Nel, O’Farrell, Sitas, & Nel, 2015). Another common way to refer to these top down approaches is a ‘command and control’ style of management (Scolobig, Prior, Schröter, Jörin, & Patt, 2015) that is typically rooted in research, science, and experiences that may not always be contextually relevant to the disaster area, which is broadly referred to in Figure 1 as ‘science.’ Our proposed change is to still have the benefits of outside resources but encourage a ‘people-centered’ approach where LINK (local and indigenous knowledge and practices) drives the DRR process instead of being a mere passenger.

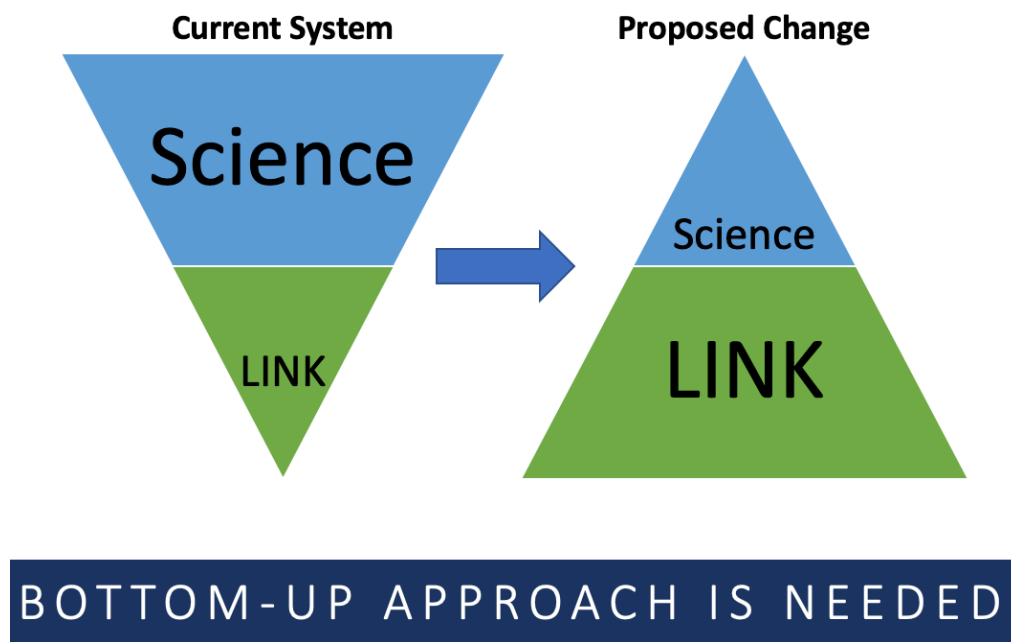


Figure 1: Proposed change to DRR rooted in a bottom-up approach

Figure 2 below shows the proposed framework for a bottom up approach to DRR-CCA, which focuses on three important areas: education, community assets, and community governance. The framework shows that LINK are the drivers of the DRR-CAA with scientific, research, and partner organizations playing a supportive role. The interaction between LINK, science and

the three areas (education, community assets, and community governance) is dynamic in nature allowing the stakeholders to be responsive to the needs of the affected communities and best place outside aid and resources as LINK deems appropriate. The framework takes into consideration that recent top-down DRR strategies and Disaster Risk Management (DRM) have made assumptions about the technical knowledge, social processes, and political pressures on communities affected by disaster that are often simplified and do not take into consideration the complexities and human dynamics at play in a community (Scolobig, Prior, Schröter, Jörin, & Patt, 2015, pp. 203-206). Thus, a bottom-up approach with LINK (Figure 2) allows for a much more community driven process to DRR-CAA and honors and acknowledges the complexities inherent in any community.

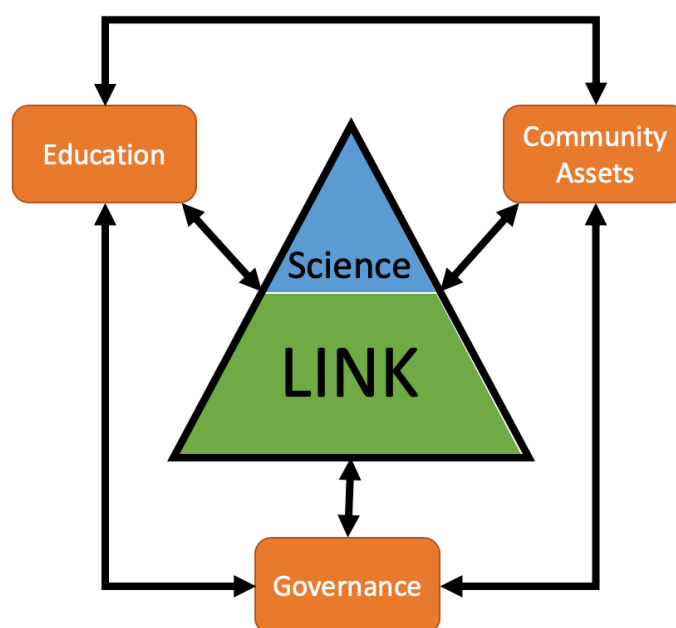


Figure 2: Framework for bottom up approach to DRR-CCA incorporating education, community assets, and community governance.

PURPOSE: Therefore the overall goal/purpose of this research is to investigate how a bottom-up approach to Disaster Risk Reduction – Climate Change Adaptation (DRR-CCA) can be effectively used in a community affected by coastal storms

RESEARCH QUESTION: Therefore the research question to be answered by this research is; how can a bottom-up approach to DRR-CCA be effectively used by communities affected by coastal storms?

OUTCOMES/DELIVERABLES :

The expected outcomes of this research will include:

- Identifying best practices in integrating local and indigenous knowledge in

education and community design

- Identification of practical challenges between science and community practices in disaster risk reduction
- Proposing a methodology in integrating LINK into disaster risk management plans
- Deliverables are a practical integration guide and journal articles

Goals and objectives

RESEARCH QUESTION (from T1):

How can a bottom-up approach to DRR-CCA be effectively used by communities affected by coastal storms?

OUTCOMES/DELIVERABLES (from T1):

- Identification of best practices in integrating local and indigenous knowledge in education and community design
- Identification of practical challenges between science and community practices in disaster risk reduction
- Proposal of a methodology for integrating LINK into disaster risk management plans
- Deliverables include a practical integration guide and journal articles

OBJECTIVES: To achieve the research goal or answer the research question, the study will address the following objectives:

1. To understand strategies in Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) that can be used in educational domains
2. To understand strategies in Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) that can be used in community asset domains
3. To understand strategies in Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) that can be used in governance domains

Specific research questions

Identify the specific research questions that you will need to ask to find and analyse the information that will help you achieve each objective. They may include a range of What, Why, Impact and Action focused questions and should reflect a sequence that can guide the sequence of data collection and analysis steps. In the third column, reflect on any issues you are aware of either in initial scope or implications if for whatever reason a certain question cannot be fully answered

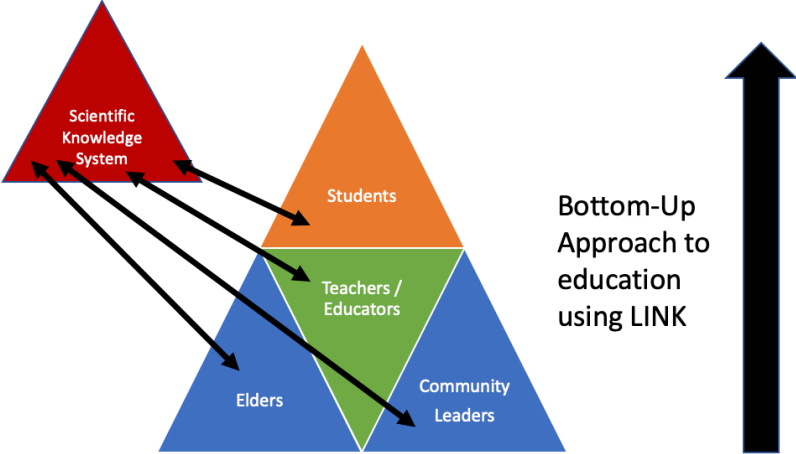
Research objectives (from T2)	Specific research questions	What are the assumptions or known issues involved and therefore the limitations with this approach; is that satisfactory to set the boundary of the thesis?
1. To understand strategies in Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) that can be used in educational domains	1.1 What existing strategies are used to teach disaster risk reduction and climate change adaptation in coastal communities affected by storms?	<p style="color: blue; text-decoration: underline;">LINK-Based DRR-CCA in Education</p> <p>Climate change and disaster risk reduction are closely linked. More extreme weather events in future are likely to increase the number and scale of disasters, while at the same time, the existing methods and tools of disaster risk reduction provide powerful capacities for adaptation to climate change (UNISDR, 2008). Disaster risk is the potential loss expressed in lives, health status, livelihoods, assets and services, which could occur to a community or a society due to the impact of a natural hazard. Disaster Risk Reduction (DRR) is a systematic approach to identifying, assessing, and reducing that risk. Specifically, the purpose of DRR is to minimize vulnerabilities and disaster risks throughout a society to avoid (prevent) or limit (mitigate and prepare for) the adverse impacts of natural hazards, as well as to facilitate sustainable development. DRR is also recognized as a key</p>
	1.2 How is local and indigenous knowledge represented in disaster education?	
	1.3 What are the means to integrate both local and scientific knowledge in disaster education?	

climate change adaptation strategy (UNICEF, 2009). It has unanimously understood that projected change in climate will aggravate associated vulnerabilities by introducing supplementary stresses to populations' resilience. Therefore, integration of climate change adaptation (CCA) with disaster risk reduction (DRR) has progressively gained prominence in global governance, which seems encouraging in retrofitting existing community disaster management structures (Bhatt, Mall, & Banerjee, 2015).

Current DRR literature focuses on the education of children in school systems or from external organizations, like NGOs, with an emphasis on top-down approaches to DRR education (Tatebe & Mutch , 2015, pp. 112-113). However, large gaps in the literature show that bottom-up approaches to DRR education are rarely studied and that community-based DRR educational programs and curriculum could be developed and researched further. Thus, bottom-up approaches to education, and specifically LINK-based DRR-CAA in education, are essential.

There are several constraints for successful bottom-up approaches to LINK-based DRR-CAA in education such as mandated curriculum, pressures from outside organizations, and teacher training. These constraints are only negative to the DRR process if they are the dominant force in the relationship. The Framework for LINK-based DRR in education (Figure 3) proposes to work with the 'Scientific Knowledge System,' which can be defined as external forces like NGOs or mandated curriculum, but enables LINK to be drivers of the process to building DRR capacity and resilience. That is to say that the 'Scientific Knowledge System' has much to add to the process but it is not a dominant force in the relationship as is traditionally the case. The

		<p>Framework for LINK-based DRR in education recognizes elders and community leaders as the pillars of the bottom-up process as they possess the knowledge, experience, and community understandings to initialize the educational processes in a community. Teachers and educators play a pivotal role in the framework as they are the transmitters of knowledge to children and youth, who will eventually take on the roles of elder and community leaders. Lastly, at the top of the framework is the students who benefit from a LINK-based educational approach to DRR. Students are recognized as a major force in communities as they bring energy and enthusiasm to the educational process and play an important role in transmitting the knowledge they learnt from teachers and educators to the community such as parents and family members. Lastly, the 'Scientific Knowledge System' plays an essential role to provide scientific understandings, research, and resources to the educational process although it plays a more supportive role in this proposed framework.</p>
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		<p style="text-align: center;">LINK based DRR in Educational Settings</p>  <p style="text-align: center;"><i>Figure 3: Framework for LINK-based DRR in education. Adapted from: Sim, Dominelli, & Lau (2017)</i></p> <p>Overall, the Framework for LINK-based DRR in education (Figure 3) is important for three reasons: (1) Education is key to raising awareness to disasters and climate change (2) LINKS are part of community culture and identity and (3) LINK-Based Education allows complementation of knowledge systems without compromising community values.</p>
<p>2. To understand strategies in Disaster Risk Reduction and</p>	<p>3.1 How do coastal communities design their assets against coastal</p>	<p>LINK-Based Design of Community Assets</p>

Climate Change Adaptation (DRR-CCA) that can be used in community asset domains	storms?	<p>Traditional community infrastructure and assets are created to withstand the challenges of their environment. However, these designs were often seen as undeveloped. As a result, people associate modernly designed buildings as developed and tend to veer away from traditional-looking housing. While modernly designed buildings can be resilient, it requires substantial knowledge and costly materials to create. While poorer people aspire to have modern-looking houses or assets, the lack of funds to do this creates a disastrous compromise in building material and design. Thus, in the event of disasters, such poorly designed housing can lead to injury or death. There is a need to bring back LINK-Based design of community assets. The research then needs to analyze both weaknesses and strengths of vernacular architecture (houses).</p> <p>There are three weaknesses points of the current vernacular. Firstly, building rooted to the ground increase susceptibility to floods. Secondly, modern architectural forms increase susceptibility to lateral loads. And thirdly, flat or low sloped roofs not adapted to tropical climates.</p> <p>However, the original resilient design of houses have been proving the strengths with six outstanding elements that could brought back and adapted with the new technologies.</p> <ol style="list-style-type: none"> 1. Habitable spaces protect against floods. 2. Regular geometric configurations help resist lateral forces form wind and earthquakes. 3. Thatched roofs aid in wind deflection, efficient water run-off, and passive cooling
	3.2 Are these designs, particularly housing, resilient against coastal hazards?	
	3.3 What is the best way to modify the design of existing community assets, particularly housing, to make them more resilient?	

		<ol style="list-style-type: none"> 4. Easily sourced materials such as bamboo and wood allow for ease of construction and maintenance. 5. Traditional wood joinery keeps the structure strong. 6. Community clustering and surrounding natural features shield against disasters.
<p>3. To understand strategies in Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) that can be used in governance domains</p>	<p>3.1 What are the existing governance structures in coastal communities?</p>	<p>LINK-Based DRR-CCA Governance</p> <p>DRR-CCA governance at the community scale currently lacks stakeholders' involvement, which leads to a shortage of ownership of the local stakeholders on the projects that were implemented on their behalf. Usually, when third parties such as NGOs or other countries support programs intervene in DRR-CCA governance, they just come for a short period of time. When there is not enough participation and engagement of the local stakeholders within the community, after the third parties leave, the projects usually die out quickly.</p> <p>However, inherent in communities in Southeast Asia are local and indigenous practices and traditions that are molded by the way they lived with the environment. Practices such as understanding the weather, designing food stores, creating resilient housing, and using passed down knowledges have been vital to creating resilience against changing climate and intensifying hazards (Bankoff, 2004; Hiwasaki et al, 2014I; Syawfina, 2014) There is a need to integrate these existing practices into local governance structures through a community approach (Hiwasaki et al, 2014). Despite this, the key challenge is to set these traditional knowledge systems on equal footing to modern scientific knowledge. Integrating and complementing LINK with scientific knowledge is essential in order to enable adaptive</p>
	<p>3.2 Does the existing structure have a disaster management mandate?</p>	
	<p>3.3 Do coastal communities have a disaster risk reduction plan and how are local practices integrated into it?</p>	

		<p>governance against increasing disaster and climate risks (Djalante et al, 2011).</p> <p>Therefore, there is a need to integrate local and indigenous knowledge (LINK) into a comprehensive DRR-CCA plan. The purpose of this section is to demonstrate how LINK can be integrated into long-term DRR-CCA community governance.</p> <p>The expected outcome is a LINK-based DRR-CCA Plan, where LINK serves as a key component. The plan includes three main parts. The first part is a co-validated risk assessment, which is co-created and co-validated by both the local stakeholders within the community and academic advisers. The assessment results will be used as the resources to develop the DRR-CCA plan. The main four themes for the plan are Prevention, Preparedness, Response, and Recovery based on the sequence of disaster responses. What is different about this plan compared to existing DRR-CCA plans in the literature is that this plan prioritizes the short, medium, and long-term activities, investments, and measures for the community itself. The last component of the proposed plan is the support mechanisms, which contains funding sources both from internal and external sources and needs and opportunities for partnerships.</p>
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RESEARCH PLAN TEMPLATE 4

Plan for data collection and analysis to provide evidence for answering the research questions defined for each objective

Specific research questions (from T3)	Techniques of data collection	Source of data	Techniques of data analysis/ model development
1.1 What existing strategies are used to teach disaster risk reduction and climate change adaptation in coastal communities affected by storms?	Secondary data gathering and key informant interviews	Local Education Sector	Literature Review and Thematic Analysis
1.2 How is local and indigenous knowledge represented in disaster education?	Secondary data gathering and key informant interviews	Local Education Sector, Community Leaders	Thematic Analysis
1.3 What are the means to integrated both local and scientific knowledge in disaster knowledge transfer?	Focus group discussions and participatory workshops	Community	Thematic Analysis
3.1 How do coastal communities design their assets against coastal storms?	Transect Walk and Key Informant Interviews	Community	Visual Assessment
3.2 Are these designs resilient against the coastal hazards?	Focus Group Discussion	Experts	Validation of Transect Walk and Key Informant Interviews
3.3 How to modify the design of existing community assets to make them more resilient?	Focus Group Discussion and Participatory Workshops	Community Stakeholders and Experts	Integration of local design with expert knowledge
3.1 What is the existing governance structure in coastal communities?	Key Informant Interviews	Community Stakeholders	Stakeholder Analysis

3.2 Does the existing structure have a disaster management structure?	Focus group discussion	Community Stakeholders	Community Risk Assessment
3.3 Do the coastal communities have a disaster risk reduction plan and how are local practices integrated into it?	Participatory Workshops	Community Stakeholders	Community-based Disaster Risk Management Workshops

RESEARCH PLAN TEMPLATE 5

Use the final template to allocate time to achieve each objective and detailed research question, paying attention to those that can be done in parallel, and those which need to be done in a certain sequence. Allow sufficient time for literature review and in particular, the write-up of the thesis. Adjust the timescale to your intended schedule.

Planned submission:

Expected time to complete the project:

Project component	Time (e.g. Month)	1	2	3	4	5	6	7	8	9	10	11	12
Literature review													
Data collection													
Data analysis/ model development													
Policy recommendation													
Write up													

- Bankoff, G. (2003). *Cultures of Disaster: Society and Natural Hazard in the Philippines*. London, UK: RoutledgeCurzon.
- Bhatt, D., Mall, R. K., & Banerjee, T. (2015). Climate change, climate extremes and disaster risk reduction. *Natural Hazards*, 78(1), 775-778.
- Cadag, J. R. D., & Gaillard, J. C. (2012). Integrating knowledge and actions in disaster risk reduction: The contribution of participatory mapping. *Area*, 44(1), 100-109.
<https://doi.org/10.1111/j.1475-4762.2011.01065.x>
- Djalante, R., Holley, C., & Thomalla, F. (2011). Adaptive governance and managing resilience to natural hazards. *International Journal of Disaster Risk Science*.
<https://doi.org/10.1007/s13753-011-0015-6>
- Gadeng, A. N., Maryani, E., & Rohmat, D. (2018). The Value of Local Wisdom Smong in Tsunami Disaster Mitigation in Simeulue Regency, Aceh Province. In IOP Conference Series: Earth and Environmental Science. <https://doi.org/10.1088/1755-1315/145/1/012041>
- Hiwasaki, L., Luna, E., Syamsidik, & Mar??al, J. A. (2015). Local and indigenous knowledge on climate-related hazards of coastal and small island communities in Southeast Asia. *Climatic Change*. <https://doi.org/10.1007/s10584-014-1288-8>
- Hiwasaki, L., Luna, E., Syamsidik, & Shaw, R. (2014). Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities. *International Journal of Disaster Risk Reduction*. <https://doi.org/10.1016/j.ijdrr.2014.07.007>
- International Strategy for Disaster Reduction (ISDR). (2008). *Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region*. Bangkok: ISDR.
- IPCC. (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, 688.
<https://doi.org/10.1017/CBO9781107415324.004>
- Kron, W. (2013). Coasts: the high-risk areas of the world. *Nat Hazards*, 1363-1382.
- Mercer, J., Dominey-Howes, D., Kelman, I., & Lloyd, K. (2007). The potential for combining indigenous and western knowledge in reducing vulnerability to environmental hazards in small island developing states. *Environmental Hazards*.
<https://doi.org/10.1016/j.envhaz.2006.11.001>
- Rahman, A., Sakurai, A., & Munadi, K. (2017). Indigenous knowledge management to enhance community resilience to tsunami risk: Lessons learned from Smong traditions in Simeulue island, Indonesia. In IOP Conference Series: Earth and Environmental Science.
<https://doi.org/10.1088/1755-1315/56/1/012018>
- Reyers, B., Nel, J. L., O'Farrell, P. J., Sitas, N., & Nel, D. C. (2015). Navigating complexity through knowledge coproduction: Mainstreaming ecosystem services into disaster risk reduction. *PNAS*, 112(24), 7362-7368.
- Scolobig, A., Prior, T., Schröter, D., Jörin, J., & Patt, A. (2015). Towards people-centred approaches for effective disaster risk management: Balancing rhetoric with reality. *International Journal of Disaster Risk Reduction*, 202-212.

- Sim, T., Dominelli, L., & Lau, J. (2017). A Pathway to Initiate Bottom-Up Community-Based Disaster Risk Reduction within a Top-Down System: The Case of China. *International Journal of Safety and Security in Engineering*, 7(3), 283-293.
- Syafwina. (2014). Recognizing Indigenous Knowledge for Disaster Management: Smong, Early Warning System from Simeulue Island, Aceh. *Procedia Environmental Sciences*.
<https://doi.org/10.1016/j.proenv.2014.03.070>
- Tatebe, J., & Mutch, C. (2015). Perspectives on education, children and young people in disaster risk reduction. *International Journal of Disaster Risk Reduction*, 108-114.
- UN-General Assembly. (2015). Sendai Framework for Disaster Risk Reduction. Third United Nations World Conference on Disaster Risk Reduction. <https://doi.org/A/CONF.224/CRP.1>
- UNICEF. (2009). *Disaster Risk Reduction and Education. Disasters*. United Nations.
- UNISDR. (2008). *Climate Change and Disaster Risk Reduction*. International Strategy for Disaster Reduction.