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# Local and indigenous knowledge for community resilience

*Hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities*


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Educational, Scientific and
Cultural Organization

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# Executive summary

Coastal communities living in archipelago countries and small island states in Asia are particularly vulnerable to the impacts of hydro-meteorological hazards such as storms, droughts, landslides, and floods. Environmental degradation such as deforestation, desertification, biodiversity loss, soil erosion, and climate change, as well as social factors such as poverty and inequality, further compound their exposure to such hazards and make these communities extremely vulnerable to disasters. Disaster risk reduction efforts in recent years are increasingly focussing not only on the hazard itself, but on the risks surrounding the hazard and the underlying components of vulnerability which can contribute to turning a hazard into a disaster. An important factor that can increase the resilience of communities is their local knowledge.

Since the 1990s, local and indigenous knowledge has received increasing attention in the fields of natural resource management, disaster risk reduction, and climate change adaptation. In the disaster risk reduction field, the 2004 Indian Ocean earthquake and tsunami has been recognized as a turning point, when specialists and scientists began to show interest in such knowledge. However, local and indigenous knowledge is yet to be included in policies on disaster risk reduction or climate change adaptation, and the wealth of documented knowledge and practices have not led to increased efforts to make use of this knowledge to enable communities to increase their resilience.

A project officially launched in 2011 focussing on local and indigenous knowledge related to hydro-meteorological hazards and climate change in Indonesia, the Philippines and Timor-Leste addresses this gap. Funded by the Japanese government through UNESCO Funds-in-Trust (2010-2014) and by the Asia-Pacific Network for Global Change Research (2012-2013), the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Jakarta Office implements this project in close partnership with government agencies, research institutes in the three countries, and experts from Japan.

After two years, the project has documented local and indigenous knowledge and practices that help communities to predict, mitigate and adapt to hazards; produced tools for integrating local and indigenous knowledge with science; and published information, education and communication materials that integrate local and indigenous knowledge and science on hydro-meteorological hazard risk reduction and climate change impacts.

This publication introduces the results of the research activities implemented between 2011-2013, based on which the action-oriented third phase of the project is being implemented. The publication begins with an introduction of the background, basic concepts and methodology used in the project. This is followed by Section 2, which consists of country-specific lessons and action points derived from activities implemented in the three countries, with a view to further promoting knowledge integration in the three countries in the final year of project implementation. Sections 3 and 4 are policy briefs. The first policy brief focuses on steps taken to integrate local and indigenous knowledge with science and technology to increase community resilience. "LIVE Scientific Knowledge", a community tool for documenting and validating local and indigenous knowledge, and integrating it with science and technology, is introduced. The second policy brief describes the process of incorporating local and indigenous knowledge and science in disaster and climate change education. Different media for information, education and communication materials, and factors to take into consideration when developing such materials to ensure effective impacts, are outlined. Both policy briefs articulate specific policy actions and tools to be taken to promote the use of local and indigenous knowledge with science for disaster risk reduction and climate change adaptation. The publication ends with a set of recommendations of actions that can be taken by national and local governments, and communities.

The primary audience for this publication is national and local government entities and communities interested in promoting the use of local and indigenous knowledge and willing to take actions to integrate such knowledge with science and technology to increase coastal community resilience. Experts, academics and practitioners working in the fields of disaster risk reduction and climate change adaptation will also find the tools and recommended actions in the policy briefs useful, in their efforts to integrate local and indigenous knowledge in their work.

# Table of Contents

# Acronyms

| | |
|---|---|
| APN | Asia-Pacific Network for Global Change Research |
| AP-DRR | Action Plan for Disaster Risk Reduction, Indonesia |
| AVP | Audio Visual Production |
| BNPB | Badan Nasional Penanggulangan Bencana (Indonesian National Disaster Management Agency) |
| BPBD | Badan Penanggulangan Bencana Daerah (Provincial/District Disaster Management Agency, Indonesia) |
| CCA | Climate change adaptation |
| CCC | Climate Change Commission, the Philippines |
| CBDRM | Community-based disaster risk management |
| CDP | Center for Disaster Preparedness, the Philippines |
| CIGD | Inter-Ministerial Commission for Disaster Risk Management, Timor-Leste |
| CSI | Coastal and small island |
| CSO | Civil society organization |
| DDMC | District Disaster Management Committee, Timor-Leste |
| DENR | Department of Environment and Natural Resources, the Philippines |
| DepED | Department of Education, the Philippines |
| DNPI | Dewan Nasional untuk Perubahan Iklim (National Council on Climate Change), Indonesia |
| DRR | Disaster risk reduction |
| DRRM | Disaster risk reduction and management |
| DRRMC | Disaster Risk Reduction and Management Council, the Philippines |
| DTB | Desa Tangguh Bencana (Disaster Resilient Village Program), Indonesia |
| ENSO | El Niño Southern Oscillation |
| FGD | Focus group discussion |
| GDP | Gross Domestic Product |
| IEC | Information, education and communication |
| KIDA | Knowledge, Interest, Desire, and Action |
| KKP | Kementerian Kelautan dan Perikanan (Ministry of Marine Affairs and Fisheries, Indonesia) |
| LDRRMO | Local Disaster Risk Reduction and Management Office, the Philippines |
| LGU | Local government unit in the Philippines |
| LINK | Local and indigenous knowledge and practices |
| LINKS | Local and Indigenous Knowledge System Programme of UNESCO |
| LIPI | Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences) |
| LPPM | Lembaga Penelitian dan Pengabdian Masyarakat (Center for Research and Community Services), Indonesia |
| LIVE Scientific Knowledge | Local and indigenous knowledge and practices Inventory, Validation, and Establishing Scientific Knowledge |

| | |
|---|---|
| MPBI | Masyarakat Penanggulangan Bencana Indonesia (Indonesian Society for Disaster Management) |
| MusrenbangDes | Musyawarah Perencanaan Pembangunan Desa (Village Development Planning Meeting), Indonesia |
| MusrenbangProv | Musyawarah Perencanaan Pembangunan Provinsi (Provincial Development Planning Meeting), Indonesia |
| NAPA | National Adaptation Programme of Action, Timor-Leste |
| NCCAP | National Climate Change Action Plan, the Philippines |
| NDMD | National Disaster Management Directorate, Timor-Leste |
| NDRMP | National Disaster Risk Management Policy, Timor-Leste |
| NDRRMP | National Disaster Risk Reduction and Management Plan, the Philippines |
| NGO | Non-governmental organization |
| PAGASA | Philippine Atmospheric, Geophysical and Astronomical Services Administration |
| PDPT | Program Desa Pesisir Tangguh (Resilient Coastal Village Program), Indonesia |
| PKK | Pemberdayaan Kesejahteraan Keluarga (Empowerment Family Welfare), Indonesia |
| PRB Prov | Rencana Penanggulangan Bencana Provinsi (Provincial Disaster Management Plan), Indonesia |
| RAD-PRB | Rencana Aksi Daerah Pengurangan Risiko Bencana (Local Action Plan for Disaster Risk Reduction), Indonesia |
| RAP | Republic Act of the Philippines |
| Ren-Aksi PRB | Rencana Aksi Pengurangan Risiko Bencana (National Action Plan for Disaster Risk Reduction, Indonesia) |
| Renas-PB | Rencana Penanggulangan Bencana (National Disaster Management Plan, Indonesia) |
| RPB | Rencana Pengurangan Bencana (Disaster Management Plan, Indonesia) |
| RPJM | Rencana Pembangunan Jangka Menengah (Mid-term Development Plan, Indonesia) |
| SDMC | Suco Disaster Management Committee, Timor-Leste |
| SIDS | Small Island Development States |
| SSB | Sekolah Siaga Bencana (School Disaster Preparedness Programme, Indonesia) |
| SSE | State Secretariat for Environment, Timor-Leste |
| StResCom | Strengthening Resilience of Coastal and Small Island Communities towards Hydro-meteorological Hazards and Climate Change Impacts project of UNESCO Jakarta |
| TDMRC | Tsunami and Disaster Mitigation Research Center, Indonesia |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNISDR | United Nations International Strategy for Disaster Reduction |
| UNTL-CNIC | National Center of Scientific Research, National University of Timor-Leste |

# 1 Introduction

## 1.1 Background

Asia and the Pacific is a region particularly vulnerable to natural hazards. In the first decade of the 21st century, over 200 million people were affected and more than 70,000 people were killed annually by disasters caused by natural hazards in the region, which represents 90% and 65% of the world's total, respectively (UNESCAP 2012). According to the World Risk Index, six out of the world's ten highest disaster risk countries are in Asia and the Pacific (Birkmann et al. 2011). Asian communities are thus extremely vulnerable to disasters, which are caused by natural hazards—such as earthquakes, tsunamis, cyclones, droughts, landslides, and floods—in combination with environmental degradation such as deforestation, desertification, biodiversity loss, pollution and soil erosion, as well as social factors such as poverty and inequality. Considering that climate change is an important driver of disasters, it is all the more necessary to develop strategies to tackle these two threats simultaneously, and integrate the strategies within wider development contexts (Kelman and Gaillard 2008).

Archipelago and small island states in Southeast Asia—where many poor communities live in coastal areas—are particularly vulnerable to the impacts of hydro-meteorological hazards.[1] In the first decade of the 21st century, the death toll from disasters caused by natural hazards in Southeast Asia constituted nearly half of Asia and the Pacific as a whole (UNESCAP 2012). Climate change impacts such as sea level rise, more frequent and intense storms, increased rainfall, and warmer ocean temperatures exacerbate hydro-meteorological hazards. Thus, not only are coastal and small island (CSI) communities in the sub-region prone to more extreme hydro-meteorological hazards, they are also affected by slow-onset changes resulting from climate change such as coastal erosion, coastal flooding, water pollution and loss of coastal ecosystem biodiversity, all of which pose a direct threat to their livelihoods.

Efforts to mitigate the impacts of hazards and climate change tend to focus on infrastructure development such as building high sea walls, or on high-tech solutions such as sophisticated early warning systems based on scientific data and modelling. These technical and scientific solutions save lives when hazards strike, however, they need to be complemented by actions to address risks surrounding the hazard and the underlying components of vulnerability—the interrelated human, social and cultural factors that influence risk—which can contribute to turning a hazard into a disaster (Wisner et al. 2004). An important component that addresses such risks and that can increase the resilience of communities is their local knowledge. Although recent years have marked the decline of such knowledge, in combination with outside knowledge, it has helped communities manage crises—be it natural hazards, economic problems, or political conflict (Ellen 2007). Evidence that local knowledge and practices can improve disaster preparedness has grown since the 1970s (Dekens 2007b), with much research being conducted (Alcántara-Ayala 2004; Battista and Baas 2004; Campbell 2009; Chan and Parker 1996; Cronin et al. 2004; Dekens 2007a; McAdoo et al. 2009; Parker and Handmer 1998; Rasid and Paul 1987; Roncoli et al. 2002; Scott and Walter 1993; Wisner 1995). Indigenous perceptions of disasters and coping mechanisms are also being documented (Bankoff 2004; Blolong 1996; Campbell 2009; Dove 2008; Lavigne et al. 2008; McSweeney 2002). Globally, the Hyogo Framework for Action (2005-2015) has acknowledged "traditional and indigenous knowledge and cultural heritage" as

1 According to the UNISDR, hydro-meteorological hazards are "[p]rocess or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage." In the context of Southeast Asian coastal communities, such hazards include tropical cyclones (typhoons and hurricanes), thunderstorms, coastal storm surges, floods including flash floods, drought, and heatwaves. Such hazards can also be a factor in other hazards such as landslides and wild fires (2009).

one source of "knowledge, innovation and education to build a culture of safety and resilience at all levels" (UNISDR 2007: 9).

It is, however, only in recent years that local and indigenous knowledge (LINK) has received increasing attention by both scientists and practitioners. In the aftermath of the 2004 Indian Ocean earthquake and tsunami, knowledge that helped indigenous communities survive the disaster was widely publicized (Meyers and Watson 2008; Rungmanee and Cruz 2005). In fact, the Indian Ocean tsunami has been credited with sparking interest in indigenous knowledge and its integration with science for disaster risk reduction (Mallapaty 2012). Publications with compilations of case studies on traditional knowledge and disaster risk reduction in Asia and the Pacific, such as Dekens (2007b), Shaw et al. (2008) and Shaw et al. (2009), attest to this heightened interest in the topic.

According to Shaw et al. (2008), the four primary arguments for including local and indigenous knowledge in disaster risk reduction policies are:

- Indigenous knowledge can be transferred and adapted to other communities in similar situations;
- Incorporating indigenous knowledge encourages community participation and empowers communities in reducing disaster risk;
- Indigenous knowledge can provide invaluable information about the local context; and
- The non-formal means of disseminating indigenous knowledge can serve as a model for education about disaster risk reduction.

Similarly, social scientists have studied indigenous knowledge and its relevance in our understanding of climate change and adaptation strategies since the 1970s, but recent years have witnessed an explosion of research on the topic. While much of this research focuses upon the Arctic (Alexander et al. 2011; Armitage et al. 2011; Berkes et al. 2007; Cruickshank 2001; 2005; Krupnik and Ray 2007; UNESCO 2009; Weatherheard et al. 2010) and the Pacific (Bridges and McClatchey 2009; Kuruppu 2009; Lefale 2010), other regions of the world are represented in a special issue of Global Environmental Change journal (Salick and Ross 2009), Climatic Change journal (Green and Raygorodetsky 2010), a compilation of case studies by Galloway McLean (2010) and a literature review in Nakashima et al. (2012). The Intergovernmental Panel on Climate Change (IPCC) acknowledged indigenous knowledge in its Fourth Assessment Report as "an invaluable basis for developing adaptation and natural resource management strategies in response to environmental and other forms of change" (Anisimov et al. 2007: 673-674). In addition, indigenous peoples themselves have been actively engaging scientists and policy-makers (Anchorage Declaration 2009; IIPFCC 2009; Tebtebba Foundation 2009).

Despite the recognition of the important role that local and indigenous knowledge can play in disaster risk reduction (DRR) and climate change adaptation (CCA), such knowledge has yet to feature prominently in climate change policy and science (Adger et al. 2011). Moreover, the increasing number of local and indigenous knowledge and practices documented on the topic of climate change and disasters have yet to lead to increased efforts in translating this knowledge into actions that increase communities' resilience against their impacts.

## 1.2 UNESCO's project on community resilience and local and indigenous knowledge

It is against such a background that the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Jakarta Office launched the Strengthening Resilience of Coastal and Small Island Communities towards Hydro-meteorological Hazards and Climate Change Impacts (StResCom) project focussing on local and indigenous knowledge related to hydro-meteorological hazards and climate change in Indonesia, the Philippines and Timor-Leste. Funded by the Japanese government through UNESCO Funds-in-Trust[2] and by the Asia-Pacific Network for Global Change Research (APN)[3], the project attempts to fill the gaps identified above, first in the three countries, and then with expanded impacts to other small island and archipelago countries in the region. The project is guided by international experts and is being implemented by the UNESCO Jakarta Office in collaboration with organizations in the three countries.

UNESCO operates at the interface between education, the sciences, culture and communication. Having played a vital role in constructing a global culture of resilient communities, UNESCO is thus in a unique position to implement such a project. UNESCO has long experience working in Asia and the Pacific in the field of disaster preparedness and local

2 The StResCom project is funded from 2010 to 2014.

3 "Capacity-building to strengthen resilience of coastal and small island communities against impacts of hydro-meteorological hazards and climate change" project, funded from 2012 to 2013.

and indigenous knowledge, such as volcanic hazard management in Ambae island, Vanuatu (Cronin et al. 2004; 2007). In the aftermath of the 2004 Indian Ocean earthquake and tsunami, the Jakarta Tsunami Information Centre was established in the UNESCO Jakarta office in 2006, and UNESCO's offices in Bangkok and Jakarta worked with both the Moken of the Surin Islands off the coast of Thailand and Myanmar and the people of Simeulue Island in Indonesia.

The Philippines, Timor-Leste, and Indonesia—which rank 3rd, 7th and 28th, respectively, in the World Risk Index mentioned above (Birkmann et al. 2011)—were chosen for this project, due to their particular vulnerability to the impacts of hydro-meteorological hazards and climate change, as well as their rich diversity, both cultural and biological. In Indonesia, about 60% of the population lives in coastal zones (which include cities) and small islands, facing the threat of hydro-meteorological hazards and climate change impacts daily (Tarigan 2007). However, most of the disaster preparedness activities in the country focus on geological hazards, earthquakes and tsunamis, with less attention being paid to hydro-meteorological hazards. In the Philippines, about 62% of the population are living in the country's coastal municipalities and cities, which are exposed to severe typhoons, flooding, and storm surges (DENR 2001). The Philippines have the highest number of tropical typhoons, with an average of 20-22 typhoons hitting the country annually (Coastguard 2013). In Timor-Leste, all but two out of 13 districts are coastal, and over 40% of the population lives under the national poverty line (UNDP 2006 in ADRA 2013). Timor-Leste is prone to multiple hazards, including earthquakes, tsunamis, floods, landslides, wildfires, and droughts. In addition, many villages are exposed to strong winds that destroy homes and crops each year (IFRC 2013).

The goal of the StResCom project is to reduce the risk and raise the resilience of coastal and small island (CSI) communities towards hydro-meteorological hazards and climate change impacts. The objectives of the project are:

- Increase stakeholder involvement in community preparedness and mitigation of hydro-meteorological hazards and climate change impacts in CSI communities;
- Identify and document local and indigenous knowledge in CSI communities related to hydro-meteorological disasters and climate change adaptation;
- Develop hydro-meteorological hazards and climate change educational and awareness-raising materials and tools for CSI communities, based on the integration of local and indigenous knowledge with science;
- Enable governments and communities to develop policies, community action plans and models to tackle hydro-meteorological hazards and climate change impacts for CSI communities, integrating local and indigenous knowledge with science; and
- Strengthen learning relationships through sharing of lessons learned and good practices in CSI communities in dealing with hydro-meteorological hazards and climate change impacts.

The use of the term resilience in this project is defined by the United Nations International Strategy for Disaster Reduction (UNISDR) as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UNISDR 2009). The concept of resilience was first introduced in the field of systems ecology and emerged in the climate and disaster literature in the 1970s before spreading widely in the 1990s. It should be acknowledged, however, that there is an ongoing debate among social scientists regarding the concept and its uses (Gaillard 2010). The focus here is on societal-environmental interactions with changes in social, cultural, economic or political factors viewed as a prerequisite to achieving resilience (Gaillard 2010). Similarly to the complex and multi-faceted layers of vulnerability, the concept of resilience is also complex and multi-faceted (Twigg 2007). The focus of the project is thus to build community resilience by addressing the specific components of knowledge and education within the concept of resilience. Following Twigg's (2007) guidance note on the "Characteristics of a Disaster Resilient Community", the project specifically focuses on knowledge and education through the integration of scientific and local and indigenous knowledge, in order to build resilience.

## 1.3 Local and indigenous knowledge and its relationship to science: Definition and basic principles

According to UNESCO's programme on Local and Indigenous Knowledge Systems (LINKS), local and indigenous knowledge refers to the understandings, skills and philosophies developed by societies

with long histories of interaction with their natural surroundings. For rural and indigenous peoples, such knowledge informs decision-making about fundamental aspects of day-to-day life (UNESCO undated). At the workshop to officially launch the StResCom project held in March 2011, it was agreed that the term local and indigenous knowledge (LINK) is analogous to terms such as local knowledge, traditional ecological knowledge, indigenous technical knowledge, and endogenous knowledge. In this broad sense of the term, LINK used in the context of the project refers to the whole array of knowledge related to DRR and CCA, which can be categorized as follows:

- perceptions and understandings of climatic changes and related natural phenomena (e.g., prediction of storms based on observations of the sky, sea and wind);
- livelihood sustainability practices (e.g., livelihood diversification);
- survival, coping and mitigation strategies (e.g., migration to higher ground, construction of houses using local materials); and
- cultural belief systems (e.g., traditional rituals and ceremonies).

According to Agrawal (1995), up until recently, LINK had been regarded as inferior to science and technology, a factor that has hindered the development process of communities. Since the 1990s, however, such attitudes have largely shifted, and the positive contributions of LINK to enable cost-effective, participatory, and sustainable natural resource management have become widely acknowledged by development practitioners (Ellen 2007). It is also around this time that scientists outside the field of anthropology began to show interest in such knowledge as a field of research (Agrawal 1995). The "Declaration on Science and the Use of Scientific Knowledge" that came out of the World Conference on Science in June 1999 calls for a broad collaboration between science and local cultures in meeting the challenges of the future, noting that "traditional and local knowledge systems" are "dynamic expressions of perceiving and understanding the world, [which] can make and historically have made, a valuable contribution to science and technology" (ICSU 2002: 2).

The StResCom project, which focuses on integration of LINK with scientific knowledge, was implemented with the premise that the two forms of knowledge are equal, with the intent to highlight the former's positive role in DRR and CCA. The project thus builds upon work of Dekens (2007a) who developed a framework to collect and analyse indigenous knowledge related to disaster preparedness, and on Mercer (et al. 2007; 2010), who developed a framework to integrate indigenous knowledge with science in the field of DRR in the context of small island development states (SIDS).

Researchers and scientists involved with the project were fully aware that the process of validation was a potentially contentious process which has been subject to much criticism (German 2010), and were careful not to disregard knowledge that could not be explained or validated scientifically or empirically. The LINK categorization that emerged out of the research can be seen below in Figure 1.1.

**Figure 1.1: Categorization of local and indigenous knowledge (LINK) on disaster risk reduction (DRR) and climate change adaptation (CCA) and its relationship to scientific validation**

| | |
|---|---|
| I<br>LINK which can be scientifically explained/validated, and related to DRR and/or CCA | II<br>LINK which cannot be scientifically explained/validated, but related and relevant to DRR and/or CCA |
| III<br>LINK which can be scientifically explained/validated, but not related to DRR and/or CCA | IV<br>LINK which cannot be scientifically explained/validated, and not related or relevant to DRR and/or CCA |

It is important to promote the use of not only the LINK category I, which can be scientifically validated or explained relatively easily, but also the LINK category II, which cannot be explained by science. Traditional ceremonies, rituals and stories related to hazards, for example, are intimately rooted in the belief systems and worldviews of a community. These play an important role in fortifying the inner strengths of individuals, social cohesion, increasing communities' awareness, and thus increasing community resilience. Section 3.4 below provides a more detailed description of these categories and the process of establishing the scientific explanations of the LINK.

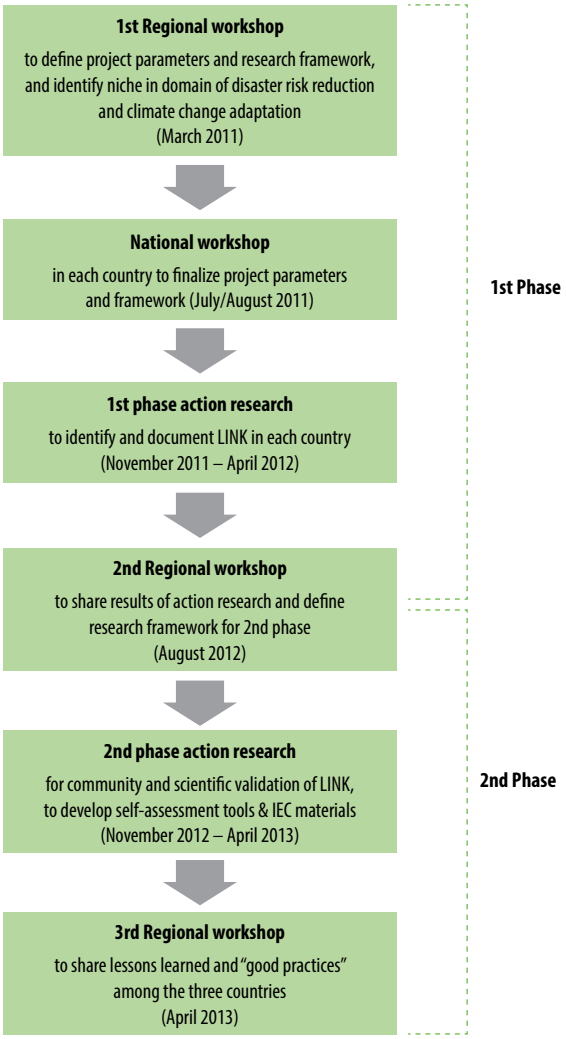
Finally, a dimension of LINK that needs to be fully acknowledged is the uneven distribution of LINK or unequal access to such knowledge that often exists, which contributes to increasing the vulnerability of certain groups within communities. This reflects the existing power dynamics, based on factors such as gender, age, and clan affiliations (Wisner 1993), and renders certain members of communities

more vulnerable to the impacts of disasters than others, as evidenced, for example, after the 2004 Indian Ocean earthquake and tsunami, which had a disproportionately high female mortality. Existing gender inequities in communities contribute to gender-based vulnerabilities to disasters (Kelman 2007). Disaster aid and relief efforts frequently reinforce the status quo, thus further contributing to the process of marginalizing vulnerable groups based on socio-economic status, gender, age, ethnicity, and disability (Wisner 1993). Although gender issues were not the focus of action research in the three countries, researchers frequently noticed this inequality. Thus, although this dimension is not explicitly mentioned in other parts of this publication, it is included as an important component in the recommendations in section 5 below.

## 1.4 Research methodology

The LINK research was undertaken during the first two phases of the three-phase StResCom project. During these two phases, UNESCO engaged an organization in each country, which implemented action research, a process which entails involving communities and stakeholders in such a way that they are motivated and willing to engage in a process of guided discovery (Mercer et al. 2008; UNESCO 2011). At the regional workshop in March 2011, UNESCO and StResCom's niche in the domain of DRR and CCA was identified. Then, national workshops were organized in each country to finalize the project parameters and research framework, and to seek interest from potential partner organizations. Partner organizations were then chosen in Indonesia, the Philippines and Timor-Leste, based on an open call for proposals. Local and indigenous knowledge related to climate change impacts and adaptation and hydro-meteorological hazards were identified and documented by the selected organizations in three CSI communities in each country. Community leaders and groups (such as youth and women's groups), traditional and religious leaders, local and national governments, local and national non-governmental organizations (NGOs), and local academics and experts were involved in the action research. Methods included field observations, focus group discussions (FGDs), workshops, semi-structured interviews, participatory mapping, and transect walks. Action research sites were selected to be as diverse as possible in terms of socio-cultural background and geography, thus when possible, one urban coastal settlement, one rural coastal settlement, and a small island were selected (in Indonesia and Philippines, considering the size and diversity of these two countries).

**Figure 1.2: Activities of the StResCom project, phases 1-2**




As for the research sites and target communities, researchers in each country acknowledged that coastal environmental problems do not just involve people in coastal areas, since they are affected by activities upstream. However, it was agreed that the sites would be defined by the common climate and hydro-meteorological issues they face, namely gradual-onset climate change impacts such as sea level rise, coastal erosion, drought, and saline intrusion, and sudden-onset phenomena such as storm surges, typhoons, coastal flooding, strong winds, and intense rainfall. Each country team developed its own working definition of what constitutes a "small island" to allow for differences in each country's context.[4]

4 The official definition of "small Islands" in the Philippines, according to the Department of Environment and Natural Resources (DENR) Administrative Order No. 2000 – 83, is "islands/islets with an area of not more than 50,000 hectares" (= 500 km$^2$). In Indonesia, a small island is an area "less than or equal to 2,000 km$^2$" (National Law No. 27 Year 2007 on Coastal Area and Small Islands Management).

All organizations implemented research under a shared framework, key definitions, and outputs agreed upon by participants at the regional workshops. This way, each organization was working with the same objectives and framework, while leaving room for flexibility to make adjustments according to each country's circumstances. Action research in the first phase was undertaken in Lipang Island and Kendahe, Sangihe Island, (North Sulawesi), Sayung, Demak district (Central Java), and Pengastulan (Bali) in Indonesia from December 2011 – April 2012 by Bingkai Indonesia, an NGO. In the Philippines, action research was conducted by the Center for Disaster Preparedness (CDP) from November 2011 – March 2012 in Rapu Rapu Island (Albay), Alabat Island (Quezon) and Angono (Rizal). Research results from the three sites in Timor-Leste in the first phase did not have sufficient details to merit inclusion in this paper.

The second phase of the project began with the second regional workshop held in August 2012. Activities were undertaken in three different sites in Indonesia: Pulo Breueh and Pulo Nasi Islands, Pulo Aceh district (Aceh) and Sayung, Demak district (Central Java) between November 2012 – April 2013 by Tsunami and Disaster Mitigation Research Center (TDMRC) in cooperation with the Indonesian Society for Disaster Management (MPBI) for Sayung. In Timor-Leste, the National Center for Scientific Research, the National University of Timor Leste (UNTL-CNIC) implemented research in Lau-Hata (Liquiça), Maluru-Beaço (Viqueque) and Raimea (Covalima) between December 2012 – April 2013, while in the Philippines activities were implemented between November 2012 – March 2013 by the CDP in the same sites as in the previous phase.

The first activity was validation of the LINK documented in the first phase, which was done both by communities and by scientists. Validation with communities involved (a) confirmation that knowledge was widely held in the study area (e.g., by fisherfolk in Aceh) and not just by one or two

**Figure 1.3: Map of project research sites, 2011 – 2013**

individuals; (b) existence of proof that the belief, knowledge, or practice has existed in the community for more than one generation; (c) relevance to anticipate or to cope with hydro-meteorological hazards and climate change adaptation; and (d) whether the LINK is still being practised and is effective (i.e., did the expected outcome from the LINK take place?). The scientists and experts then provided scientific explanations or empirical evidence as to why the LINK can be used for hydro-meteorological hazard risk reduction and climate change adaptation. FGDs and workshops were organized for community validation and for establishing scientific explanations.

Based on the results of these processes, self-assessment tools (consisting of guidelines and checklists) were developed in each country to help communities use their knowledge, in conjunction with science, to reduce their disaster risk and enable them to better adapt to climate change. The tools were piloted in one to three sites in each country, and were subsequently revised as necessary. The organizations then developed information, education and communication (IEC) materials that integrate the local knowledge with science, such as posters, flipcharts, video, booklets, and cartoons.[5] Lessons learned, self-assessment tools, and materials were shared among the three countries in a regional workshop that took place in April 2013, which resulted in another revision process for the tools and materials.

In the third phase of the project, which began in September 2013, the IEC materials developed in the second phase will be strategically disseminated, the importance of LINK for DRR and CCA will be demonstrated in pilot communities, the capacities of government entities and scientists will be developed to incorporate LINK in DRR and CCA policies in each country, and advocacy campaigns will be implemented to encourage use of LINK for DRR and CCA. The project will wrap up with a final regional workshop to share lessons learned and "good practices" widely among CSI communities in the region, and is planned for mid-2014.

## 1.5 About this publication

This publication introduces the results of the research activities implemented between 2011-2013 under the UNESCO project on local and indigenous knowledge related to hydro-meteorological hazards and climate change in Indonesia, the Philippines and Timor-Leste. Each section of the publication is written in a way so that it can be read independently, especially the policy briefs, allowing the reader to read only sections of interest.

The focus of the publication is not on the LINK identified and documented in the three countries, but on the methodologies for identifying, documenting, validating LINK and integrating LINK with science, with a view to promoting the use of such methodologies in other CSI communities.

The primary audience of this publication is national and local government entities and communities interested in promoting the use of LINK and willing to take actions to integrate such knowledge with science and technology to increase coastal community resilience. Experts, academics and practitioners working in the fields of disaster risk reduction and climate change adaptation will also find the tools and recommended actions in the policy briefs useful, in their efforts to integrate LINK in their work.

5 Information, education and communication materials will be developed in Timor-Leste in the third phase, due to the delay in project implementation.

# 2 Country-specific lessons and action points

## 2.1 Philippines

### 2.1.1 Vulnerability and resilience to hydro-meteorological hazards and climate change impacts

The Philippines, an archipelago country located in Southeast Asia that borders the Pacific Ocean, is highly exposed to hydro-meteorological hazards and climate change impacts, and ranks third in the World Risk Index of countries most vulnerable to disasters (Birkmann et al. 2011). The Philippines is prone to climatic conditions such as the inter-tropical convergence zone (ITCZ), thunderstorms, monsoons, and typhoons. Annually, an average of 20 tropical cyclones goes through the region, nine of which directly hit the country. Related climate risks expose the Philippines to super-typhoons, El Niño, projected temperature rises and intense rainfalls, and floods (DENR 2010).

The climate change scenario for 2020 and 2050 prepared by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) shows that the country's average annual mean temperature is projected to increase by between 0.9 degrees centigrade (°C) to 1.2 °C for 2020, and between 1.7 °C to 3.0 °C by 2050. It is projected that there will be a 1-metre sea level rise in many parts of the country, which will affect coastal settlements and livelihoods (CCC 2010; DENR 2010).

Many coastal and small island (CSI) communities in the Philippines are thus extremely vulnerable to the impacts of climate change and hydro-meteorological hazards. One resource that can be mobilized to help them adapt to climate change impacts and reduce disaster risks is the local and indigenous knowledge (LINK) in these communities. To mobilize this resource, it is necessary to make an inventory of the LINK, validate them to establish their scientific basis, and promote and integrate them into education, policies, programs and projects for disaster risk reduction (DRR) and climate change adaptation (CCA). Action research for the Strengthening Resilience of Coastal and Small Island Communities towards Hydro-meteorological Hazards and Climate Change Impacts (StResCom) project was conducted in three areas which are very vulnerable to hydro-meteorological hazards and climate change impacts: Angono (Rizal), a coastal municipality along Laguna Lake and two islands facing the Pacific Ocean, namely Alabat Island (Quezon) and Rapu-rapu (Albay). The three sites represent different contexts; Angono is an urban community located in the coastal area of a large lake, whereas Alabat and Rapu-rapu are both rural and small island communities.

**Figure 2.1.1: Children in front of a traditional house in Alabat Island, the Philippines**

Angono is vulnerable to floods caused by typhoons and strong rains. Flood water from Metropolitan Manila and higher parts of Rizal makes its way to the Laguna Lake through different river systems, resulting in the expansion of the lake and flooding of surrounding communities. Flooding is caused by heavy siltation due to deforestation that caused the transport of eroded soil into the lake. Industrialization and solid wastes also contribute to degradation of water ecosystems such as rivers and tributaries, and cause the elevation of the lake to increase. Angono was heavily hit by the flood caused by the overflowing of Laguna Lake in 2009 due to typhoon Ketsana. In some communities, the flooding lasted from September to January 2010.

Alabat is located in the typhoon belt of the country. Typhoons destroy crops, wash out houses due to storm surges and strong winds, cause landslides, and injure and kill people. Alabat residents have noticed changes in the climate, such as days and nights becoming warmer. There has also been a change in rainfall patterns, where rain comes in unexpected months and does not fall at times when it is usually expected to fall. Unpredictable weather has caused minor flooding in riverbank communities.

Rapu-rapu belongs to a multi-hazard region. It is exposed to earthquakes, droughts, typhoons and floods. The northeast and southwest monsoons bring rain and typhoons throughout the year, which may cause flooding to low-lying areas and settlements along riverbanks. These monsoons also isolate island communities while communication and transportation are stopped for days and even weeks. Rapu-Rapu residents have noted seasonal changes in the past five years, most notably more frequent and stronger typhoons. Rapu-Rapu has been struck by major typhoons such as Sisang in 1987, Rosing in 1994, and Reming in 2006 in recent years.

### 2.1.2 Local and indigenous knowledge in selected coastal and small island communities

Coastal zones and small islands are highly vulnerable to hydro-meteorological hazards, and the CSI communities' LINK can be used to help them become more resilient towards natural hazards. According to Shaw et al., "… inhabitants of [these] coastal areas have been developing mechanisms to survive and to adapt to such hazards for centuries. They are rich in indigenous knowledge relating to the environment and how to live in harmony with it much of which is manifested in survival and livelihood strategies" (2009: 7).

In the Philippines context, a knowledge system termed "endogenous system", which is a hybrid of indigenous knowledge and local knowledge, can be considered as LINK. The endogenous system refers to the interrelated mechanisms coming from within, using internal resources and capacities. It includes values and practices that are of external origin but have been assimilated by local people in their way of life. The endogenous way of the people is a source of power from within, collectively manifested as community resilience that can help communities overcome vulnerabilities and disasters. As a universal phenomenon that cuts across time, space and cultures, the endogenous system has to be recognized and mobilized in initiating changes and transforming communities to reduce risks and disasters (Luna 2006).

One such endogenous knowledge is the coping mechanism through family, extended family, religious organizations, clans, villages and local government. These structures allow people affected by disasters to respond to and recover from calamities and difficult situations. Another known LINK in the Philippines is the *bayanihan*, a voluntary collective action of people to assist those in need, such as moving a hut to another place, planting crops, and helping neighbours in times of emergencies and calamities (Luna 2006).

**Figure 2.1.2:** ***Bodyong,*** **a conch shell, used to warn villagers about oncoming bad weather such as typhoons (practised in Rapu Rapu, Albay, the Philippines)**

There is a wealth of LINK related to DRR in the three areas where the action research was conducted. The LINK documented included observation of animal behaviour, celestial bodies, the natural environment, and material culture used for disaster prediction, response and recovery; and traditional and faith-based beliefs and practices. For example, people are able to forecast weather by observing the stars and the sky. Some relate animal behaviour to the coming of the rain and storms. When they are sure of the coming storms, people use their LINK to prepare them for the disaster. They have developed an early warning system using conch shells, they reinforce their houses, and preserve food that will enable them to eat without cooking during a storm. During the actual hazard, *bayanihan* takes centre stage as people help each other (*pagtutulungan*), share one's burden (*padadamayan*) and empathize with one another (*pakikiramay*). Their faith and religious rituals help them endure losses, build inner resilience and give them hope that they will be able to recover with the help of God.

The outcome of the action research shows the need for creating mechanisms that can promote and popularize LINK through public awareness-raising materials, educational activities, mainstreaming LINK in policies, programs and services at national, local and community levels. For example, LINK has to be integrated in DRR strategies, particularly in hazard prediction and warning in an area and in response to hazards. Livelihood activities in agriculture and fishing have to be reviewed, with due consideration of the LINK pertaining to these activities. This can help identify processes and strategies needed to adapt to the changing environmental and climatic situations.

### 2.1.3 Integrating local and indigenous knowledge in national policies and programs

The Philippines have made significant progress in the formulation of policies, frameworks and plans for DRR and CCA through the new Philippine Disaster Risk Reduction and Management Act of 2010 (Republic Act 10121), and the Disaster Risk Reduction Policies and Plan.

Republic Act 10121 (RA 10121) strengthens the Philippine disaster risk reduction and management system by adopting a DRR approach that is holistic, comprehensive, integrated, and proactive in decreasing the socio-economic and environmental impacts of disasters. It also adopts a coherent, comprehensive, integrated, efficient and responsive DRR program integrated in the development plan at various levels. The act mainstreams DRR and climate change in the development process. RA 10121 stipulates state policies that can serve as entry points for the integration of LINK, which are:

- developing and implementing a comprehensive national disaster risk reduction and management (DRRM) plan aimed to strengthen the capacity of national and local governments and build the resilience of communities for disaster reduction (Sec. 2.e);
- ensuring that DRR and climate change measures are gender responsive, sensitive to indigenous knowledge systems, and respectful of human rights (Sec.2 j);
- engaging civil society organizations (CSOs), the private sector and volunteers in the government's DRR programs towards complementing resources and effectively delivering services to the citizenry (Sec 2.m);
- developing and strengthening the capacities of vulnerable and marginalized groups to mitigate, prepare for, respond to, and recover from the effects of disasters (Sec.2.n).

Anchored in RA 10121, the National Disaster Risk Reduction and Management Plan (NDRRMP) 2012-2028 was formulated to serve as the nation's guide to achieve sustainable development through inclusive growth while building the adaptive capacities of communities, increasing the resilience of vulnerable sectors, and optimizing disaster mitigation opportunities. The NDRRMP outlines activities aimed at strengthening capacities of the national government and local government units (LGUs) together with partner stakeholders, in building disaster resilient communities and in institutionalizing mechanisms for DRR. There are four priority areas: disaster prevention and mitigation; disaster preparedness; disaster response; and disaster rehabilitation and recovery (NDRRMC 2011).

It is significant to note that while the policies and plans clearly recognize LINK, there is little understanding of what exactly these LINK are, and there is lack of concrete proposals on how to proceed in operationalizing the use of LINK in DRR and CCA. To meet this gap, suggestions for integrating LINK in the implementation of the NDRRMP's strategies are proposed below in table 2.1.1.

**Table 2.1.1: Strategies to integrate local and indigenous knowledge in the implementation of the National Disaster Risk Reduction and Management Plan, the Philippines**

| NDRRMP strategy | Ways to integrate LINK |
|---|---|
| Advocacy and Information, Education and Communication (IEC) | - Include LINK in the advocacy and IEC agendas<br>- Produce IEC materials that integrate LINK |
| Competency-based capacity building | - Develop capacities of institutions and people to understand LINK and how these can be used in DRR and CCA |
| Contingency planning | - Include LINK before, during and after disaster events |
| Education on DRRM and CCA for all | - Integrate LINK in the curriculum and non-formal training on DRR and CCA |
| Institutionalization of Disaster Risk Reduction and Management Councils (DRRMCs) and Local Disaster Risk Reduction and Management Offices (LDRRMOs) | - Recognize and mobilize local structures and institutions and the LINK they practise |
| Research, technology development and knowledge management | - Conduct national and local research to inventory LINK across communities and sectors<br>- Promote academic research on LINK |
| Monitoring, evaluation and learning | - Include LINK as an area of concern in monitoring, how LINK are used, and the outcomes<br>- Document the lessons in LINK |
| Networking and partnership building between and among stakeholders, media and different levels of government | - Support organization of LINK advocates, researchers and practitioners |

It is stipulated in the NDDRMP that a DRRM Training Institute will be established to train the public at the national and local levels on disaster risk reduction and management. The Institute will be mandated to consolidate and prepare materials and publications for books and manuals to assist workers in planning and implementing DRRM programs and projects (RA 10121. Sec.9.i). The work of this Institute can be enhanced by promoting LINK in their training and development of educational materials.

The Philippines Climate Change Act or Republic Act (RA) 9729 mainstreams climate change into government policy formulation, establishing the framework strategy and program on climate change. Enacted on 27 July 2009, the Climate Change Act created the Climate Change Commission (CCC) with the following powers and functions, among others:

- Ensure mainstreaming of climate change, in synergy with DRR, into national, sectoral and local development plans and programs (Sec.9.a);
- Recommend legislation, policies, strategies, programs on and appropriations for climate change adaptation and mitigation and other related activities (Sec.9.e);
- Create an enabling environment that promotes broader multi-stakeholder participation and integrates climate change mitigation and adaptation (Sec. 9.h);
- Formulate and update guidelines for determining vulnerability to climate change impacts and adaptation assessments, and facilitate the provision of technical assistance for their implementation and monitoring (Sec. 9.l);
- Facilitate capacity building for local adaptation planning, implementation and monitoring of climate change initiatives in vulnerable communities and areas (Sec. 9.n);
- Oversee the dissemination of information on climate change, local vulnerabilities and risks, relevant laws and protocols and adaption and mitigation measures (Sec. 9.p).

The law mandates formulation of a national climate change framework and the roles of national agencies in implementing the strategy. Although the strategy does not mention LINK, ideas on how to mainstream LINK in the roles of national agencies are presented in Table 2.1.2.

Table 2.1.2: Roles of national agencies in the implementation of the Climate Change Act, the Philippines, and how local and indigenous knowledge can be mainstreamed

| National Agency | Role as defined by RA 9729 | How LINK can be mainstreamed |
|---|---|---|
| Department of Education (DepEd) | Integrate climate change into primary and secondary education curricula and/or subjects | Include LINK in the curricula and subject matter |
| Department of Interior and Local Government (DILG) and Local Government Academy (LGA) | Facilitate development and provision of training programs for LGUs in climate change | Develop training courses on LINK and promote inclusion of LINK in other programs |
| Department of Environment and Natural Resources (DENR) | Oversee the establishment and maintenance of a climate change information management system and network | Include LINK-related information in the information management system |
| Philippine Information Agency (PIA) | Disseminate information on climate change, local vulnerabilities and risk, relevant laws and protocols, and adaptation and mitigation measures | Include LINK in IEC materials production and dissemination |
| Government Financial Institutions | Provide preferential financial packages for climate change related projects | Provide financial support to projects that promote the use of LINK for CCA |

The National Climate Change Framework, which is translated into National Climate Change Action Plan (NCCAP), prioritizes food security, water sufficiency, ecosystem and environmental stability, human security, climate-smart industries and services, sustainable energy, and capacity development. For knowledge and capacity development, the priorities are:

- Enhanced knowledge on the science of climate change;
- Enhanced capacity for climate change adaptation, mitigation and disaster risk reduction at the local and community level;
- Established gendered climate change knowledge management accessible to all sectors at the national and local levels.

The NCCAP stipulates the various strategies of national agencies in pursuing these priorities. LINK, which falls under the mandate of knowledge and capacity development priorities, can be integrated in the specific activities in pursuit of the priorities.

### 2.1.4 Actions to integrate local and indigenous knowledge in national policies and programs

Given the policies, institutional set up and programs on DRR and climate change, and the initial ideas on the integration of science and technology with local and indigenous knowledge presented above, the next step is to conduct activities targeting government authorities and scientists. The purpose of these activities is to demonstrate the efficacy of LINK by showcasing the results of pilot projects, and demonstrating how these can be incorporated into existing DRR and CCA programs and policies in the Philippines. The following are examples of concrete activities that could be implemented:

**National Summit** to disseminate local and indigenous knowledge on disaster risk reduction and climate change adaptation, and to discuss its integration into policies and programs. The summit would involve national government agencies, CSOs, and LGUs. Other agencies can be asked to co-sponsor the program, such as PAGASA and the World Bank Philippine Climate Change Adaptation Project. It would consist of workshops attended by policy makers, practitioners and academics, and would be a one or two-day activity where resource persons would speak on various topics, followed by a workshop to formulate action plans for policy, as well as program development and advocacy.

**Forums** to integrate local and indigenous knowledge in DRR and CCA programs and projects of government agencies. The target audience would be local government units and agencies working on related issues. The strategies, programs, projects and activities laid down would be reviewed to identify local and indigenous knowledge, and then the LINK would be validated to improve the programs.

**Consultations or roundtable discussions with national government agencies** to promote the integration of LINK in the school curricula. The relevant government agencies for this endeavour

are the National Disaster Risk Reduction and Management Council (NDRRMC), Education Cluster, DepEd and the Commission on Higher Education (CHED). LINK could be included in the school curriculum through:

- National-level policies made by ministries and departments of education mandating schools to integrate LINK into appropriate subject areas.
- At the tertiary level, by offering courses on DRR and CCA with LINK as a topic. Considering that curriculum revision takes time, a more immediate way would be to promote LINK among the faculty so that they can integrate the knowledge as a topic in existing courses. LINK can be integrated into the syllabus and curriculum of existing courses on disaster relief reduction and climate change adaptation.

**Training of trainers** on LINK among CSOs engaged in DRR training. The contents will be similar to the community trainings described below, with the exception that LINK would be discussed more extensively.

**Media exposure** by tapping national networks with DRR-related programs. Resource people serving as guest commentators on radio or television programs could disseminate LINK. The national media can be invited to feature local and indigenous knowledge during national summits and conferences.

**Presentation and publication of research outcomes** at national and international academic conferences and journals. The StResCom project in the Philippines has generated adequate materials and lessons that could be shared with a wider audience.

**Advocacy to promote the integration of LINK** within existing CSO programs that are involved in disaster risk reduction and climate change. Although many CSOs work on these issues, they do not integrate LINK. National NGO networks such as the DRRNet Philippines can be mobilized for advocacy.

### 2.1.5 Actions to integrate local and indigenous knowledge by local governments

In government units at the provincial, city, and municipality levels, local disaster risk reduction and management offices are responsible for developing, implementing, and coordinating DRRM programs. The Philippine Disaster Risk Reduction and Management Act stipulates the functions of these LDRRMOs, which would be enhanced if LINK were mainstreamed into their functions (RA 10121 Sec. 12.) Specific ideas on how this can be done are illustrated in Table 2.1.3.

**Table 2.1.3: Mainstreaming local and indigenous knowledge in Local Disaster Risk Reduction and Management Office functions in the Philippines**

| Function of the LDRRMO (RA 10121, Sec.12) | Ways to mainstream LINK |
|---|---|
| Design, program and coordinate DRRM activities | Include LINK in these activities and initiate new LINK-related activities |
| Facilitate and support risk assessments and contingency planning activities | Incorporate LINK while making risk assessments |
| Consolidate local disaster risk information which includes natural hazards, vulnerabilities and climate change risks, and maintain a local risk map | Include local people in preparing the information to incorporate their knowledge |
| Organize and conduct training, orientation, and knowledge management activities on DRRM | Develop training modules on LINK and incorporate LINK in other DRRM modules |
| Formulate and implement a comprehensive and integrated local DRRM plan | Use LINK as inputs in the plan formulation and ensure that the plans are appropriate and in consonance with LINK |
| Disseminate information and raise public awareness about hazards, vulnerabilities and risks, early warning signs and counter-measures | Include relevant LINK, such as those on disaster warning and local communities' response to disaster events |
| Respond to and manage the adverse effects of emergencies and carry out recovery activities | Adopt LINK, particularly those related to disaster response and recovery, such as material culture, traditions, and faith-based beliefs and practices |

**A municipal-wide summit** on LINK in StResCom project areas to be attended by LGUs, CSOs and community representatives would promote LINK and to draw the attention, resources and commitments of local governments and CSOs towards programs and services that incorporate LINK.

### 2.1.6 Actions to integrate local and indigenous knowledge by local communities

Since village or district (*Barangay*) DRRMCs are responsible for developing, implementing and coordinating DRRM programs in the community, CSOs and local community organizations can be mobilized to promote their own LINK within their community (Republic Act, Sec. 12.a). The following are examples of concrete activities that could be implemented:

**Strengthen DRR and CCA policies**, especially in StResCom project sites where LINK documentation, assessment and scientific integration have already been implemented. Disaster risk reduction and climate change adaptation activities will be enhanced if local and indigenous knowledge with scientific, technological and sociological basis is integrated into programs, projects and activities through the Community-Based Disaster Risk Reduction and Management Program.

**Develop and disseminate simple and effective information,** education and communication materials that are appropriate and relevant to the local culture and day-to-day life.

**Organize a LINK scientific validation workshop** in the community, with widespread participation of the community, thus reinforcing the principle that conducting research and validating LINK requires the adoption of participatory processes.

**Hold community forums** to raise community awareness through the presentation of audio-visual productions (AVPs) developed in the second phase of the StResCom project. Open-floor discussions will allow the community to comment and raise questions. Posters may be posted in key places in the community.

**Conduct community training sessions** for community leaders and teachers who will be trained on:

- DRR and climate change impacts in the community
- DRR and CCA strategies
- LINK for DRR and CCA
- How to best use IEC materials (such as flipcharts and posters) developed in the StResCom project.

**Include LINK in the school curriculum,** through the formulation of policies at the school level. Schools can provide guidelines to assist teachers in integrating LINK into appropriate subject areas such as science, social studies and arts. This would not require curriculum revision, which can be complicated and lengthy, but this method can have a very limited impact because the scope would be an individual school.

**Inventory and assess LINK** through participatory action research in more communities. The more communities participate in this kind of endeavour, the better it is. This can be undertaken if local or national policies that give mandate to undertake LINK documentation, assessment and scientific integration exist. Policies could be formulated by community level authorities to implement "LIVE Scientific Knowledge" (described below in section 3.4), the tool used in conducting this activity.

Lessons and action points from the Philippines spell out realities that:

- remind us of the risks and vulnerabilities of the country and its coastal and small island communities, located in a region that is most affected by climate change impacts and hydro-meteorological hazards;
- show the rich local and indigenous knowledge used for disaster mitigation, preparedness, response and recovery in the communities;
- affirm the significance of legislative mandates that support institutionalization and sustaining of disaster risk reduction and climate change adaptation initiatives;
- it is possible and feasible to incorporate local and indigenous knowledge in education and training, both in formal and non-formal settings;
- illustrate how local and indigenous knowledge can be mainstreamed and integrated in various policies, functions, roles, programs and services of the local government units and national agencies to build resilience of the communities.

## 2.2 Indonesia

### 2.2.1 Vulnerability and resilience to hydro-meteorological hazards and climate change impacts

Positioned on the equator, Indonesia lies between the Indian Ocean and the Pacific Ocean, and has more than 13,000 islands, most of which are small islands. The majority of the population is made up of coastal and small island (CSI) communities, which are exposed to a number of hydro-meteorological hazards, such as sea storms (cyclones and typhoons), coastal abrasion, strong winds, floods, droughts, and climate change impacts. Coastal areas around Aceh, Southern Java, the north coast of Sulawesi and Eastern Nusa Tenggara experience a number of typhoons every year. Although the typhoons rarely hit these areas directly, the effects they generate around the ocean are still powerful enough to have adverse impacts on these communities.

In the last decades, the combination of land subsidence and sea level rise has been observed in several places in Indonesia. One of the areas most affected by the sea level rise is the north coast of Central Java and Jakarta, with the impacts of sea level rise also observed at several coastal villages in Eastern Nusa Tenggara. Unlike Jakarta, which is constructing giant sea walls to mitigate the increasing sea level, other areas in Indonesia are far from ready to cope with the effects of climate change.

Bedono village, located on the north coast of Central Java Province, is an example which illustrates the vulnerability of coastal communities to hydro-meteorological hazards and the impacts of climate change. Before 1995, most people in this village cultivated rice on paddy fields. However, in the past ten years, all the paddy fields have been submerged by intruding sea water, forcing people to change their land into fish ponds. The villagers have also had to elevate their houses to avoid sea water at every high tide.

The Pulo Aceh islands are located on the northern tip of Sumatra Island in Aceh province, which is prone to hydro-meteorological hazards and the impacts of climate change. Between 2002 and 2011, 25 cases of extreme waves and coastal erosion, and 49 cases of strong winds were reported in the province by the Indonesian National Disaster Management Agency (BNPB 2012). Pulo Aceh islanders have had to adapt and anticipate sea storms and strong winds generated around the Andaman Sea and the Indian Ocean. Extreme sea weather often disrupts transportation between the islands and mainland Sumatra, cutting communities off from the mainland and leaving them isolated for several days. Inadequate communication and transportation infrastructure also contributes to the difficulties faced by these communities. They do have their own local and indigenous knowledge to anticipate hydro-meteorological hazards, some of which is similar to knowledge found in other parts of Indonesia.

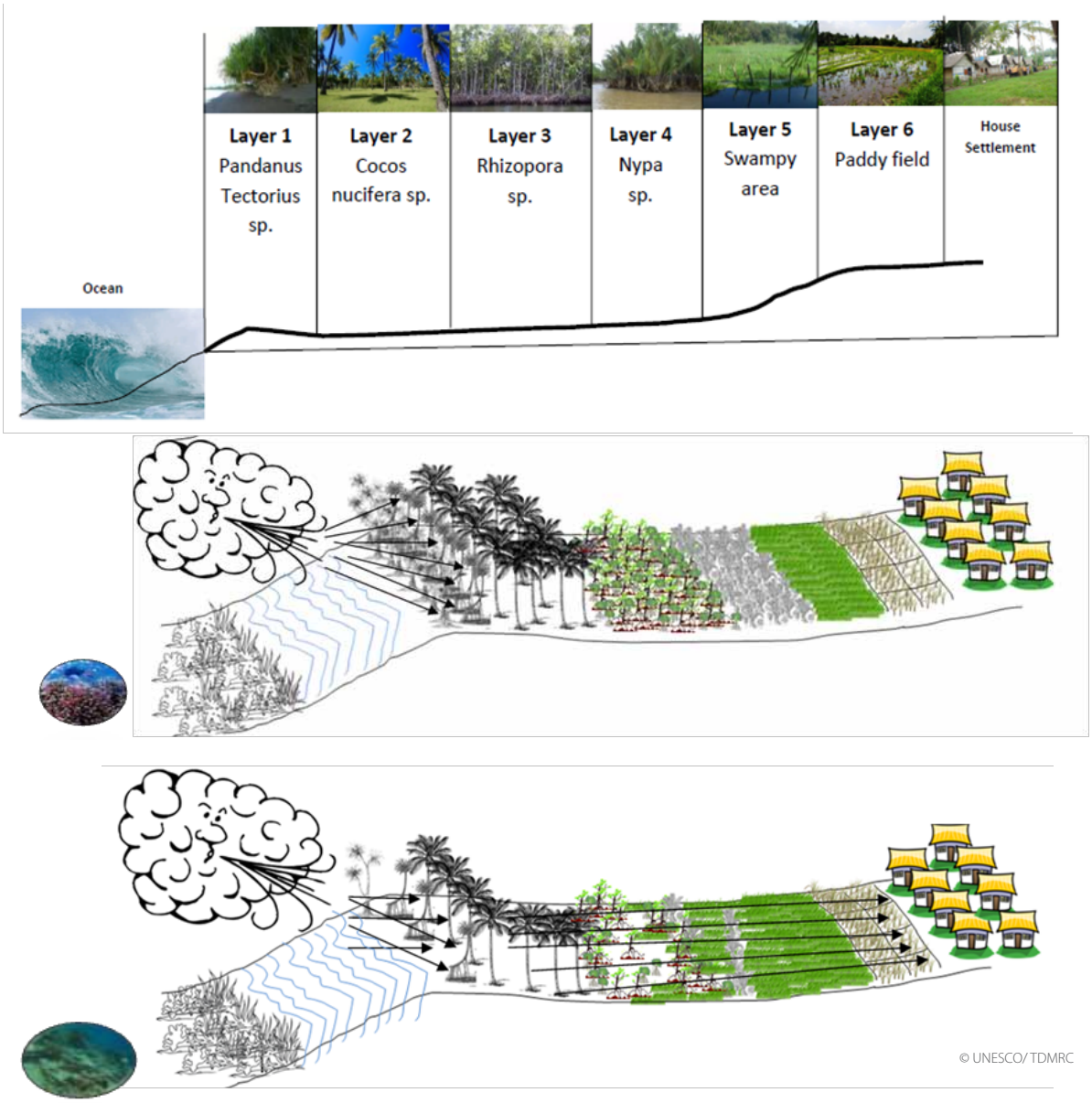
**Figure 2.2.1: Coastal flooding in Bedono Village, Sayung, Central Java**

## 2.2.2 Local and indigenous knowledge in selected coastal and small island communities

Since Indonesia is an archipelago country rich in cultural diversity, with over 300 ethnic groups and more than 700 languages spoken, much local and indigenous knowledge has been observed and documented (Lewis et al. 2013). In Aceh, one of the project sites, much local and indigenous knowledge (LINK) related to reducing disaster risk has been handed down over generations. One example is the traditional regulation surrounding the establishment of settlements around river catchment areas. For big rivers, people are forbidden to build houses closer than 100 m from the river's bank while for small rivers, the distance must be more than 50 m, which prevents damage during flood events. Other Acehnese practices to prepare for floods include putting chicken cages higher on the ground, and building traditional elevated wooden houses.

Local and indigenous knowledge that became well known after the 2004 Indian Ocean tsunami is *Smong*, a series of natural phenomena learned through songs, stories and monuments that helped communities in Simeulue Island, located to the west of Sumatra Island, to predict the coming of a tsunami. This information was passed down through the generations after the powerful 1907 tsunami when many islanders were killed (Meyers and Watson 2008).

**Figure 2.2.2: *Uteun Pasie* (coastal forest), used to prevent and mitigate impacts of high waves, strong sea winds and coastal erosion (practised by communities in Pulo Nasi, Aceh, Indonesia). The cross-section of the *Uteun Pasie* in the first two illustrations are of pre-2004 Indian Ocean tsunami destruction. The last is the current state of *Uteun Pasie*, where strong winds destroy houses and paddy fields.**



Much of the LINK identified and documented in research sites in Indonesia is based–partially or wholly—on Islamic beliefs since nearly 90% of the population is Muslim. This type of local and indigenous knowledge has influenced the way coastal and small island communities anticipate and adapt to extreme weather events and hazards. There are, however, knowledge that are not directly relevant for the purpose of disaster risk reduction and climate change adaptation, and knowledge that cannot be explained scientifically or empirically. Thus some of the LINK documented in Indonesia could be included in DRR and CCA policies, programs and activities, while other knowledge needed to be seriously considered before it is promoted and widely disseminated.

*Uteun Bangka*, documented in Aceh, is similar to a practice found in other coastal areas, of planting mangrove trees around a coastal area to reduce the wind energy and tidal forces in inland areas. *Uteun Bangka* is a customary law supported by the Acehnese cultural system and enforced by the traditional fishermen's organisation of *Panglima Laot*. The traditional calendar system called *Pranoto Mongso* found in Central Java is used to predict the right time to go fishing and how to avoid bad sea weather. Similar traditional calendar systems can be found in other CSI communities in Indonesia, and have helped fisherfolk in these areas to predict and mitigate hazards.

### 2.2.3 Integrating local and indigenous knowledge in policies and programs

Disaster management in Indonesia is implemented at several levels of government, as a result of decentralization. Although some national programs still work at the village administrative unit,[6] most disaster management programs have been delegated to lower policy levels. Some suggestions for promoting LINK in Indonesia's DRR and CCA policies and planning are outlined in this section. The levels are divided into national government, local government, and community levels in Table 2.2.1.

**Table 2.2.1: Summary of entry points for integrating local and indigenous knowledge for disaster risk reduction and climate change adaptation in Indonesia**

| Level | Actor | Possible entry points |
|---|---|---|
| National government | Indonesian National Disaster Management Agency (BNPB) | • National Disaster Management Plan (Renas-PB)<br>• National Action Plan for Disaster Risk Reduction 2014-2017 (Ren-Aksi PRB)<br>• Disaster Resilient Village Program (DTB)<br>• Master Plan for Disaster Management |
| | Ministry of Marine Affairs and Fisheries (KKP) | • Coastal Resilient Village Program (PDPT)<br>• Coastal and Small Islands Planning Programs |
| | National Council on Climate Change (DNPI) | • National Strategy for Climate Change Adaptation |
| | Ministry of Education | • University Research Development Program<br>• School Disaster Preparedness Programme (SSB) |
| Local Government | Department of Education | • SSB<br>• Curriculum integration<br>• Extra-curricular activities |
| | Department of Marine Affairs and Fisheries | • Coastal and Small Islands Spatial Planning<br>• Coastal Disaster Mitigation Program |
| | Provincial/District Disaster Management Agency (BPBD) | • Provincial Disaster Management Plan (PRB Prov).<br>• Local Action Plan for Disaster Risk Reduction (RAD-PRB) |
| | Regional Development Plan Agency (Bappeda Prov) | • Mid-term Development Plan (RPJM)<br>• Provincial Development Planning Meeting (*MusrenbangProv*) |
| | Traditional Council | • Strengthening of traditional organisation<br>• Promotion of LINK in cultural events |
| Communities | Local People | • Village Development Planning Meeting (*MusrenbangDes*)<br>• Village-based regulations<br>• Establishment of disaster response unit<br>• Incorporation in women's and youth organisations (e.g., *Karang Taruna* and PKK) |

6 In Indonesia, several words are used for "village", such as *Gampong* in Aceh, *Nagari* in West Sumatra, and *Desa* or *Kelurahan* in most other parts of Indonesia.

### 2.2.4 Actions to integrate local and indigenous knowledge in national policies and programs

Disaster management in Indonesia is regulated under National Law No. 24 enacted in 2007 (UU 2007). The Indonesian National Disaster Management Agency (BNPB) was established shortly afterwards to replace the previous agency responsible for disaster management, the National Disaster Coordinating Agency (BAKORNAS). With the enactment of this law, the paradigm of disaster management in Indonesia has shifted its focus on pre-disaster work, including disaster risk reduction. Out of BNPB's four deputies, the Deputy for Disaster Prevention and Preparedness is potentially where integration of LINK into DRR could be accommodated. There are five components in disaster management: legislation, planning, institutionalisation, budgetting, and capacity building. The relationship between the components can be seen in Figure 2.2.3.

There are nine disaster management strategies adopted by BNPB as stated in the National Planning for Disaster Management for 2010-2014. Recommendations on how LINK can be mainstreamed into the strategies are outlined in Table 2.2.2.

The opportunity to integrate LINK in DRR is already stated as part of the vision of disaster management in the Indonesian National Law No. 24 (2007) on Disaster Management. According to article No. 31 of the Law, Indonesia's disaster management should be based on four aspects, one of which is incorporating social, economic and cultural factors of communities. Further integration of LINK into DRR can be made at the program level. For example, the LINK can be incorporated into certain community-based disaster management programs, in the program for planning, but needs to be supported by sufficient funding for program execution.

**Figure 2.2.3: Indonesia's Disaster Management System**

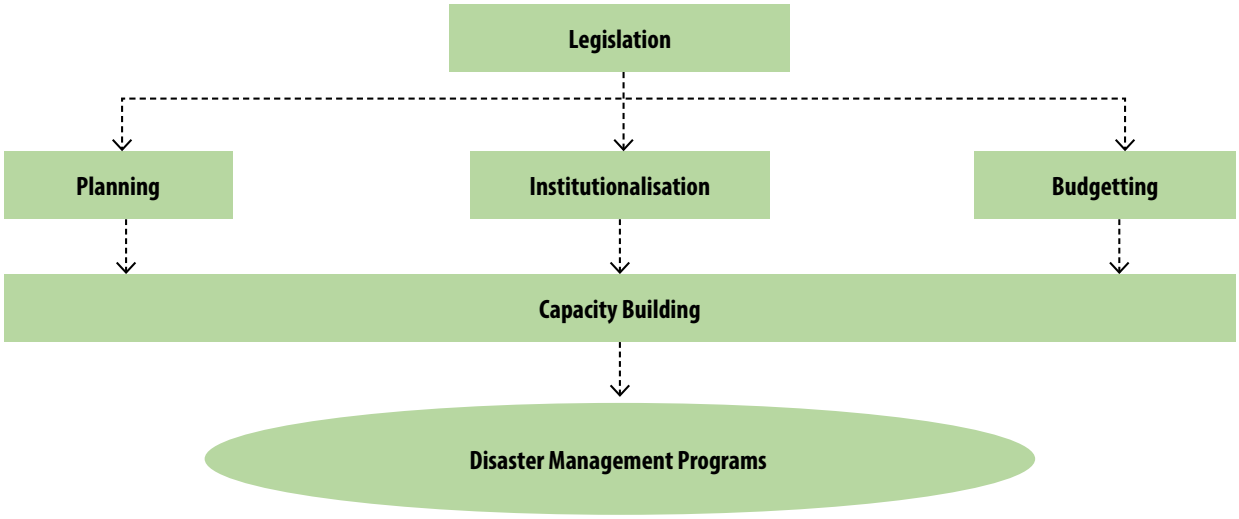


**Table 2.2.2: Strategies to integrate local and indigenous knowledge into Indonesia's national disaster management program**

| BNPB Program | Way to integrate LINK |
|---|---|
| Legislation and institutional capacity building | Insert LINK into the capacity-building process by using IEC materials and provide training that incorporates LINK |
| Integrated disaster management planning | Emphasize the important role of LINK in DRR and CCA efforts and in sustainable recovery processes |
| Research, education and training | Develop IEC materials to be included in education and training, and encourage further research on LINK related to DRR and CCA |
| Community capacity building and participation in DRR | Valorize LINK as a community's heritage that can motivate local communities to participate in DRR |
| Disaster prevention and mitigation | Promote LINK related to disaster mitigation |
| Early warning | Validate LINK that predict hazards and promote it as part of disaster early warning |
| Preparedness and emergencies | Provide actions plans to increase community preparedness by incorporating LINK |
| Rehabilitation | Adopt Build Back Better principles by incorporating LINK in the process |
| Reconstruction | |

In the system formulated by BNPB, nine prioritized programs are highlighted, one is increasing community capacity and participation of community and other stakeholders in DRR. This clearly indicates that the community is central to the DRR program. Therefore, under this program, LINK useful for DRR can be valorized as a community's heritage and promoted in activities implemented under the program. Another priority area is early warning. Since many LINKs are related to predicting certain hazards, these LINKs can be introduced as community-based hazard predictions and early warning and thus support the implementation of the program.

In addition to integrating LINK into the country's disaster management program, documents or programs to which LINK can be integrated for DRR and CCA are described below.

**National Disaster Management Plan**

A National Disaster Management Plan (*Renas-PB*) is formulated in consultation with stakeholders every five years. The vision promoted by the BNPB for disaster management in Indonesia was a "country resilient towards disasters" for *Renas-PB* 2010-2014, with the word "resilient" implying that all steps in disaster management be addressed to increase the country's resilience. Although the National Disaster Management Plan is a good entry point where LINK can be included as part of the disaster response, the idea of promoting local and indigenous knowledge for DRR and CCA is not yet familiar. The two most recent management plans, *Renas-PB* 2008-2010 and *Renas-PB* 2010-2014, did not include much local and indigenous knowledge as part of the country's DRR plan. Although many policy makers at the national level regard LINK as an important part of a response to disasters, there is no program at the national level that directly promotes local and indigenous knowledge. In *Renas-PB*, local and indigenous knowledge could be included both as part of the policy and strategy. One of the strategies is Community Based Disaster Risk Management (CBDRM). Considering that CBDRM relies on the internal capacity of communities to anticipate disasters, by integrating LINK into CBDRM, it can play an important role in filling gaps in disaster management programs. Moreover, LINK can be used to promote ways local communities adapt to the impacts of climate change. In the next Disaster Management Plan (RPB) dealing with climate change adaptation, the integration of local and indigenous knowledge can be included as one measure for coastal and small island communities. For example, knowledge on traditional seasonal calendars found in many parts of Indonesia to estimate the beginning of rainy and dry seasons can help communities adapt to climate change, with some necessary modifications to incorporate recent changes in climate. Traditional calendars rely on a formula that calculates when the rainy season starts and when the best time to plant will be. However, in recent years due to climate change, the rainy season has shifted slightly to start a little later, and there are more frequent droughts. For example, communities in Pulo Aceh began their paddy cultivation in early November decades ago. In recent years, however, there is not sufficient water to do so in November. The rainy season is the only time that provides enough water for the paddy fields since there is no dam to provide water at other times. Therefore, some modifications are necessary to make the traditional calendars continue to be relevant and useful for CSI communities in light of climate change.

**National Action Plan for Disaster Risk Reduction 2014-2017 (Ren-Aksi PRB)**

The National Action Plan for Disaster Risk Reduction document (*Ren-Aksi PRB)*, developed every three years, lists all DRR actors and activities, as well as the time, duration, and location of each planned project. The promotion of local and indigenous knowledge could be incorporated into the action plan, targeting disaster-prone CSI communities in particular. It is important to highlight that BNPB has recently begun to air films promoting local and indigenous knowledge for disaster risk reduction on national television, which has attracted significant attention from communities. The theme for the annual competition for disaster-related documentaries in 2013 was on local and indigenous knowledge for disaster risk reduction, further demonstrating the importance of this topic.

**Disaster Education Program by the Ministry of Education**

Local and indigenous knowledge for disaster risk reduction can be mainstreamed and disseminated through the school curriculum, rather than creating a new subject so as not to create additional work for teachers and students. The Ministry of Education, through the Directorate of Elementary and Secondary Education, could integrate LINK into several intra- and extra-curricular activities. The School Disaster Preparedness Programme (SSB), implemented jointly by BNPB and the Ministry of Education, could integrate LINK into the program by promoting activities related to community knowledge and climate change adaptation.

**National Research Development Strategy**

Local and indigenous knowledge for disaster risk reduction and climate change adaptation could also be mainstreamed into research activities, which are managed by the Ministry of Education, the Ministry of Research and Technology, and the Ministry of Marine Affairs and Fisheries (KKP). Other agencies and institutions actively conducting research on disasters and climate change impacts include the Indonesia Agency for Assessment and Application of Technology (BPPT) and the Indonesian Institute of Science (LIPI), as well as universities. The Ministry of Education and the Ministry of Research and Technology could promote research related to LINK at these institutions. Every university in Indonesia has a Center for Research and Community Services (LPPM or *Lemlit*). According to the Directorate of Higher Education at the Ministry of Education, each LPPM needs to formulate its own research focus, and since some centers have listed disaster mitigation as one of their research areas, research on LINK for disaster risk reduction and climate change could be included in this category. However, a clear policy direction on how LINK can be integrated into research should be formulated before this is proposed.

**National Council on Climate Change (DNPI)**

Estimates suggest that in the year 2100, about 2.5% of Indonesia's Gross Domestic Product (GDP) will be lost due to the impacts of climate change. Effective responses to climate change will reduce the loss up to 1.6% from the national GDP, thus underlining the importance of comprehensive climate change adaptation efforts. Climate change responses in Indonesia are managed by several departments and institutions, and depend on the anticipated effects of the climate change and the level of policy. In 2008, Indonesia established the National Council on Climate Change (DNPI). According to the Policy Brief on Indonesia's Strategies to Anticipate Climate Change, there are two prioritized sectors: agriculture and fisheries, and coastal and small island areas. The Policy Brief developed by DNPI was also part of the National Strategy for Climate Change Adaptation, developed by Indonesia's National Development Planning Agency (*Bappenas*).

The DNPI has eight working groups, each responsible for formulating national policies, program strategies and activities to mitigate the impacts of climate change in Indonesia and to coordinate the various activities. The DNPI can mainstream local and indigenous knowledge into national policies and activities on climate change adaptation, such as the the Mid-term Development Plan (RPJM) at national and provincial levels list development programs for the next five years. Since constructing infrastructure for climate change adaptation will be very expensive, LINK could be integrated into the DNPI's program by inserting activities to promote LINK either in the media or during community training/meetings. Together with other institutions or agencies, the Council could promote local and indigenous knowledge for CCA, such as *Uteun Pasie* to combat coastal abrasion and to reduce the impacts of strong winds and typhoons. For this type of disaster, KKP would also be an important partner for integrating this knowledge into the adaptation process.

**Village-based Disaster Management Programs**

It is important to highlight that national government institutions are also responsible for fostering community resilience at the village level. There are several ministries and national agencies with programs aimed at creating resilient villages, such as the Disaster Resilient Village Program (DTB: *Desa Tangguh Bencana*) managed by the BNPB, the Coastal Resilient Village Program (PDPT: *Pengembangan Desa Pesisir Tangguh*) run by the KKP, and other

village-based programs implemented by other ministries or national agencies. The DTB program has been designed to use quantitative and qualitative indicators to measure resilience levels in the planning, program implementation, monitoring and evaluation processes. The ability of communities to develop coping mechanisms using local resources is an indicator in measuring the resilience of a community towards disasters. Thus, increasing the coping capacity of communities through the use of local and indigenous knowledge can elevate the disaster threshold level of a village. Since LINK is found at the community level, it can be easily integrated into village-based programs to increase communities' resilience.

Against this background, activities to be implemented at the national level to integrate local and indigenous knowledge in policies and programs include the following:

**Focus group discussions (FGDs) for mainstreaming LINK into research**

Only a small number of proposals submitted by university researchers to the Higher Education Directorate of the Ministry of Education and Culture every year are related to LINK for DRR and CCA. One of the reasons may be because few attempts have been made to introduce local and indigenous knowledge as part of research for DRR and CCA. In Indonesia, a limited number of universities have an anthropology department, and, even if they have an anthropology department, limited research related to LINK and disaster management has been conducted. LIPI is one of national leading agencies for social and anthropological research, and often promotes multi-disciplinary research for disaster management, but its research has not been adapted by other researchers, including those in universities. Focus group discussions could be organized which target researchers and attempt to trigger creative ideas on how to incorporate LINK for DRR and CCA into research. Universities are often good partners for government and local communities, in helping to solve local problems including disasters, and their research results can also be used as references for proposing methods to predict disasters.

**National Conferences**

Presenting research on local and indigenous knowledge at national conferences will further enhance the visibility of this research at the national level. KKP and BNPB are two national institutions that regularly organize national conferences on disaster management and climate change adaptation, during which researchers, DRR practitioners, and policy makers share their experiences and knowledge. This would be a good venue to communicate lessons learned from research and to promote research outcomes directly to disaster practitioners. One of the reasons why research results have had minimal impacts on disaster management practices is the lack of appropriate communication with practitioners. Complicated research presentations have not been successful in showing practitioners how LINK can be mainstreamed. Presentations that illustrate best practices can yield better results and promote the idea of action research at the national level.

### 2.2.5 Actions to integrate local and indigenous knowledge by local governments

Promoting LINK at the local government level (provincial and district) requires some deliberation since most disaster management entities at this level are not very much familiar with the concept. In Indonesia, the District Disaster Management Agency (BPBD) implements disaster management at the local level. Showcasing best practices in local communities could be a potential entry point.

**Provincial and District Disaster Management Plan *(PRB Provinsi)***

The National Law No. 24 Year 2007 on Disaster Management specifies that every province should have its own disaster management plan (RPB), explaining the type of actions and which agency and department should be responsible for managing the actions. The Local Action Plan for Disaster Risk Reduction (RAD-PRB) outlines budgeting, and the location and name of the agency or institution responsible for implementation. Government Regulation No. 21 Year 2008 about Implementation of Disaster Management explains this in further detail. At present, every province in Indonesia has a Disaster Management Plan (Provincial/District RPB) and Local Action Plan for DRR (Provincial/District RAD-PRB). These can be good venues to mainstream local and indigenous knowledge for DRR and CCA at this level. Ideas or initiatives to integrate LINK can be helpful since these documents are developed through participatory processes. It must be noted, however, that the term "climate change" is not usually found in concrete actions or programs at this level so integrating LINK for climate change adaptation will be more challenging than for disaster risk reduction.

**Provincial Mid-term Development Plan (RPJM)**

One of the priorities in the Provincial Mid-term Development Plan (RPJM) is disaster risk reduction and environmental conservation. All departments

and official institutions put their programs into the Provincial Mid-term Development Plan after the Provincial Development Planning Meeting (*MusrenbangProv*), a meeting during which departments propose programs and activities considered important in the next five years, including programs for DRR and CCA. In most cases, LINK is not included as a priority program. Disaster risk reduction programs usually include community training and the construction of physical structures for disaster mitigation. In many places, local and indigenous knowledge is considered anecdotal and has never been seriously incorporated into government actions. Furthermore, since the tools and practices used for LINK are often not considered to be "modern" approaches towards disaster mitigation, they are not considered as part of the official DRR and CCA approaches. This gap could be filled by integrating local and indigenous knowledge into DRR programs in the next five years.

**The Department of Education**

The Department of Education at the provincial level can play an important role in mainstreaming LINK for education policies by supporting the dissemination of information, education and communication materials through their curriculum (without creating new subjects) and by developing supportive education policies. The support of the Department of Education would be important, considering that the Department's approval is necessary before materials are disseminated to schools. The assessment and dissemination of these materials would be done in consultation with the Department of Education at the provincial and district levels, which would ensure that the materials do not create further complexity to the educational system. There have been cases in Indonesia where educational materials were formally introduced into schools but were later retracted due to confusion and controversy because the contents were considered contradictory to the moral values and religious sensitivities of the communities. Thus, consultation with the Department of Education will ensure that the materials are reviewed and checked by the official procedures. Furthermore, since local and indigenous knowledge is usually based on a local culture including its religious practices, promoting LINK for DRR and CCA at the local government level can also be undertaken jointly with traditional and religious organisations in the area. For example, in Aceh, the Aceh Tradition Council (MAA) is a leading organisation that manages and influences many activities in the province. Since most Indonesians identify themselves with a religion, the participation of religious leaders and organisations will be key to the successful promotion of this knowledge.

The following two activities are proposed for the local government level:

**Disseminate information, education and communication materials in communities**

Different types of information, education and communication (IEC) materials, such as comic books, posters, booklets, and audio visual productions (AVP), can be disseminated to local communities and schools. Posters and booklets can be distributed during village meetings or gatherings. Baseline and endline surveys can be conducted before and after dissemination to monitor the effects of the disseminated materials. AVP materials can be aired on local television channels. It will be important to have strategic ways of monitoring and evaluating the impacts of airing such materials since it is difficult to have information on the viewers and their reactions.

**Focus group discussions and workshops with local government agencies**

FGDs and workshops can be organized at the local government level. As explained above, although the importance of local and indigenous knowledge has been highlighted as a component of local capacities to be promoted to cope with disasters in some policy documents, concrete actions to make the integration of LINK as part of disaster risk reduction and climate change adaptation have still not materialized. Therefore, FGDs and workshops could help encourage local government agencies to incorporate LINK into their programs and activities related to DRR and CCA.

### 2.2.6 Actions to integrate local and indigenous knowledge by communities

**Community-based Organisations**

Community-based organisations and village officers are two parties that can play important roles in promoting local and indigenous knowledge for disaster risk reduction and climate change adaptation. While the formal structure of the village authority is basically the same throughout Indonesia, informal organisations, such as those for youth, women, culture and religion, can vary among different villages. In Aceh, the support of *Tuha Peut* and *Tuha lapan* (cultural support organisations) are important if programs are at the village level. *Ninik Mamak* (traditional leader) has been found to be a powerful force behind change in villages in many parts of West Sumatra Province. Thus the community context is important for promoting the integration of LINK for DRR and CCA programs at the village level.

Women's organisations at the village level, such as the Empowerment Family Welfare (PKK), are usually active in undertaking social activities, and are thought to be an important way through which to communicate disaster risks at the village level (Mulyasari and Shaw 2013). There are several government programs implemented with the support of the PKK. In the 1990s, for example, the Family Planning Program was very successfully introduced to reduce birth rates in Indonesia with PKK's support. Thus strengthening the use of local and indigenous knowledge in communities for DRR and CCA could be done through PKK activities. *Majelis Wirid Yasin* is another informal women's organisation often found at the village level, which consists of women gathering on a regular basis to recite the *Qur'an*. This informal gathering is used by women to exchange information with other women in the village and could also be used as an alternative to promote LINK for DRR and CCA.

**Village Development Planning Meeting *(MusrenbangDes)***

According to Decree No. 2 Year 2012 about Disaster Resilient Village from the Head of the BNPB, it is mentioned that local and indigenous knowledge for DRR should be one of the measures to increase institutional capacity at the village level. The Disaster Resilient Village program also aims to increase the role of village communities in managing their resources and in DRR. Development planning at the village level takes place every year when the community discusses how best to allocate the government budget. Promoting LINK at this level can be undertaken by establishing a special unit for disaster management in the village. Recently, some villages in Indonesia created a special group for emergency disaster response, implying that villages are aware of the importance of managing disasters in their area. Although LINK is in use in many communities, the inclusion of this knowledge in their infrastructure-oriented approach to disaster management may not be well understood. This could be due to the lack of documentation of LINK and the diminishing influence of cultural and traditional practices in many communities. Thus, the process of identifying, documenting, and validating LINK in the villages (using tools such as the one introduced in section 3 of this publication) can facilitate the valorization of LINK at the village level and enable communities, DRR and CCA practitioners (both policy makers and scientists) to understand the importance of LINK for DRR and CCA.

**Traditional and religious activities**

Cultural and religious events can also be used to disseminate local and indigenous knowledge within communities. For example, in Aceh, *Khanduri Laot* or the coastal traditional festival is an important event used to disseminate LINK during which the leader of the traditional fishermen's organization (*Panglima Laot*) reminds all fisherfolk to obey the traditional rules for fishing, such as to maintain *Uteun Pasie* and *Uteun Bangka* and to observe *Keuneunong* and *Angeen Badee* before going out to sea. Another important event is *Khanduri Blang*, which is performed to celebrate paddy harvesting season, and serves to remind farmers of the importance of observing the right timing of when to start planting based on *Keuneunong*. This also provides farmers with some local measures to prevent crop failures and to anticipate the drought season. Although the interpretation of *Keuneunong* was traditionally specialized knowledge held only by certain people within the community, this information could be more widely disseminated to help CSI communities in Indonesia, since they are frequently exposed to hydro-meteorological hazards and are expected to face more challenges arising from climate change. It is, therefore, important to facilitate the capacity building of these communities to strengthen their ability to use LINK for DRR and CCA.

Another activity to be implemented at the community level is **working with local youth organisations** to integrate the idea of LINK for DRR and CCA. Youth organisations (*Karang Taruna*) have a strong influence over the young generation at the village level. Activities involving youth and women's groups are also part of *Karang Taruna*'s typical activities, but not all villages have strong and functional *Karang Taruna*. However, despite these differences in the influence of *Karang Taruna* on communities, the young generation is an important socio-cultural driving force in the community. The *Remaja Mesjid* (Mosque Youth Organisation) is another significant influence in the community, and could be an alternative way of revitalizing LINK within the community. Furthermore, local youth organisations can be involved in disseminating IEC materials and in monitoring the progress of advocating LINK for DRR and CCA in the area. For example, in the case of Pulo Aceh Island, the *Karang Taruna* organisation and the Pulo Aceh Students Association could be involved in the process, which would also ensure that the mainstreaming process becomes more sustainable in the targetted area.

General recommendations for promoting local and indigenous in Indonesia

Specific strategies at different levels are needed to promote the use of local and indigenous knowledge for disaster risk reduction and climate change adaptation in Indonesia, to ensure that this will accelerate the process of increasing coastal and small island communities' resilience without adding further complexity in the country's disaster risk reduction and climate change adaptation efforts. In this regard, the following points are recommended:

- to take into consideration the new disaster management structure in Indonesia that was introduced in 2007, in order to fully understand the different tasks and responsibilities mandated to different government entities responsible for disaster risk reduction, and to target each organization at the appropriate level.
- to fully consult and discuss interventions with related official agencies, in order to confirm that LINK promotion activities are relevant to the existing disaster management road maps and to prevent further complexities in these efforts.
- to include local communities, especially traditional and religious leaders in local and indigenous knowledge promotion in order to accelerate the process of mainstreaming, disseminating, and educating local and indigenous knowledge for disaster risk reduction and climate change adaptation in costal and small island communities, helping to ensure that the process is appropriate locally.

## 2.3 Timor-Leste

### 2.3.1 Vulnerability and resilience to hydro-meteorological hazards and climate change impacts

Timor-Leste, a small island development state (SIDS), has 15,000 km$^2$ of land, a coastline of 700 km, and a population of only some 1.2 million. Located on the easternmost part of the Indonesian archipelago, with Indonesia to the west and Australia to the south, Timor-Leste is considered very vulnerable to climate change and multiple natural hazards (World Bank undated). Floods, high winds, tropical cyclones with heavy rainfall, landslides, coastal erosion and droughts are the most common hydro-meteorological hazards that affect the country. Climate change is expected to exacerbate the situation, by decreasing average rainfall resulting in an extended dry season, and increasing the amount of extreme weather events. Timor-Leste is also affected by the El Niño Southern Oscillation (ENSO) climate variability, which changes the timing and volume of rainfall, resulting in a drought year one out of every four years (RDTL-MED 2010). Farming has led to deforestation and soil erosion, leading to landslides and coastal flooding. In turn, these hazards result in other problems such as insect infestations, an increase in diseases and food insecurity. These problems further compound the existing poverty in the country, which is on the list of UN's least developed countries (LDCs). It is estimated that in 2007, 20% of households were classified as food-insecure, 23% as highly vulnerable, 21% as moderately vulnerable, and 36% as food-secure with severe stress on food availability during certain times of the year (WFP 2013). The technical means to prevent and mitigate natural hazards are lacking, especially in many parts of the country which are isolated and lack basic infrastructure such as reliable roads. When hazards strike, the capacity for an effective response is limited, and the slow, centralized response exacerbates the impact of the hazard (World Bank undated).

Figure 2.3.1: Roads damaged by frequent floods in Viqueque, Timor-Leste



The three sites selected for LINK identification, documentation, and validation for the second phase of the StResCom project are all coastal communities vulnerable to hydro-meteorological hazards and climate change impacts. Raimea in the Covalima district is a lowland coastal area facing the Timor Sea. In recent years, the community reported experiencing many hazards such as heavy rain and floods (2009-2010), drought (2004, 2005, 2006) and storms (2002, 2003 and 2011).

Lau-Hata in Liquiça, located 35 km west of Dili, the country's capital, is an upland coastal area. The village experienced the impacts of climate change and hydro-meteorological hazards such as an extension of the dry season, non-stop rain, floods, landslides, and sea level rise. The community experienced extended dry seasons in 1976, 1985, 1987 and 2010. Between 2004 and 2011, however, they experienced non-stop rain, inundation, landslides and sea level rise, with strong winds observed in 1976, 1995 and from 2004 to 2012.

Maluru-Beaço in Viqueque, a coastal village facing the Timor Sea, is exposed to drought, heavy rain, storms, erosion, landslides, as well as a rise in sea level and sea surface temperature. The community recalls experiencing extreme weather events and natural hazards since 1975, with non-stop rain and sea level rise being noticed in 1982, 1984, 1994 and 1996, and increasing in frequency in 2000, 2004, 2006, 2007 and 2010 until 2012. The periods between the rains are marked by drought, with villagers recalling springs drying up. Since 2000, extremely strong winds that have destroyed trees, houses and animal stalls have been observed every other year.

## 2.3.2 Local and indigenous knowledge in selected coastal and small island communities

Despite its small size, Timor-Leste is quite diverse, and can be divided into six agro-climatic zones and three zones by rainfall and temperature patterns. Timor-Leste is also rich in ethnic and cultural diversity, with over 16 spoken languages. Although the majority of the population is Catholic, there is a wide variation in indigenous knowledge systems, customs and governance structures. It is thus not surprising that various forms of local and indigenous knowledge (LINK) were identified in the three coastal communities selected by the project. Observations of the sun, moon, clouds, sea, animals, plants, and insects allow these communities to predict storms, heavy rainfall, floods, droughts, and landslides, and have enabled them to better prepare for such

**Figure 2.3.2: Traditional house in Raimea Village, Covalima, Timor-Leste, with *Ai Tatan* to clamp the roof from storms and strong winds, and *Lenik* to prevent strong winds from entering the house.**



hazards and mitigate their impacts. Traditional ceremonies and rituals based on respect for nature are practised to stop heavy rainfall and storms, and rituals to stop rain (*Queror* in Lau-Hata, Liquiça or *Bare-Bare* in Maluru-Beaço, Viqueque) are performed. Customary laws (*Tara Bandu*) related to conservation of the environment and the management of natural resources play important roles in preventing and mitigating landslides and floods. These beliefs, rituals, and laws help reduce communities' vulnerability to hydro-meteorological hazards and climate change, because they engender and reinforce respect for the environment and strengthen social relationships.

Thus, strengthening existing local and indigenous knowledge by combining it with scientific information will enable communities to be even better prepared for hydro-meteorological hazards and climate change. LINK combined with science will result in local and context-specific information, education and communication materials, action and adaptation plans. This is particularly important considering the cultural and linguistic diversity of Timor-Leste, as well as the fact that when a disaster strikes, a rapid government response is unlikely. It is, therefore, all the more important to develop local strategies to help communities develop their own means of predicting and dealing with hazards, disasters, and climate change impacts.

### 2.3.3 Integrating local and indigenous knowledge in national policies and programs

Currently, the National Disaster Management Directorate (NDMD), under the Ministry of Social Solidarity (MSS), is responsible for the disaster risk reduction activities of the entire country. The National Disaster Risk Management Policy (NDRMP) published in 2008 set out the following five points:

- Promote national hazard, vulnerability and risk monitoring and analysis;
- Create early warning systems, particularly relating to rain and drought;
- Conduct training and capacity building of human resources in the area of disaster risk management;
- Be able to provide an immediate response when disaster occurs;
- Establish inter-sectoral coordination mechanisms to respond to natural disasters.

To ensure the sustainability of these policies and actions, the policy emphasizes the importance of building the capacities of disaster managers at national, district and community levels through awareness raising and training. The policy also calls for the creation of national, district and local entities for disaster risk management institutions with "the skills and mandate to provide technical and political assistance to disaster managers" which, in turn, can be "supported by community members and non-governmental and international institutions" (RDTL-MSS 2008: xi).

The Policy recognizes that local people suffer the most from disasters. They are the front-line responders, which may include "fright and flight" human survival measures such as evacuating to higher ground and harvesting survival foods, building traditional shelters, and using traditional medicines. Communities undertake precautionary measures and assist others before outside help comes. The increasing frequency of disasters and the resulting impacts on lives and livelihoods has led community members to develop several coping mechanisms and strategies based on their existing capacities. However, because of limited resources, knowledge, skills and technical support, communities are often outside of any rapid assistance network. The more able communities are to manage emergencies, the less external assistance will be needed. At present, many emergencies turn into disasters because local communities do not have the capacity or resources to respond adequately. For example, requests for assistance are often made to the national government in Dili following vehicle accidents when a person is trapped in a vehicle and when there is a small landslide.

The NDRM recommends that priority be given to community-based capacity building to strengthen existing local coping strategies. Local experience and preparedness should enable community members to act as first responders. Although the Policy does not explicitly mention local and indigenous knowledge, integrating LINK would improve disaster risk preparedness, mitigation and prevention, and would strengthen the preparedness and prediction part of the NDMD's work. Local and indigenous knowledge related to the prediction of hazards could be integrated in the NDMD's efforts to establish early warning systems.

As for climate change, the State Secretariat for Environment (SSE), under the Ministry of Commerce Industry and Environment, has elaborated the National Adaptation Programme of Action (NAPA) on Climate Change, with following nine adaptation measures as priorities:

- Food Security: Reduce the vulnerability of farmers and pastoralists to increased drought and flood events;
- Water Resources: Promote Integrated Water Resource Management (IWRM) to guarantee water access in a climate change context;
- Human Health: Enhance the capacity of the health sector and communities to anticipate and respond to changes in the distribution of endemic and epidemic climate-sensitive diseases, and reduce the vulnerability of populations to infection from the expansion of climate-related diseases;
- Natural Disasters: Improve institutional and community capacity to prepare for and respond to climate change induced natural disasters;
- Forests, Biodiversity and Coastal Ecosystems: Maintain and restore mangroves and forests, and promote awareness raising to protect coastal ecosystems and forests from climate change impacts;
- Livestock Production: Improve planning and legal framework for the promotion of sustainable and balanced food for livestock production;
- Physical Infrastructure: Improve regulations, standards and compliance for climate-resilient infrastructure;
- Support the ambitious target by improving the capacity to forecast and adapt offshore oil and gas infrastructure to withstand the expected increased storm intensity at sea;
- Underpinning all others, develop a National Institutional Capacity for Climate Change through which programme level coherence will be ensured.

Once again, there is no mention of LINK in NAPA, however, it recognizes the need to "increase the resilience of vulnerable groups and to support them to understand, avert and manage disasters" (RDTL-MED 2010: 37). The NDMD and the SSE can work together in the Sector Working Group on disasters to promote the use of LINK to increase CSI communities' resilience to climate-related hazards by, *inter alia*, increasing their awareness and improving their knowledge by combining LINK with science. It has been recognized that climate-related risks can be reduced if cooperation among relevant government agencies is promoted and collaboration and coordination activities are formalized through a multi-sector mechanism (cf. RDTL-MED 2012).

### 2.3.4 Actions to integrate local and indigenous knowledge in national policies and programs

Given the institutional set up and policies described above, it is clear that coordinated actions can be taken by the various national agencies to promote the integration of LINK into the country's actions towards DRR and CCA.

The following are concrete activities that could be implemented:

**A forum** involving representatives of various ministries and agencies, international, national, and local NGOs, and development partners, taking advantage of the existing Community Based Disaster Risk Management (CBDRM) Working Group and the Inter-Ministerial Commission for Disaster Risk Management (CIGD), which was established as a follow-up to the National Disaster Risk Management Policy (NDRMP). Organized by the NDMD, the purpose of such a forum would be to:

- promote the importance of local and indigenous knowledge related to disasters, climate change, and environment to the staff of NDMD, SSE, and other relevant government agencies (such as those mentioned below);
- strengthen communication between NDMD, SSE, the Ministry of Agriculture and Fisheries (responsible for developing and maintaining policies and legislation regarding land use, and issues related to animals, crops, and fish), the State Secretariat of Natural Resources (environmental protection and disaster risk reduction and development), and others involved with CIGD;
- strengthen coordinated efforts with the Department of Peace-Building and Social Cohesion under the Ministry of Social Solidarity (responsible for promoting the use of *Tara Bandu*; the State Secretariat of Culture (responsible for safeguarding traditional institutions that enable local knowledge to be maintained and transmitted, such as *Uma Lulik* (sacred house) and *Lia Nain* (traditional leaders);
- promote to donors, development agencies, and NGOs at various levels, the international recognition of LINK as an important resource in development programmes.

**Wide dissemination of information, education, and communication (IEC) materials** that promote the use of LINK with science and technology for DRR and CCA. Audio visual productions (AVPs) could be shown on local television Radio Televizaun Timor Lorosae (RTTL) while posters would be an effective way of conveying messages to local communities, especially those without electricity. Poster submissions could be sought from students through a country-wide competition, for example, and would help increase awareness of the importance of LINK and promote its use for disaster risk reduction and climate change adaptation programmes, planning, and activities.

### 2.3.5 Actions to integrate local and indigenous knowledge by district governments

As a follow up to the NDRMP, decentralized District Disaster Management Committees (DDMC) were established in 13 districts as of 2010. DDMCs are responsible for disaster mitigation, preparedness, prevention, response and recovery, and have a wide range of responsibilities: to implement "data collection, public awareness campaign, public information dissemination, food security, early warning dissemination and communication, rescue health [sic], logistics and transportation, evacuation, reconstruction and rehabilitation" (RDTL-NDMD 2010: 3).

**Training workshops** could be implemented in at least one of the pilot project sites from the second phase, in order to build district governments' capacities to incorporate LINK into their work. The participants would be district representatives of national agencies (representatives or focal points of national government entities such as the NDMD, the Ministry of Agriculture and Fisheries as well as representatives of district government entities and sub-district administration. The objective of the workshop would be to enable them to incorporate LINK in their DRR planning, and to promote the work of village (*suco*) councils and villagers to document, validate, and valorize local and indigenous knowledge for use in DRR and CCA actions. This could then be expanded to other communities in the country, with the goal of incorporating LINK into existing district planning sessions.

### 2.3.6 Actions to integrate local and indigenous knowledge by *suco* and *aldeia* (hamlet) councils

Within each village, the *suco* chief and village leaders (such as elders, traditional leaders and members of *suco* councils) are responsible for emergency and disaster risk reduction activities. Suco Disaster Management Committees (SDMC) have been formed in some villages. An activity that could be implemented in at least one of the three project sites is to promote the formation (if not already existing) of a SDMC involving *suco/aldeia* chiefs and councils, traditional leaders, women, and youth. Although the current focus of SDMCs is to request assistance from the sub-district and district administration during and after emergency situations, these committees could also be used as a venue through which traditional leaders and elders transmit LINK related to hydro-meteorological hazards and climate change, and as a vehicle to disseminate the IEC materials developed.

*Suco* councils, with support from sub-district management committees and District Disaster Management Committees (DDMC), can implement the process of documenting LINK related to hazards and climate change, with the goal of incorporating LINK into their village and hamlet disaster plans.

To promote the use of local and indigenous knowledge for disaster risk reduction and climate change adaptation in Timor-Leste, it is important to note that:

- It is a country where customary laws (*Tara Bandu*) to protect and conserve natural resources and maintain social relationships are strongly supported by the national government, thus local and indigenous knowledge is well-entrenched and practised daily in many parts of the country.
- At the same time, government entities at national and district levels are still in the process of building their capacities to formulate programmes, plans and activities to deal with multiple hazards in addition to climate-related hazards.
- Actions at this point would be best directed at supporting the formation of disaster risk reduction entities at different levels, and developing the capacities of these, as well as government entities, and national and local NGOs that play central roles in disaster risk reduction and climate change adaptation, to include local and indigenous knowledge in their disaster plans.
- Local and indigenous knowledge can also be incorporated into broader planning processes, for example, during the revision of the National Disaster Risk Management Policy.
- It is just as important to secure the strong support of development partners and international NGOs to promote the recognition of local and indigenous knowledge (and its identification, documentation, validation, and integration) as an important resource in development programmes.

# 3 Policy brief: Local and indigenous knowledge, science and technology

## 3.1 Context

Coastal and small island (CSI) communities have local and indigenous knowledge and practices (LINK) that they use to predict hazards, for early warning, and to respond to and cope with emergencies and losses. LINK includes the observation of animal behaviour, celestial bodies and the environment, and local technologies and materials are used to mitigate hazards. Communities have traditional and faith-based beliefs and practices that are embedded in their day-to-day lives. When threatened with a disaster, they respond by making use of all this knowledge and practices, which has evolved over generations, and will continue to adapt to future changes.

To collect, document and validate LINK related to hydro-meteorological hazards and climate change impacts, participatory action research and community organizing processes are necessary, and include participation in community activities, key informant interviews, workshops, focus group discussions (FGDs), and consultations with members of the community. In the Philippines, these activities yielded positive results, with traditional leaders becoming more open to the idea of sharing their knowledge to help CSI communities become resilient to hydro-meteorological hazards.

There were similarities in the LINK documented in the project sites across the three countries, particularly in the interpretation of their observations of celestial bodies. Since these areas are very prone to typhoons and storms, much of the LINK documented in the three countries relate to the prediction of bad weather through observations of celestial bodies, animal behaviour and the environment. This prediction is very important since fishing is the basic source of livelihood for people in CSI communities. Looking at the sky and stars helps them judge if it is safe to go fishing at night or not.

The natural environment of a community and their relationship to nature determine the kind of role LINK plays in their daily lives. For example, in communities whose interactions with their natural environment have lessened, LINK is not used to predict storms; instead, they rely solely on the radio or television for national weather forecasts, which may not be precise in their specific locations. People who closely observe environmental and weather changes daily, such as fisherfolk and farmers, are already experiencing the impacts of climate change; and thus many LINK being practised by these communities today will change.

Local and indigenous knowledge is often best sustained in traditional communities which are family oriented. This knowledge is a way of projecting the identity of a community, and the wealth of LINK reflects their culture and identity, and can speak a lot about a society's social system such as obligatory reciprocity and relationships with the divine. Having an established identity and unity is a community resource that can also be harnessed as a resource for disaster risk reduction (DRR) and climate change adaptation (CCA).

**Figure 3.1: *A tagak* (heron) perching on the back of a *carabao* (water buffalo). When these birds are observed gathering in the paddy fields and flying low, it means that the rainy season is approaching (practised in Rapu Rapu, Albay, the Philippines)**

In order to make the best use of such diverse LINK for DRR and CCA, it is necessary to obtain a deeper understanding and analysis of its scientific basis and social relevance. Much of the LINK that has a scientific basis can be enhanced and promoted to strengthen a community's resilience against the impacts of hydro-meteorological hazards and climate change. For example, LINK that predicts an incoming weather disturbance can be disseminated to warn communities, and also help make the younger generation aware of this knowledge. The tools and technologies that are used to mitigate and respond to disaster events can be made more effective and precise when their scientific basis is understood. It is for this reason that LINK should be integrated with science and technology to develop more robust DRR and CCA policies.

The policy actions and tools in this brief were developed on the basis of the LINK identified, documented, validated and integrated through the Strengthening Resilience of Coastal and Small Island Communities towards Hydro-meteorological Hazards and Climate Change Impacts project of UNESCO Jakarta (StResCom) project in the Philippines, Indonesia and Timor-Leste.

## 3.2 Steps for validation of local and indigenous knowledge

Integrating local and indigenous knowledge with science and technology involves a participatory process. The community organizing processes adopted in Community-Based Disaster Risk Management (CBDRM) can be used in the integration process with the community, by mobilizing community leaders, implementing awareness-raising activities, strengthening local organizations, and establishing linkages with local government officials. Integration entails taking a LINK inventory, assessing and validating LINK, and coming up with measures to integrate LINK into policies. Because the scientific community has very strict protocols on its processes, scientific validation of local and indigenous knowledge enhances its credibility vis-à-vis scientists. On the other hand, LINK with little or no scientific basis should be assessed in terms of how it increased a communities' resilience against hazards.

### 3.2.1 Community validation

Integration of local and indigenous knowledge with science and technology starts with an initial assessment and validation of the knowledge by the community itself. The documented LINKs need to be presented to the community to determine which ones are considered effective and most commonly used. This can be done through FGDs and key informant interviews. In the Philippines, a one-page FGD guide was used to ask farmers, the elderly, fisherfolk, and women's groups to assess whether the LINK identified in their community was still being used and effective (i.e., whether or not the expected outcome from the LINK actually takes place). A scale of 1 to 10 was used where 1 is not effective, with 10 as most effective. In Indonesia, validation with the communities involved (a) confirmation that knowledge was widely held in the study area (e.g., by fisherfolk in Aceh) and not just by one or two individuals; (b) existence of proof that the belief, knowledge, or practice has existed in the community for more than one generation; (c) relevance to anticipate or to cope with hydro-meteorological hazards and climate change adaptation.

### 3.2.2 Validation or scientific explanation by scientists

The next step is presenting the outcome of the community validation to a group of scientists and experts. In the Philippines, this was done in a workshop that gathered scientists, with doctorate degrees in their own area of specialization, from both natural and social sciences, such as marine science, meteorology, biology, anthropology and development studies.

**Figure 3.2: *Tinabaw*, a loft-like part of a house that serves as a place to keep occupants and their belongings safe in times of floods and typhoons (practised in Perez, Alabat Island, the Philippines)**

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The scientists were given a "LINK Validation Form", which guided their comments. They first gave an assessment, stating whether there was the presence, absence or uncertainty of a scientific explanation to the local and indigenous knowledge. They were then asked to provide detailed scientific explanations (or explain the lack thereof) on the LINK identified by the community. They also gave comments on how to assess LINK that cannot be explained by science at this point in time. Finally, they provided insights on how scientific knowledge can be integrated with the local and indigenous knowledge. For example, most of the LINKs on observations of the meteorological and celestial bodies (e.g., the sun, moon, sky, stars, clouds and winds) were found to have scientific bases. Similarly, there were scientific explanations to some animal behaviour such as the flying of dragonflies to indicate the coming of rain. Some animals instinctively adapt to the changing environment or seasons, such as migratory birds. On the other hand, scientists were not conclusive in assessing some animal behaviours. For example, fish are often observed as acting restless before typhoons, but scientists determined that this behaviour is not necessarily related to meteorological elements, but could be due to factors such as mating, searching for food and the like. For this reason, it was concluded that more focussed research on animal behaviour was needed to establish the veracity of these LINKs in predicting hazards.

### 3.2.3 Scientific explanation of local and indigenous knowledge to the community

The next step entails taking back the results of the scientific workshop to the community to make them aware that there are scientific explanations to some of their LINK. The LINKs that cannot be scientifically explained at this point in time can also be presented. This step enables the two-way learning of action research, since communities learn about the science behind some of their knowledge.

In the Philippines, the community validation after the scientific workshop was conducted by comparing the outcomes of community surveys and focus group discussions (FGDs), and the scientific explanations. The validation was participatory with selected community members invited to a FGD and workshop, which involved the following steps:

- A review of LINK identified in the community;
- A discussion of the scientific assessments of LINK (based on the workshop with the scientists) so that people obtained a better understanding of LINK from a scientific point of view;
- A discussion of which LINK the community would like to disseminate through appropriate information, education, and communication (IEC) materials;
- A discussion on self-assessment tools to see how they themselves can carry out the process of documenting and validating LINK;
- A discussion on how LINK can be incorporated into the DRR and CCA activities of the community.

**Figure 3.3: Community validation FGD in Raimea, Covalima, Timor-Leste**

## 3.3 Suggested policy actions

From the results of the action research implemented during the project, it is possible to put forward recommended policy actions to be implemented by local communities, local government units, NGOs and national-level government agencies.

### Strengthen disaster risk reduction and climate change adaptation in pilot communities

In communities where participatory action research was undertaken in the Philippines, DRR and CCA activities can be enhanced by integrating LINK pertaining to meteorological hazards prediction, warning, preparedness, response and recovery into their programs, projects and activities. The LINKs with scientific, technological and sociological bases can be easily integrated into community plans through the Community-Based Disaster Risk Reduction and Management Program of each community.

### Pursue local and indigenous knowledge integration with science across the country

Since documenting and assessing LINK in communities is imperative, participatory action research should be replicated in other communities. More communities would be able to participate in this exercise if national or local policies endorse the implementation of LINK assessment and scientific integration. Policies can be formulated at the community level to implement a tool called "Local and Indigenous Knowledge and Practices Inventory, Validation, and Establishing Scientific Knowledge (LIVE Scientific Knowledge)", described in section 3.4.1 below, while implementation at the national level can be carried out through a program for this purpose.

### Promote validation of local and indigenous knowledge with science in schools and through university projects and research

At the local level, the integration of LINK in science and technology can be undertaken as part of projects and activities in schools, colleges and universities:

- In elementary and secondary education, students can be instructed to validate some of the LINKs practised in their community through school projects. Students can observe LINKs and then report what happened after the observations. These exercises will not only make the students aware of the local and indigenous knowledge but will enable them to appreciate the scientific explanation for the LINK being practised in their community.
- At the tertiary level, studies to establish scientific bases for local and indigenous knowledge can be pursued as part of student research projects, theses and dissertations, and can be undertaken by university professors and researchers. Biologists can focus on animal behaviour and observations of plants; marine scientists can study fish behaviour and changes in the oceans. Physicists and meteorologists would be able to provide scientific bases for LINKs related to observations of the moon, sun, stars, clouds and sky while social scientists can conduct research that allow us to better understand the traditions, customs and beliefs that will help people in disasters.

National universities can be influenced to pursue research that examines LINKs and their scientific explanations if national agencies in the education, science and technology sectors provide the mandates and financial support.

### Integrate science with local and indigenous knowledge for disaster risk reduction and climate change adaptation programs and projects

Government entities, NGOs, and research agencies undertaking DRR and CCA programs and projects can strengthen their knowledge and practices by incorporating LINK with a scientific explanation. Strategies, programs, projects and activities can be reviewed to identify any relevant LINK, followed by validation to establish the scientific basis and help improve the accuracy of each practice.

The integration of LINK with scientific knowledge is only possible through the development of tools that help validate the knowledge. Each policy action put forward in this section can be operationalised by using the tools as shown below in table 3.1. Both tools are described in the next sections.

Table 3.1: Summary of policy actions and tools for integrating local and indigenous knowledge with science

| Policy Action | Tool | Remarks |
|---|---|---|
| Strengthen DRR and CCA in pilot communities | LIVE Scientific Knowledge | Community-based process where local researchers are trained to observe, document and validate their own knowledge |
| Pursue LINK integration with science across the country | | |
| Promote validation of LINK with science in schools and through university projects and research | Scientific assessment by experts and scientists | Validation process conducted in institutions undertaking DRR and CCA programs, projects and activities |
| Integrate science with LINK for DRR and CCA programs and projects | | |

## 3.4 Policy tools

Two tools, developed through the research undertaken in the Philippines to assess and establish the scientific basis of local knowledge, can be applied to other contexts. The first is the community-based "LIVE Scientific Knowledge", while the other tool is scientific assessment by experts and scientists. Both tools are described below.

### 3.4.1 LINK Inventory, Validation and Establishment of Scientific Knowledge (LIVE Scientific Knowledge): the community tool for integrating science with local and indigenous knowledge

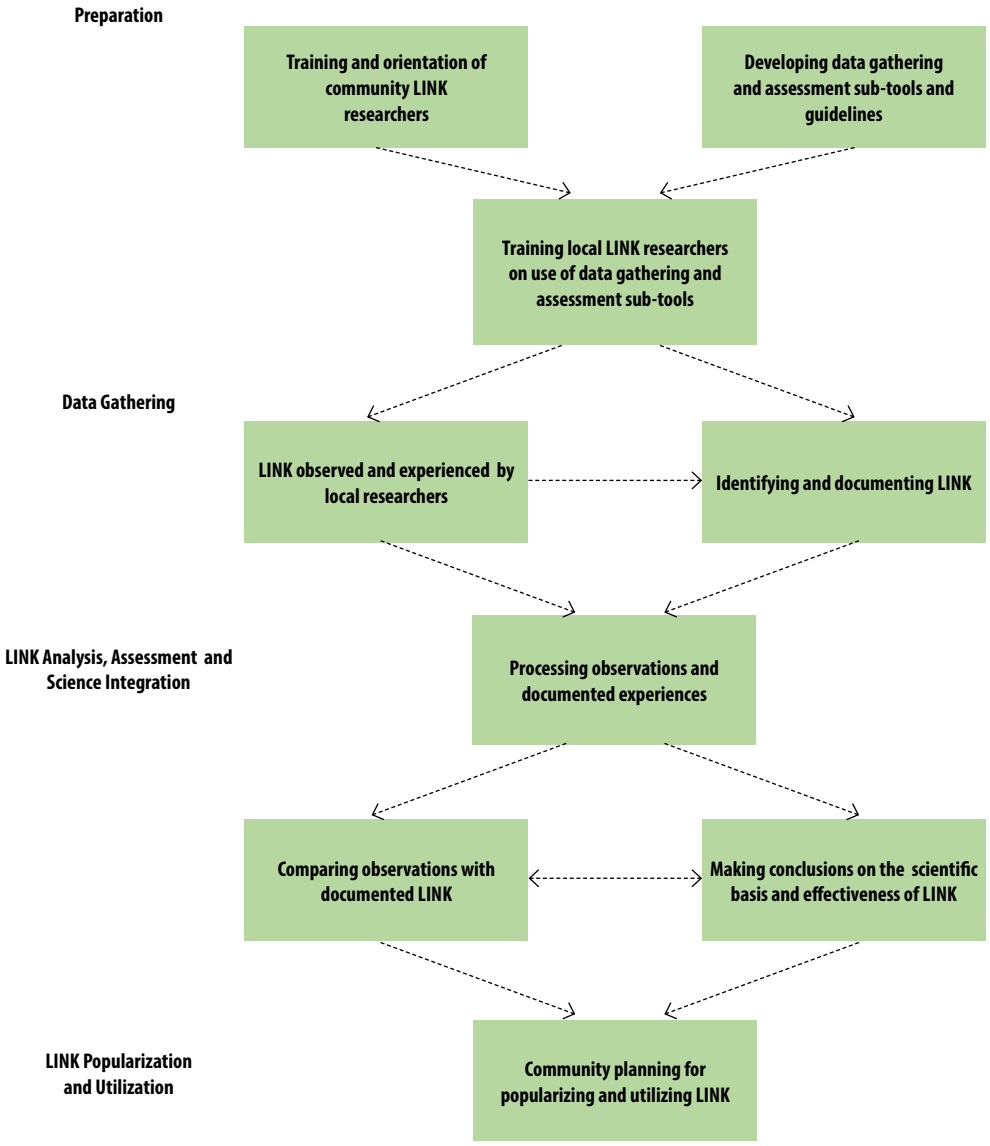
A process framework by which indigenous and scientific knowledge can be integrated to enhance the ability of local communities to deal with hazards and to reduce their vulnerabilities was developed by Mercer et al. (2009). It adopts four stages: (1) community engagement, (2) identification of vulnerability factors, (3) identification of indigenous and scientific strategies, and (4) formulation of an integrated strategy.

Building upon this work, action research carried out in the project focussed on the inventory, validation and establishment of a scientific basis for local and indigenous knowledge through the community-based disaster risk management (CBDRM) approach. The action research in the Philippines produced a tool called "LIVE Scientific Knowledge**"** that can be used by communities to assess and utilize their knowledge for DRR and CCA. The tool creates an integrated process for observing, validating, analyzing and utilizing LINK by the owners of such knowledge themselves.

Since researchers and NGO organizers rarely live permanently in the communities where action research takes place, it is necessary for communities themselves to have tools to document and assess their own knowledge. This tool, developed by the researchers in the Philippines, is community-led. There is initial support from research agencies or development organizations, which provide the initial orientation and training needed by the community so that they can document, assess, validate and improve the accuracy of their local and indigenous knowledge.

The LIVE Scientific Knowledge process is composed of the following stages.

**Figure 3.4: Flowchart of "LIVE Scientific Knowledge"**



The LIVE Scientific Knowledge process begins with the preparatory phase, when the methodology is selected (i.e., LIVE Scientific Knowledge tool), and local researchers are selected and trained on the process and methodology. In the Philippines, a module for training and orienting local researchers was prepared and implemented in each study site. Five sets of data-gathering forms were prepared, with one for each category of LINKs (i.e., (1) observation of animal behaviour, (2) observations of celestial bodies, (3) observations of the environment, (4) material culture, and (5) traditional and faith-based beliefs and practices). Each form consists of a table that allows for the recording of each LINK observed, when it was observed, what disaster event or impact happened after the LINK was observed, and when the impact occurred. See Annex II for an example of the form developed in the Philippines. Although different countries and communities have their own unique local and indigenous knowledge, the form can be used or modified slightly for use in other places. For example, the animals may be tropical in one region, and from the temperate zone in another, but there would still be animals whose behaviour can be observed to predict hazards. Thus similar categories can be used even if the meaning of the local and indigenous knowledge and its impact vary because of different contexts.

The same data-gathering form is used by all local researchers to ensure that data gathering is systematic. The use of such forms promotes standardization of data collected, and a scientific and rational thinking process composed of the following steps:

- Observation: observing the LINK researchers have identified in their community;
- Recording: documenting observations on the data-gathering form;
- Analysis and interpretation: Giving meaning to the observations and confirming that the expected impact actually took place;
- Making conclusions: From the outcomes of the observed LINK, making measurable and verifiable conclusions.

In this process, selected community members act as local researchers who observe and document LINK by filling in data-gathering forms. Each local researcher focuses on a specific category of LINK, and through regular assessment by the local researcher, the LINK is validated. Through this assessment, local researchers are able to validate the effectiveness of each LINK.

In the LINK analysis, assessment, and science integration phase, not only are scientific explanations provided for the observed events or phenomena but each LINK undergoes the scientific method, with steps such as:

- Formulating the problem: which are the LINKs that can be used for DRR and CCA?
- Data analysis: this involves tabulating the frequency of the observations made, analyzing the trends, comparing outcomes, and providing explanations about the outcomes. See Annex III for an example of the form used in the Philippines.
- Making conclusions and recommendations: Conclusions and recommendations can be made from the analysis on how to use the LINK for DRR and CCA, and which LINK can be integrated with science.

Once the process of observing, recording, analyzing, validating, and integrating LINK is complete, the knowledge can be widely disseminated. For details on how the fourth stage of the LIVE Scientific Knowledge tool can be implemented, refer to the second policy brief in section 4 below.

**Table 3.2: Documents to prepare in the different phases of LIVE Scientific Knowledge**

| Phase | Materials Needed |
|---|---|
| Preparation | Module for training and orienting local researchers on LINK for DRR and CCA |
| | Data-gathering forms, assessment sub-tools, and guidelines on how to use them |
| Data gathering | Data-gathering forms: to be filled by the local researchers when they observe or experience the LINK |
| LINK analysis, assessment and science integration | LINK data processing sub-tool: used to tabulate data gathered from observations (LINK observed and documented will be assessed, analyzed, and integrated with science) |
| LINK popularization and utilization | Information, education and communication materials |

**Figure 3.5: Clouds movement and formation used by local people in Pulo Nasi, Aceh, Indonesia to predict arrival of storms**

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LINK validation and the integration of scientific knowledge must be done through participatory action research where local communities are trained on the research process and mentored to enable them to do the research themselves. Thus, the challenge in adopting LIVE Science Knowledge as a validation and integration tool is the need to adapt participatory approaches. Individuals and institutions will have difficulty using the tool if they are not familiar with and committed to participatory approaches, most notably action research perspectives and methods.

### 3.4.2 Scientific assessment by experts and scientists

Local and indigenous knowledge is part of the everyday life of coastal and small island communities, but for that knowledge to be used effectively for DRR and CCA, it needs to be well understood, both by users and observers. One way to facilitate this is establishing the scientific basis of a LINK. For this to take place, the LINK must be observable, measurable, predictable and valid.

Many LINKs involving the natural environment and animal behaviour can be assessed using the above parameters. A LINK can be observed and documented. The frequency of the observation is a measurement. This can be used to predict and the outcome of the prediction can be assessed as valid or not. By assessing each LINK, it becomes possible to document and measure the observation, the prediction and the outcome, and thus establish the scientific validity of the LINK. There are also LINKs that have proven very useful in predicting and responding to calamities and disasters. This knowledge has not been documented or popularized because of the perceived lack of scientific basis and the fear that such knowledge will be dismissed as superstitious. There is thus a need for continued work and a thorough study of such knowledge across these communities, with the help of the scientific community.

The scientific validation of LINK can be illustrated by examples described below in box 3.1, where scientists provide scientific explanations to the LINK. Social scientists can provide the social relevance of LINKs for which the natural scientists were not able to provide explanations.

For LINKs with a scientific basis, the next step is for scientists to combine such knowledge with empirical data from the field. In cases where scientists cannot translate the LINK to its universal name, there is a need for more in-depth studies. For this, it is important to involve experts from many scientific

disciplines and not scientists who specialize only in one field. It is also necessary to read published studies on LINKs that could add to the understanding of a LINK, locally or internationally. Four categories of LINK emerged out of the research in the Philippines, with scientific explanations and its relationship and relevance to DRR and/or CCA. These, shown in figure 1.1 above, are described below.

**LINK category I,** with scientific explanation and related to DRR and/or CCA: there are three types of LINK that fall under this category, i.e., (1) observation of celestial bodies which can help the people predict hazards, e.g., the moon, stars and sun; (2) observation of the environment such as direction and strength of winds; colour, formation and location of clouds; plants; and animal behaviour; (3) material culture that people use for mitigation, preparedness, response and recovery. Examples of these are the design and materials used for housing; food eaten during periods of food scarcity, and other protective measures taken during hazards such as storms and droughts.

**LINK category II,** without scientific explanation but are related to DRR and/or CCA: these are faith-based beliefs, traditional rituals, legends and songs, which cannot be explained by science at this point in time, but are practised by communities and help them build resilience. For example, by having faith and practising prayers, through processions and acts of offering flowers and gifts to the divine, people are able to have peace despite possible turmoil or calamities, are able to endure difficulties and suffering, and maintain stability. It provides the psychological and inner strength that can make people more resilient. It is necessary to maintain these LINKs for the next generation, as long as communities can rely on them before a disaster or in times of difficulty. Such LINKs also contribute to increasing a community's awareness of possible hazards and thus result in increased preparedness.

**LINK category III,** with scientific explanations but are not related to DRR and/or CCA: there were many LINKs that are said to be related to climate and disaster prediction, but their relationship with weather and disaster prediction cannot be scientifically established. For example, fish are often observed acting restless before typhoons, but scientists determined that such behaviour is not necessarily related to meteorological elements. These behaviors are often simply part of the mating or food-searching behaviours of these animals.

**LINK category IV,** without scientific explanation and not related to DRR and/or CCA: there are some beliefs that have no scientific basis and at the same time cannot be linked to weather prediction or disaster events. For example, it is said that when some dogs start to howl, it serves as an omen and a disaster or something bad will happen. There is no scientific basis for this and at the same time, the observation is not at all related to actual disaster events.

LINK in category I can be readily integrated with science, widely disseminated and integrated into the school curriculum. It can be used to enhance policies and programs on DRR and CCA. Category II LINKs that cannot be explained by science but have just as much significance for DRR and CCA, should not be disregarded. Disaster survivors often say that faith-based beliefs and practices have made them resilient, strengthened their inner will and enabled them to move forward. If empiricism is to be applied, then science has to accept that those who practise faith have high resilience to disaster events. Categorizing LINK as above makes it possible to valorize local and indigenous knowledge that cannot be explained by science and enables us to understand that it is a body of knowledge in itself, different from scientific knowledge. As such, it should not be judged solely using scientific parameters, but assessed by another system appropriate to the context and social impact.

**Box 3.1: Scientific explanation of local and indigenous knowledges documented in Indonesia, Philippines and Timor-Leste**

| LINK | Description | Scientific explanation |
|---|---|---|
| Observation of the sky and the environment to predict *Angeen Badee* (strong winds and high waves)<br><br>Documented in Aceh, Indonesia | Observation of dark towering clouds on the horizon, and their upward movement from winds, in combination with position of beehive in a tree, calm sea weather during transition period (according to the traditional calendar) and rancid smell from the sea | The cloud formation and movement is Cumulus nimbus (Cb.) cloud type. This cloud is also part of the indication of cyclone effects generated around the Indian Ocean and the Andaman Sea. The rancid smell is an indication of over-evaporation process at the sea surface. This is also an indication of massive cloud formation process that can accumulate large water volume that can later produce high rainfall. |

| | | |
|---|---|---|
| Observation of the environment to predict and prevent landslides<br><br>Documented in Covalima, Liquiça, and Viqueque, Timor-Leste | When sacred trees (*Ai Lulik*: such as teak, bamboo and Beechwood) are cut, and sacred stones (*Fatuk Lulik*) are destroyed or removed, there will be landslides. | When forests are destroyed or stones are removed, springs will dry up from evaporation because there are no leaves (canopy strata) to cover the spring, and when in rainy season there is no infiltration of water into the land, the physical structure of soil is fragile when there are no stones and tree roots to secure the ground, thus landslides will occur. |
| Observation of the environment to predict typhoons<br><br>Documented in Rapu-rapu Island, the Philippines | Branches of trees (such as *gmelina, talisay, pili, marukbarok, tamarind, santol, narra*) and banana leaves fall to the ground even when there is no strong wind. Two days after such observation is made, heavy rains, storm surges or strong winds will hit the community. | The banana is characterized as having the weakest structure. As the temperature decreases, the plants' ability to make chlorophyll stops. Further the synthesis of a plant hormone called auxin also stops. This causes the cells at the junction of the petiole and the twig to weaken and sooner or later the joints break and leaves fall to the ground. |
| Planting of coastal forest (*Uteun Pasie*) to prevent and mitigate impacts from high waves and strong winds, and coastal erosion<br><br>Documented in Aceh, Indonesia | Coastal forest around the sandy beach area where several rows of different species of trees, bushes and smaller vegetation grow along the seashore. It is managed by the coastal community through *Panglima Laot* (a traditional fishermen's organisation) organisation. | The forest can effectively reduce the wind velocity blown from the coastal area. When the wind comes from the sea, it brings saline vapour that can also create corrosive effects on metal components around the villages. *Uteun Pasie* absorbs the saline vapour. |
| Food preservation mechanism to prepare for long periods of storms<br><br>Documented in Rapu-rapu Island, the Philippines | Dig a hole in the ground and place root crops such as cassava inside the hole and fill it with soil. The stored root crop is prevented from rotting and can last up to a month, thus providing food security during long periods of storm. | Root crops grow underground and this practice is a natural way of preservation. |
| Sacred ceremony to apologize to nature after a natural hazard such as landslide<br><br>Documented in Covalima, Liquiça, and Viqueque, Timor-Leste | *Monu ain ba lulik* held by traditional leader or elder to apologize for taking stones, sand, trees, killing snake, etc. and promise not to do it again. First, an animal (chicken or pig or dog) is killed, and its blood is spread to the affected area with betel nut and betel leaf. Then, trees are replanted in sacred places such as around water sources, river banks, the beach and on upland or hills. | The ceremony reinforces respect for nature and ensures that villagers follow the sacred rules, if not, they will get nature's curse and disasters will occur. Disasters provide an opportunity for social cohesion, respect for nature, and awe for nature. Such ceremonies contribute to a form of resilience. |

The process of integrating local and indigenous knowledge with science has made it clear that:

- Many local and indigenous knowledge practised by communities have scientific bases.
- The process of validating and scientifically explaining local and indigenous knowledge, and integrating local and indigenous knowledge with science, require both community engagement and open communication, and close linkages between communities and external scientists and researchers. The learning process is two-way and it is important for all stakeholders to acknowledge this.
- Inventory, validation and establishment of the scientific basis of local and indigenous knowledge are an endeavour that requires a local and national mandate and must be recognized as a priority.
- The academic community and researchers have a significant role to play in enhancing local and indigenous knowledge with science.
- Disaster risk reduction and climate change adaptation programs, projects and strategies should integrate local and indigenous knowledge with scientific bases.
- LINKs that cannot be explained by science should not be disregarded but should be seen as part of the people's way of life that can help them adapt to climate change impact and reduce their vulnerability.

# 4 Policy brief: Local and indigenous knowledge and education

## 4.1 Context

Local and Indigenous Knowledge (LINK) faces serious challenges in its continued use for disaster risk reduction (DRR) and climate change adaptation (CCA), in light of factors such as globalization and the introduction of new technologies. The day-to-day use of LINK is hindered by the lack of opportunities to practise and inadequate means to transmit such knowledge to the younger generation. Formal education that uses national languages as the medium of instruction further compromises the transmission of LINK. Thus, effective strategies that can advocate the use and transmission of LINK are necessary. One such strategy is communicating the importance and relevance of LINK to communities, especially among youth, by using interesting, action-oriented, and appropriate information, education, and communication (IEC) materials.

By developing and using IEC materials that incorporate LINK with science for DRR and CCA, it becomes possible to:

- demonstrate the advantages of practising and adopting LINK for DRR and CCA
- revitalize and strengthen LINK by demonstrating that LINK can be used to anticipate and mitigate the hazards and impacts of climate change. Despite advances in science and technology, LINK is still important to foster the resilience of communities towards disasters and climate change.
- transfer LINK from one generation to the next, and from one community to another.
- show the relevance of LINK found in that community, thus resonating more with the target audience and facilitating the learning process. As LINK is deeply connected to a community's culture, religion, and social and economic activities, placing knowledge in the local context is pivotal to promote the use and transmission of LINK.
- demonstrate the integration of science and technology with LINK: this will help strengthen the relevance of LINK for DRR and CCA. When scientific explanations or empirical evidence for LINK are incorporated and disseminated in IEC materials, this can also encourage the scientific community to further investigate LINK.

As demonstrated in section 3, disseminating local and indigenous knowledge can be done after the process of observing, recording, analyzing, validating, and integrating LINK with science is complete. The policy actions and tools in this brief are based on the experience of developing IEC materials in Indonesia and the Philippines during the Strengthening Resilience of Coastal and Small Island Communities towards Hydro-meteorological Hazards and Climate Change Impacts project of UNESCO Jakarta (StResCom) project.

When promoting the use of local and indigenous knowledge using IEC materials, it is important to take into consideration that coastal and small island (CSI) communities are affected by different hazards, which occur in diverse environmental and cultural contexts, which affect the medium of material to be developed, the target audience, and the method of disseminating the materials. The religious and traditional belief systems of target communities are important factors when developing materials. Materials that demonstrate such sensitivities will be more easily accepted by CSI communities when they are disseminated.

Correctly identifying the audience is another important consideration. Developing and disseminating IEC materials without specifying the audience can lead to potentially ineffective and inefficient results. By targetting the promotion of LINK to a specific audience, the materials can trigger a greater impact. Materials should specifically target key groups who act as agents of change and be tailored to their interests and their capacity to absorb information.

**Figure 4.1: An awareness-raising poster developed in the Philippines. In the Philippines, seven is a lucky number and most words expressing positive attributes start with the letter K[7]**


(c) UNESCO/CDP

The medium and target audience of IEC materials developed in Indonesia and the Philippines are summarized in Table 4.1 below. For a complete list of all the materials published, see Annex IV.

**Table 4.1: Information, education and communication materials developed in Indonesia and the Philippines**

| Medium | Target audience |
|---|---|
| Comic book | Students and teachers |
| Poster | Local community in general |
| Audio Visual Production | Local community, DRR and CCA practitioners, and scientists |
| Booklet | DRR and CCA practitioners and scientists |
| Flipchart | Trainers and teachers |

7 This poster has been translated into English for the purposes of this publication.

The local and indigenous knowledge identified and documented in the three countries was very diverse. Much of the knowledge identified was in the form of stories/legends, poetry and songs, and traditional organizations (e.g., traditional fishermen's organisation of *Panglima Laot* in Aceh) and their customary laws and practices. For CSI communities, LINK is related to hazards such as extreme sea and weather conditions, i.e., typhoons, cyclones, and high waves. Considering that most LINKs are orally transmitted, documentation and records that promote the use of this knowledge does usually not exist. The elders and traditional leaders with the knowledge are often no longer using the knowledge and practices, or not transmitting their knowledge to the younger generation. So when they die, their knowledge will disappear with them. Because of the importance of LINK to further strengthen the resilience of communities, developing and disseminating IEC materials can promote knowledge transmission and the inclusion of LINK into DRR and CCA plans, and formal or informal education systems.

## 4.2 Steps for developing information, education, and communication materials

By selecting relevant knowledge and integrating it with science and technology, IEC materials can revitalize and strengthen it for DRR and CCA in coastal and small island communities. The materials will vary depending on the community, but the steps to be taken in the planning and production process of the materials will be similar. These steps can be seen in figure 4.2 below.

**Figure 4.2: Steps for developing information, education, and communication materials that integrate local and indigenous knowledge with science**

| Identification of LINK to be promoted |
|---|
| Consideration: can the LINK be clearly validated by science and technology? |
| Actions: identification, documentation, validation |
| Done by: local community, traditional leaders, scientists |

↓

| Determination of target audience |
|---|
| Consideration: what kind of language and pictures can be used? |
| Actions: discussions with key informants, selection of target audience |
| Done by: disaster management officers, local community, scientists |

↓

| Selection of media |
|---|
| Consideration: how practical is it to develop and disseminate the material? What is the capacity of the local community? How complex can the information be? |
| Done by: local community and scientists |
| Media: poster, comic, flipchart, booklet, AVP, game, etc. |

↓

| Material development, validation, and testing of KIDA principles |
|---|
| Consideration: how clear and accurate is the content? Are the materials interesting, and incite action? How effective is the material in conveying the message? |
| Done by: local community and scientists |

↓

| Printing and Dissemination |
|---|
| Consideration: How can they be most efficiently disseminated? |
| Done by: local community, schools, disaster management officers, religious and traditional leaders, scientists |

### 4.2.1 Selecting LINK to be promoted

Although many types of local and indigenous knowledge related to disaster risk reduction and climate change exist in coastal and small island communities, not all LINK would be appropriate for wide dissemination. Those in category I (with scientific explanation and related to DRR and/or CCA) would be the easiest, while those in category II (without scientific explanation but are related to DRR and/or CCA) would need to be carefully considered.[8] Local and indigenous knowledge needs to be selected taking into consideration a wide range of factors, especially the applicability to other communities. LINK related to coastal protection using certain types of coastal vegetation (*Uteun Pasie* and *Uteun Bangka*) and a traditional calendar system used by fisherfolk and farmers to time their livelihood activities (*Keuneunong*) were selected in Indonesia.

### 4.2.2 Selecting the target audience

The target audience can be classified based on educational background, occupation, and lifestyle. For example, students up to a certain grade, fisherfolk or farmers, the general public living in disaster-prone areas, or DRR practitioners and scientists.

### 4.2.3 Determining the media

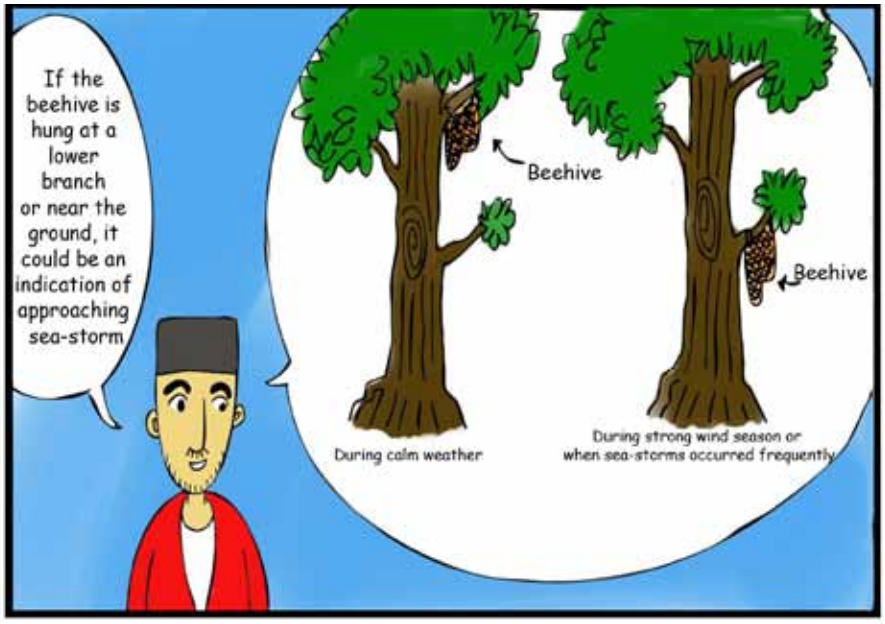
The format of the information, education and communication materials is important and should be developed with the anticipated preferences of the target audience in mind. In Indonesia, for example, comic books were developed to attract the attention of youth, especially those in secondary schools. The characters in the comics were close to the context of the targetted communities in Aceh. Since most Acehnese are Muslims, religious messages that were relevant to LINK for DRR and CCA were also included in the comics. In addition, materials that include religious messages are easily accepted. The materials need to be tailored to an audience's capacity to read and understand. Simple posters were produced for fisherfolk and farmers. In the Philippines, an audio visual production (AVP) was made, which presents some local and indigenous knowledge alongside with its scientific explanations. Flipcharts were also developed to be used as teaching aides in classrooms and in non-formal training settings.

### 4.2.4 Integrating local and indigenous knowledge with science and technology

Integrating all the knowledge identified and documented in a community with science and technology is not possible for the reasons outlined above. Thus, in the Philippines and Indonesia, only selected local and indigenous knowledge was integrated with science. The LINKs that are based on traditional beliefs and religions that cannot be validated at this point in time by science (i.e., those in category II) were not promoted in IEC materials. However, such LINK knowledge can be included in other forms of awareness-raising and educational activities to increase community resilience as well as to preserve a community's social capital.

Figure 4.3 below shows an example from a comic book about a predictor of storms mentioned in *Keuneunong* (traditional calendar) found in Aceh. The figure shows the relevance of LINK with science and technology, and demonstrates why such LINK is a valid tool for DRR and CCA. Another example is the AVP developed in the Phillippines, which presents some LINKs found in the area, followed by scientific explanations.

**Figure 4.3: An excerpt from the comic book titled *Mari Belajar Keuneunong* (Let's learn about *Keuneunong*). The figure shows that the location of the beehive enables communities in Aceh to predict the coming sea storm[9]**




(c) UNESCO/TDMRC

8 See figure 1.1 and section 3.4.2 for detailed explanations on the different LINK categories.

9 All IEC materials were published in Indonesian. The cartoon in figure 4.3 has been translated into English for the purposes of this publication.

### 4.2.5 Validating content

Before disseminating IEC materials, their content should be validated by communities and scientists to ensure accuracy. Pictures, messages, graphics, or conversations included in the materials need to be checked thoroughly to ensure that they meet the objectives. Validation should also ensure that the materials follow the principles of Knowledge, Interest, Desire and Action (KIDA).

### 4.2.6 Evaluating the effectiveness of the materials

Do the initial objectives indeed deliver impacts on the community to revitalize LINK and strengthen the visibility of LINK for DRR and CCA? The following questions can help evaluate the material:

- does the audience correctly understand the advantages of practising LINK for DRR and CCA?
- can the audiences see the relevance of LINK from the scientific and technological point of view?
- is the audience motivated to take action to strengthen LINK in their community?

## 4.3 Suggested policy actions

The IEC materials developed have to be incorporated into actions at the community and government levels. It is important that materials incite action, without which it is difficult for LINK to be widely used as a tool for DRR and CCA. Policy actions should aim to increase the capacity of CSI communities to cope with hydro-meteorological hazards and impacts of climate change. IEC materials that are targetted to become part of a country's educational curriculum will need to go through various procedures to make them available and accesible to schools in the country.

From the activities implemented in Indonesia, the following policy actions can be put forward, in the context of developing education for LINK, DRR, and CCA:

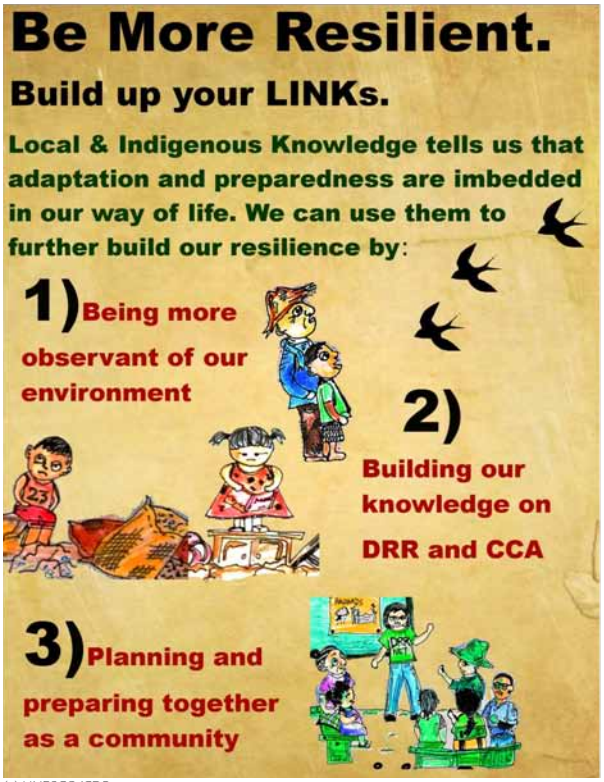
### Mainstream the use of local and indigenous knowledge in disaster risk reduction and climate change adaptation

This needs to be done at the community and government levels. Local and indigenous knowledge related to DRR and CCA can be linked to policy at different levels by including relevant local information as part of DRR and CCA plans. LINK can be mainstreamed at the local government level by integrating LINK-based DRR programs in the area. For example, in Indonesia, the Local Action Plans for DRR at the District Level (RAD-PRB) is a compilation of DRR Plans for a 3-year timeframe, and LINK-based DRR programs can be inserted into the plan when the document is compiled.

### Disseminate information, education, and communication materials

Dissemination can be done either as one-way communication or in an interactive forum. In one-way communication, IEC materials are distributed and the audience's reaction to the message is not known. For example, airing material on television programs will allow the information to be disseminated widely, however, it will be difficult to obtain the audience's reaction immediately. During interactive dissemination, however, such as during a class in a school, the students' response to the material can be observed directly. A dissemination plan can help achieve the objectives of the materials, and could include a strategy for distributing the materials and for monitoring the impacts in a community. It can also include a checklist of types of materials, target audience and expected results. It is also possible to evaluate whether the type of material is suitable for the target audience, and to conduct baseline and end-line surveys to observe changes in the CSI community where IEC materials were disseminated.

**Figure 4.4: A page from flipcharts developed in the Philippines as a teaching aid**




(c) UNESCO/CDP

### Incorporate information, education, and communication materials into formal, non-formal and informal education

To incorporate IEC materials in formal education, policies must be formulated at various levels to ensure the inclusion of LINK in the school curriculum:

- School level (up until high school): policies that allow teachers to include LINK as a topic in relevant subjects such as science, social studies, and the arts.
- University level (tertiary education): courses can be introduced on DRR and CCA with LINK as a topic. However, considering that curriculum revision takes time, a more appropriate way may be to promote LINK among faculty members so that they include LINK as a topic in existing courses.
- National level: policy by relevant agencies such as ministries and department of education mandate the schools to integrate LINK as a topic in relevant subjects.

For non-formal and informal education activities, the IEC materials can be included in discussion forums, training sessions, or other types of related activities.

From the experience of project implementation in the Philippines and Indonesia, policies that promote the use of LINK for DRR and CCA, if they exist, are relatively new; and have only recently been introduced as part of DRR programs in the region. As a result, no framework to monitor or evaluate the integration of LINK for DRR and CCA currently exists. Because most local and indigenous knowledge is transmitted orally and practised instead of being written down, no clear actions have been formulated to strengthen the use of this knowledge thus far.

Therefore, IEC materials can accelerate the process for utilising LINK for DRR and CCA. Table 4.2 shows the connections between the suggested policy actions described in this section to tools that can be used to implement the actions.

## 4.4 Policy tools

It is possible to help CSI communities develop action plans by themselves, if they are provided with the appropriate tools. Because local and indigenous knowledge is often considered anecdotal, it needs to be brought to a validated body of experiential knowledge in order for it to have a clearer utility and wider application, especially at the decision-making level (Sharma et al. 2009). Needs assessment to formulate priority actions by integrating LINK into DRR and CCA will be rather difficult, if guidance or demonstration of such actions are not available. This is also the case for governments, where LINK is distinct from mainstream government policies on DRR and CCA. For example, in Indonesia, the government uses structural approaches in its DRR and CCA efforts while cultural approaches that incorporate community participation into the process are better at integrating local knowledge into these efforts.

Policy tools to strengthen the use of LINK for DRR and CCA in Indonesia can be inserted into the National Disaster Management Plan (*Renas-PB*), a document that compiles planning related to Disaster Management every five years (the current one is for 2010-2014). At the same time, the Action Plan for Disaster Risk Reduction (AP-DRR), which is formulated every three years, has more specific action planning, such as actors, an estimated budget, and proposed

**Table 4.2: Suggested policy actions and tools for developing information, education & communication materials**

| Policy Action | Tool | Remarks |
|---|---|---|
| Mainstream LINK | Community organization plans | Community participation and community capacity building will be needed |
| | Traditional events and festivals | |
| | Electronic media | |
| Disseminate LINK through IEC materials | School curriculum | Media of IEC materials and target audience need to be carefully considered |
| | Religious activities | |
| | Electronic media | |
| Incorporate LINK into education | School curriculum | Intra- and extra-curricular activities.<br>Involve not only school but also non-formal and informal venues for education. |
| | Electronic media | |

locations, etc. (the current one is for 2010-2012). The two documents are available at national, provincial, and district levels. Since these documents are developed through a series of multi-stakeholder meetings, local and indigenous knowledge could be mainstreamed in this participatory process, which would enable the voices of the local community to be heard.

The five policy tools below that can strengthen the use of IEC materials that integrate LINK with science and technology for DRR and CCA have been identified from the experience in Indonesia.

### 4.4.1 Community organisation plans

The policies of local community organisations are normally formulated through open meetings, which are attended by local people. Posters, booklets, and documentaries disseminated at these meetings can mainstream local and indigenous knowledge for DRR and CCA. In Indonesia, for example, village leaders and community representatives hold annual Village Development Planning Meeting (*MusrenbangDes)* at every village. During the meeting, local people can decide which program or activity will be undertaken in the coming year. The *MusrenbangDes* are a good venue to distribute IEC materials to the community.

### 4.4.2 Traditional festivals and events

Local communities have regular traditional festivals or events, which can serve as places to circulate posters and show videos. Local and indigenous knowledge-related themes can be advocacy subjects during these festivals in order to reach communities and agencies involved in these issues.

### 4.4.3 Electronic media

Electronic media is a tool that can be used to mainstream local and indigenous knowledge for DRR and CCA, disseminate IEC materials, and also be included in schools. Documentaries on the importance of LINK can be aired on television, radio, and AVPs can be shown in schools to attract government attention as well as the attention of CSI communities. Online media, such as websites and social networking sites, can also be utilised to disseminate LINK, especially for young generations that are widely exposed to, and frequently use, such media.

### 4.4.4 School curriculum

A very important means to disseminate LINK related to DRR and CCA, and transmit LINK to the younger generation, is through the school curriculum. However, adding a new subject in the existing curriculum in the schools can be difficult since it presents a burden to both students and teachers. An easier way is to advocate the teaching of LINK in an existing subject, such as a science class. Comic books and documentary films or AVPs can help students to understand the relevance of LINK for DRR and CCA. Information education and communication materials can also be integrated into extra-curricular activities. For example, they can be incorporated into a guidebook or activity reference book for boy scouts, whose activities are often conducted outdoors.

### 4.4.5 Religious activities

Information, education and communication materials can also be disseminated in centres for religious teaching, once the content has been approved by religious leaders. In Aceh, Indonesia, for example, LINK related to the preservation of *Uteun Bangka* (mangrove forest) and *Uteun Pasie* (coastal forest) is also part of religious teachings. In the Philippines, religious rites and ceremonies can be venues to disseminate IEC materials. Close communication with religious leaders such as the *ulama* (Muslim spiritual leader), pastor, or priest is important, to fully take advantage of this opportunity.

The policy tools described above all aim to influence government and community actions to promote the use of local and indigenous knowledge for DRR and CCA. Participatory processes that introduce LINK at different policy levels can accelerate this idea. The participation of teachers, religious leaders, community leaders, and the local community from the initial process of development of the materials is also important since their participation facilitates community validation of the LINK presented in the materials.

Based on the development of information, education and communication materials that strengthen local and indigenous knowledge for disaster risk reduction and climate change adaptation, several recommendations can be made:

- There are local and indigenous knowledge that can be easily used in information, education and communication materials and widely disseminated, while there are those that cannot. The categorization of such knowledge can be done through the local and indigenous knowledge identification, documentation and validation process such as the one described in section 3.
- The development of information, education and communication materials needs to carefully consider the context where the materials will be disseminated, the target audience, and the cultural (including religious) sensitivity of the process.
- Information, education and communication materials need to incite actions in communities to utilize local and indigenous knowledge for disaster risk reduction and climate change adaptation.
- The contents of the information, education and communication materials should be inspiring and encouraging, and include the "Knowledge, Interest, Desire, and Action" principles.
- A strategic plan is the best way to ensure the effectiveness of information, education and communication materials, as well as their dissemination and advocacy back into the community.

# 5 Recommendations

The recommendations in this section are based on research on local and indigenous knowledge (LINK) implemented in Indonesia, Philippines and Timor-Leste and draw out the lessons, policy actions and tools elaborated in the previous sections. The objectives of these recommendations are to facilitate the integration of LINK with science and technology to increase coastal and small island (CSI) communities' resilience against hydro-meteorological hazards and climate change impacts, and to promote the development of information, education, and communication (IEC) materials that facilitate this process.

The primary beneficiary of actions included in these recommendations is CSI communities that are most vulnerable to such hazards and their impacts. Actions that can be taken by all parties who play a role in disaster risk reduction (DRR) and climate change adaptation (CCA) are included: national government agencies dealing with disasters, climate change, coastal management, gender, and education; local governments; and communities themselves. The support and commitment of government entities are integral to enable communities to strengthen their knowledge, capacity and preparedness. In terms of geographical scope, these actions are directly relevant to actors in island Southeast Asia, but could also be adapted by any actor in a small island or archipelago country with vulnerable populations living in CSI regions.

## 5.1 National governments

In this section, actions that need to be taken by the following government agencies at the national level are outlined: disaster risk reduction and management; climate change; coastal management and fisheries; and education. Although many countries do not have special government agencies on gender, gender is also included as an entry point, due to its significance when discussing LINK and vulnerability, as mentioned above in section 1.3.

**Table 5.1: Recommended actions and policy support to promote local and indigenous knowledge at the national level**

| Entry point/related line agency | Actions and policy support |
|---|---|
| Disaster risk reduction and management<br>Climate change adaptation | • promote the identification, documentation, validation, and integration of LINK in each field<br>• strengthen existing CBDRM activities or climate change adaptation plans by integrating LINK<br>• support network-building and partnerships that support LINK<br>• include LINK in IEC materials<br>• build capacities of organizations<br>• include LINK as a component of monitoring and evaluation. |
| Coastal management, fisheries, and agriculture | • develop policies that valorize LINK held by fisherfolk and farmers<br>• implement activities that support building the resilience of fisherfolk and farmers based on LINK<br>• promote coastal zone management plans and coastal zone disaster mitigation plans that incorporate LINK. |
| Education | • develop policies that promote the integration of LINK in the curriculum<br>• encourage extra-curricular activities related to LINK<br>• promote research on LINK and integration with science |
| Gender | • promote the understanding that men and women hold specialized knowledge, and ensure research methodologies take this into consideration<br>• ensure that DRR and CCA strategies based on the integration of LINK do not lead to reinforcement of gender inequality. |

### 5.1.1 Disaster risk reduction and management

According to the United Nations International Strategy for Disaster Reduction (UNISDR), preparedness refers to activities and measures taken in advance to ensure an effective response to the impacts of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations. Prevention refers to activities that contribute to avoiding the adverse impacts of hazards and means to minimize related disasters. The first step towards DRR is thus to understand the risks and their impacts on all aspects of society and the environment, taking stock of vulnerability and capacity, and monitoring risk factors. DRR represents a paradigm shift away from the previous focus on disaster management that concentrates more on response and recovery. At the same time, it views disasters as caused by social, cultural and political factors, not simply as natural or environmental (Mercer et al. 2009). Shifting the paradigm to focus more on disaster preparedness and prevention requires intensive effort and resources, such as human resource capacity building, the development of programmes and action plans. Many countries are currently in the process of making this paradigm shift, and this is precisely where the opportunity lies to integrate LINK.

At the national level, government agencies responsible for DRRM can move towards LINK and science integration by developing holistic and integrated national disaster risk reduction policies and plans, which build the resilience of communities towards hydro-meteorological hazards using locally-generated knowledge with science and technology. This would entail:

- promoting the identification, documentation, and validation of LINK related to hazards, and facilitating the integration of such knowledge and practices with science. This can be done by supporting such activities by schools, universities, and by communities;
- strengthening existing CBDRM activities by integrating LINK validated (through processes such as the above);
- supporting the building of networks and partnerships that promote research and education on LINK related to hazards;
- including LINK in IEC materials, and ensuring wide dissemination of such materials using various media outlets;
- building the capacities of entities (government and non-government) responsible for and involved with disaster management to understand the importance of LINK in their work, and facilitate integration of LINK in DRR management plans and activities, through training; and
- including LINK as a component of monitoring and evaluation of DRR projects and activities.

### 5.1.2 Climate change adaptation

Throughout history, societies have managed the impacts of weather- and climate-related events and adjusted to these changes in their environment. The existing scientific knowledge about climate change and weather patterns is not sufficient to enable communities to deal with the recent human-induced climate change. At the same time, the recent speed at which climate change is occurring is making it difficult for local and indigenous people to maintain their natural resources-based livelihoods, and is challenging the relevance of their knowledge. The key is to find ways to combine LINK with scientific knowledge to enable successful adaptation at community level. For example, due to a change in weather patterns, fisherfolk are finding it difficult to predict hazards based on traditional prediction methods but prediction using modern technology based on science can augment such methods to help reduce vulnerabilities resulting from accelerated changing conditions. In addition strategies that communities have developed to prepare for disasters such as droughts or floods could be adapted by other communities who are beginning to face these conditions. Thus, national government agencies need to ensure that coordinated efforts are made between the agency involved with promoting climate change adaptation and mitigation plans and the agency dealing with disasters.

At the national level, government agencies responsible for climate change can promote LINK and science integration by ensuring that both CCA and DRR are tackled simultaneously, and that they are both integrated within the wider development contexts of each country. This would entail:

- promoting the identification, documentation, and validation integration of LINK related to climate change and facilitating LINK integration with science, in schools/universities and by communities;
- developing CCA plans that integrate validated LINK ;
- supporting the building of networks and partnerships that promote research and education on LINK related to climate change;
- including LINK in IEC materials, and ensuring wide dissemination of such materials using various media outlets;
- building the capacities of entities (government and non-government) responsible for and involved with implementing activities that support CCA, to understand the importance of LINK in their work, and facilitate the integration of LINK in their activities, through training; and
- including LINK as a component of monitoring and evaluation of CCA projects and activities.

### 5.1.3 Coastal management, fisheries, and agriculture

Local and indigenous knowledge that is specific to coastal zones include the following:

- prediction of storms and heavy rainfall, from observations of the sea (waves, tides), clouds, and direction/strength of winds;
- mitigation and prevention of coastal erosion, landslides, and strong waves, using the coastal ecosystem (mangroves, sea grasses, coral reefs);
- determination of appropriate timing to go fishing and what to catch, based on traditional calendars and/or hazard prediction methods;
- determination of the appropriate timing to plant and harvest crops, based on traditional calendars and/or rainfall prediction methods.

In this regard, government entities responsible for coastal zone management, fisheries, and agriculture can support DRR and CCA based on LINK, by:

- developing policies that valorize LINK held by fisherfolk and farmers, and promoting research that identify, document, and validate such LINK;
- implementing activities that support building the resilience of fisherfolk and farmers which are based on their knowledge and integrated with science; and
- promoting coastal zone management plans and coastal zone disaster mitigation plans that incorporate LINK.

### 5.1.4 Education

An important component of disaster education is introducing disaster preparedness, prevention and response through the educational system. Information on predicting, preparing for, and responding to hazards can be introduced in the curricula of schools and universities. According to a review of existing community-based awareness raising, preparedness, and educational materials on natural hazards and climate change adaptation in Indonesia, the Philippines, and Timor-Leste, there are some materials that mention the importance of LINK. However, they are mostly general statements without details on the kind of LINK, and how it could be used and integrated for disaster preparedness (Kodijat 2012).

In order to facilitate the development of IEC materials that help communities increase their resilience against hydro-meteorological hazards and climate change impacts, the following actions can be taken:

- developing policies that promote the integration of LINK related to DRR and climate change into primary and secondary education curricula;
- at the same time, considering the time it takes to change curricula, supporting efforts by teachers to include LINK related to DRR and climate change in specific subjects;
- encouraging extra-curricular activities in schools that promote the identification, documentation, and validation of LINK by communities;
- promoting research by universities and research institutes that focus on documenting, validating, and integrating LINK with science.

### 5.1.5 Gender

Gender is an issue that deserves special attention and the recent attention given to the topic of gender in DRR and CCA focuses on the need to address the gender divide and fulfil the special needs of women in emergency situations. More specifically in the case of LINK, there are two issues that need to be considered:

- specialized knowledge held by women and men. There is some knowledge only held by specific groups (such as midwives) that will not be identified if the research methods adapted is not appropriate, e.g., if interviews are only held with religious and spiritual leaders who are in many cases men; and if researchers are only men, with whom women would not feel comfortable speaking and/or sharing their knowledge. Women often hold unique knowledge unknown by others in the community, and therefore their knowledge would also need to be included in decision-making related to DRR and CCA.
- ensuring that DRR and CCA strategies based on integration of LINK do not lead to the reinforcement of gender inequality. Government entities need to be mindful of the fact that some traditional knowledge systems reinforce social inequality based on class, age, ethnicity, and gender, which in turn contribute to the increased vulnerability of the group. It is important to ensure that such inequalities are not reinforced when promoting the use of LINK for DRR and CCA.

## 5.2 Local governments

Local government entities are responsible for developing their own policies, plans and activities related to disaster management and education. The recommendations of actions to be taken by local government entities are divided into two departments: those that deal with disasters, and those are concerned with education.

### 5.2.1 Disaster-related departments

The following steps would need to be taken to realize LINK integration in local disaster management policies, plans and activities:

- Promote the identification, documentation, and validation of LINK related to hazards, and facilitate the integration of such knowledge and practices with science. This can be done through schools (by including LINK in the curriculum on disaster education), through universities (by promoting research on such topics), and by communities;
- Facilitate and support risk mapping and vulnerability assessments that incorporate the LINK of each area where such assessments are taking place;
- Increase awareness of the significance and relevance of LINK by their staff and others involved with DRR, by including relevant LINK in DRR training;
- Support the formation of community-based organizations that can develop community-based disaster risk management (CBDRM) plans and implement them, and their efforts to integrate LINK in their plans and activities;
- Develop simple and effective IEC materials that include LINK.

### 5.2.2 Departments dealing with education

The following actions can be taken to promote disaster education that incorporates local and indigenous knowledge:

- When possible, include LINK in the school curriculum formally, by developing policies that support it;
- At the same time, give incentives to individual teachers to include LINK as a topic in existing subjects;
- Work with disaster-related departments to disseminate the IEC materials in schools and/or in extra-curricular activities;
- Ensure the cooperation of traditional and/or religious leaders in promoting LINK related to DRR and CCA.

## 5.3 Implementing "LIVE Scientific Knowledge": A checklist for communities, local and national governments

To promote the integration of LINK in DRR and CCA plans and activities of CSI communities, the following activities can be implemented by and with the communities, with the support of various stakeholders:

<table>
<tr><th>Activity</th><th>Step</th><th>Checklist</th><th>Tools and support</th></tr>
<tr><td rowspan="6">LINK identification and documentation</td><td>Identify community documenters/researchers</td><td rowspan="2">Are the documenters / researchers:<br>✓ gender-balanced?<br>✓ well-aware of the different hydro-meteorological hazards, climate change impacts, the difference between weather and climate, distinction between ENSO (El Niño Southern Oscillation) climate variability and climate change, etc.?<br>✓ comfortable using different research methods such as FGDs, observations, interview techniques?<br>✓ know what kind of knowledge to look out for?<br>✓ using the same forms for documentation and categorization, and assessment sub-tools?</td><td rowspan="6">Support: policy support by national and local governments to facilitate this process in and by communities<br><br>Tool: "LIVE Scientific Knowledge" described in section 3.4.1</td></tr>
<tr><td>Orient and provide training to the documenters /researchers on important terminology and methodology</td></tr>
<tr><td>Identify informants in each village</td><td>Do the informants cover:<br>✓ traditional and/or religious leaders who practice ceremonies and rituals?<br>✓ holders of specialized knowledge, such as fisherfolk, farmers, women, etc.?<br>✓ different geographic areas, i.e., coastal, mountains, rivers, etc.</td></tr>
<tr><td rowspan="3">Observe and document knowledge</td><td>Is a distinction made between knowledge that can be shared and knowledge that cannot (e.g., sacred knowledge or that which can only be performed by traditional or religious leaders, etc.)?</td></tr>
<tr><td rowspan="3">When holding FGDs with communities, make sure :<br>✓ when feasible, hold separate meetings for men and women, elders and youth, leaders (religious, traditional, village), and non-leaders. Non-leaders and women are less likely to speak if leaders/men are present in the room)<br>✓ if this is not feasible, choose an appropriate facilitator who can ensure all participants will have the chance to speak. Avoid having village leaders etc. as facilitator, to ensure everyone at the meeting will be comfortable speaking.<br>✓ hold meetings when it is convenient for the target groups (e.g., avoid organizing a meeting for women at meal preparation times, avoid organizing meetings involving farmers during planting season, etc.)<br>✓ find out from villagers beforehand so meetings will not be held during important village events, such as market day, traditional ceremony, etc.<br>✓ arrange childcare for the women's meetings, as necessary.<br>✓ arrange interpreters as necessary to ensure all participants of FGDs understand the content.</td></tr>
<tr><td rowspan="2">LINK validation</td><td>By communities, using FGDs</td></tr>
<tr><td>By students, through activities in schools and universities</td><td>✓ are both communities and scientists being consulted in this process?</td></tr>
<tr><td rowspan="3">LINK and science integration</td><td>With scientists</td><td>✓ do the scientists cover all fields related to the LINK documented?<br>✓ has the LINK been categorized appropriately?</td><td rowspan="3">Tool: LINK categorization as seen in figure 1.1 and described in section 3.4.1<br><br>Support: community leaders and scientists.</td></tr>
<tr><td>Choose which LINK in category I can be integrated with science</td><td rowspan="2">✓ are communities involved with the selection process?<br>✓ are scientists and experts involved in this process?</td></tr>
<tr><td>Identify LINK that can be promoted for use in IEC materials (LINK category I or II)</td></tr>
</table>

| | | | |
|---|---|---|---|
| IEC development | Define audience of IEC materials and their needs | ✓ has each target audience been consulted on its needs?<br>✓ do the materials reflect the needs, interests, and literacy and comprehension levels of the target audience(s)?<br>✓ have the traditional/religious leaders been consulted on the appropriateness of the materials?<br>✓ are LINKs appropriate and easily understandable for the target audience(s)?<br>✓ are the scientific explanations appropriate and easily understandable for the target audience(s)?<br>✓ are measures taken to ensure that the IEC materials do not reinforce social inequalities? | Support: by local disaster management officers and scientists. |
| | Decide on IEC media (type of materials, structure and format) | ✓ do the chosen media ensure effective delivery of the message?<br>✓ are the message and medium conducive to the environment, and cultural and religious beliefs of the target community? | Support: by local community chiefs, traditional and/or religious leaders, scientists, teachers. |
| | Develop content and key messages of materials | | |
| | Test, evaluate and get feedback on the materials (by users and educators), re-design if necessary | ✓ are the local government entities responsible for disaster education and CCA involved?<br>✓ have all existing groups (e.g., youth groups, women's groups, religious groups) identified and involved in this process?<br>✓ are the materials understandable, readable, interesting, and incite action? | |
| | Map stakeholders, identify their roles in disaster education (e.g. policy makers, schools/ youth, local authorities, etc), and identify change agent "champions" to accelerate dissemination, strengthen the advocacy process, and link relevant stakeholders | | |
| IEC dissemination | Develop strategy for dissemination | When determining events and/or places where IEC materials can be disseminated (e.g., seminars, festivals, religious schools, field trips), take into consideration:<br>✓ timing of events (not to overlap with planting season for farmers, when fisherfolk are out fishing, etc.);<br>✓ role of religious or community leaders;<br>✓ different activities to be developed for men and women, children, youth and adults. | Support: local schools, local disaster management officers, religious and/or traditional leaders. Policy support from national and local government entities that promote disaster education. |
| | Hold capacity building training/ workshops using the materials | | |
| | Track the impact and effectiveness of the educational and awareness-raising materials, by training the trainers to evaluate the effectiveness of materials | | |
| | Hold follow-up meetings and events as needed, for monitoring and evaluation | | |

To facilitate the integration of local and indigenous knowledge with science and technology to increase the resilience of coastal and small island communities against hydro-meteorological hazards and climate change impacts:

- It is necessary for all actors—government entities at the district and national levels, and local communities—to work jointly towards this goal.
- Support by government entities is needed to prioritize action research to identify, document, validate, and integrate local and indigenous knowledge related to disaster risk reduction and climate change adaptation, and into existing activities and plans on disaster risk reduction, climate change adaptation, or coastal zone management. In this process, it is important for all stakeholders to acknowledge that this work must be participatory and that it will involve multi-way learning.
- Promoting the development of information, education and communication materials to increase the awareness of all stakeholders on the importance of local and indigenous knowledge, and building the capacities of both scientists and non-scientists to work with local and indigenous knowledge and integrate it with science, is crucial. This can be strengthened if materials are integrated into school curriculums, and research on LINK and integration of such knowledge with science are promoted in universities and research institutions.
- It is important to ensure that promoting local and indigenous knowledge and its integration with science does not contribute to increased vulnerability of certain groups within communities.

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# Annex I: Glossary

**Aldeia** (Tetum): hamlet
**Angeen Badee** (Acehnese, Indonesia): Prediction of sea storms
**Barangay** (Filipino): Village or district
**Bayanihan** (Filipino): A voluntary collective action when communities assist those in need, such as moving a hut to another place, planting crops, and helping neighbours in times of emergencies and calamities (Luna 2006).
**Hydro-meteorological hazards**: "Process or phenomenon of atmospheric, hydrological or oceanographic nature", and in the Southeast Asian context, includes tropical cyclones (typhoons and hurricanes), thunderstorms, coastal storm surges, floods (including flash floods), droughts, heatwaves and cold spells. It is also important to note that such hydro-meteorological conditions can also be a factor in other hazards such as landslides and wildfires (UNISDR 2009).
**Local and indigenous knowledge**: Understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For rural and indigenous peoples, such knowledge informs decision-making about fundamental aspects of day-to-day life (UNESCO undated).
**Karang Taruna** (Indonesian): Youth association
**Keuneunong** (Indonesian): Traditional Acehnese calendar system used for estimating the best time to fish in order to avoid sea storms, and to when to start cultivation
**Pagtutulungan** (Filipino): People helping each other.
**Pagdadamayan** (Filipino): People sharing each other's burdens.
**Pakikiramay** (Filipino): People empathizing with others.
**Panglima Laot** (Indonesian): A traditional fishermen's organization in Aceh, which has a unique structure from the provincial level up to a certain river mouth area.
**Suco** (Tetum): Village
**Tara Bandu** (Tetum): A customary law, marked by elaborate ceremonies, which regulates relationships between people, between people and nature, and between people and the state in Timor-Leste (de Carvalho and Coreia 2011).
**Uteun Bangka** (Acehnese, Indonesia): A combination of several types of mangrove forests.
**Uteun Pasie** (Acehnese, Indonesia): A coastal forest consisting of vegetation found around coastal areas.

# Annex II: Sample survey form for documenting LINKs

Data-Gathering Form for Local
and Indigenous Knowledge for Disaster Risk Reduction: Observation
of Celestial Bodies (Sun, Moon, Stars, Comets)

Name of Barangay:_____ Name of Local Researcher:_____

| 1<br>Observation Number | 2<br>Date and Time | 3<br>What observations of the sun, moon, stars or other celestial bodies have you seen? | 4<br>What is the meaning or prediction of this observation? | 5<br>What did you do when you observed this celestial body? | 6<br>Did the meaning or prediction actually happen?<br>Yes No | 7<br>When and what time? |
|---|---|---|---|---|---|---|
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# Annex III: Sample data processing sub-tool for tabulating frequency of LINK observations and experiences

Data Processing Sub-Tool: Frequency Table for LINK Observations and Experiences
(Sample Quantitative Processing of Aggregated Data)

**Table 1: LINKs Observed or Experienced During the Period _____**

| Name of LINKs Observed or Experienced | Frequency of Observation during the period | Percentage |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**Table 2 : Time of Occurrence of the Events Predicted by the Observations**

| LINKs Observed | Occurrence of the Predicted Events From the Time of Observation of the LINK to the Occurrence of the Predicted Events | | | | | |
|---|---|---|---|---|---|---|
| | Within 12 hours | 13 hours to 1 day | 2-4 days | 5-7 days | 8-10 days | Did not occur |
| | | | | | | |
| | | | | | | |
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## Points for Analysis:

- Quantitatively:
  If the event predicted by the LINK observed did not occur at all, then the LINK observed is not a good predictor of the event.

  The longer the time between the observation of the LINK and the occurrence of the predicted event, the lesser the effectiveness of the LINK.

- Qualitatively:
  Description of the LINK, the time of observation, the meaning of the LINK or the occurrence of event being predicted by the LINK, the behavioral response of the observer.

  Description of the event predicted by the LINK, date and time of occurrence, impact of the event.

# Annex IV: List of information, education, and communication materials developed in Indonesia and the Philippines

**Indonesia:**

- Comic books:
  - *Uteun Bangka Penjaga Pantai Kita* (Uteun Bangka, Our Beach Guardian)
  - *Bermain di Uteun Pasie* (Playing in the Uteun Pasie)
  - *Belajar Keuneunong* (Learning Keuneunong)
  - *Angeen Badee sang Perusak* (Angeen Badee, the Destroyer)
- Posters:
  - Angeen Badee
  - Uteun Pasie
  - Uteun Bangka
- Booklets:
  - *Pengetahuan Asli dan Lokal Angeen Badee* (Local and indigenous knowledge on Angeen Badee)
  - *Pengetahuan Asli dan Lokal Keuneunong* (Local and indigenous knowledge on Keuneunong)
  - *Pengetahuan Asli dan Lokal Uteun Pasie dan Uteun Bangka* (Local and indigenous knowledge on Uteun Pasie and Uteun Bangka)

**Philippines:**

- Poster: *Ang 7K* (the 7"K")
- Video: *Ang Mga Katutubong Kaalaman ng Rapu-Rapu* (with English subtitles)
- Flipchart: *Local and Indigenous Knowledge for Disaster Risk Reduction and Climate Change Adaptation* (a 10-page flipchart in English)

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