POLICY ANALYSIS EXERCISE

Community Based Flood Early Warning Systems

Improving Climate Change Adaptation in the Hindu Kush Himalayan Region

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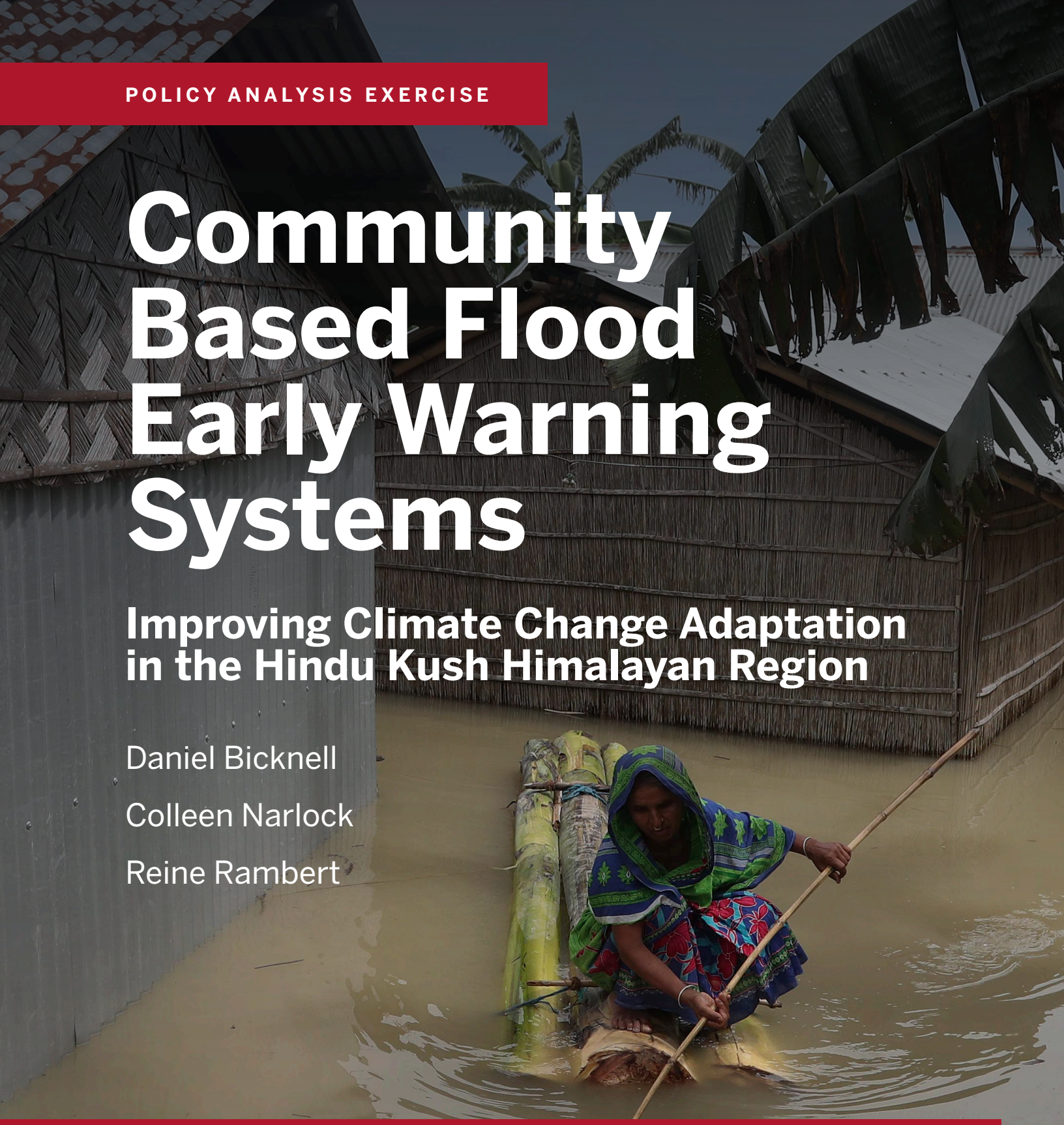

HARVARD Kennedy School
BELFER CENTER
for Science and International Affairs

POLICY BRIEF
AUGUST 2020

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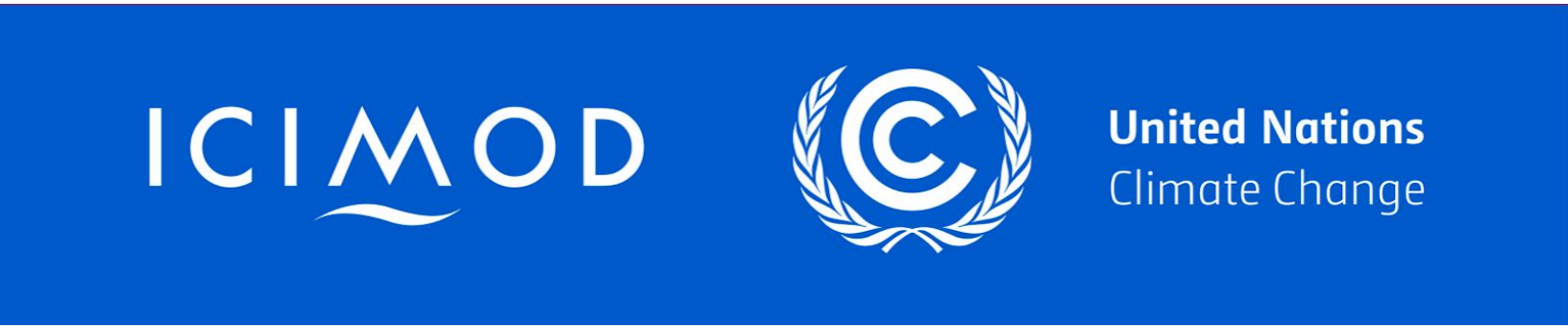
This policy brief was completed as part of a Harvard Kennedy School Policy Analysis Exercise, a yearlong project for second-year Master in Public Policy candidates to work with real-world clients in crafting and presenting timely policy recommendations.

Cover photo: A woman rows a makeshift raft near her partially submerged house in Gagolmari village, Morigaon district, Assam, India, Tuesday, July 14, 2020. (AP Photo/Anupam Nath)



This policy brief is a part of research conducted by Harvard Kennedy School Policy Analysis Exercise with support of ICIMOD and UNFCCC/NWP-LAKI to address one of the knowledge gap that serves as a barrier to climate adaptation: a lack of access to early warning systems for multiple hazards in the HKH region. The research is part of a yearlong project for second-year Master in Public Policy candidates to work with real-world clients in crafting and presenting timely policy recommendations.

We would like to acknowledge the extensive support of Neera Shrestha Pradhan and Shailendra Shakya from ICIMOD who guided us through the thesis by providing technical support, which was critical to the success of all in-country research, interviews, site visits, analysis of data, report preparation. We express our thanks to Arun Bhakta Shrestha, Sanjeev Bhuchar, Vijay Khadgi, Sarita Joshi, and other ICIMOD colleagues who provided us information about disaster risk reduction and early warning in the context of HKH. We also thank ICIMOD partner organizations and its representatives for giving us their time to explain about the field activities in Afghanistan, India, Pakistan and Nepal. Also, thanks to Hel Kumar Shrestha, Yuke Maharjan, Mahendra Shakya, and colleagues from Sustainable Eco Engineering (SEE) who guided us during the field visit and enhanced our understanding of the instrument in detail. In addition, we are also thankful to the numerous individuals that welcomed us in their communities during our visit.

We would like to express gratitude to Rojina Manandhar and colleagues from the Adaptation Programme and the Nairobi Work Programme in the UNFCCC Secretariat for their continuous support and initiating the research collaboration with ICIMOD.

Research conducted in-country for this Policy Analysis Exercise was made possible by the generous, financial support of the Robert and Renee Belfer Center for Science and International Affairs at the John F. Kennedy School of Government and the Environment and Natural Resources Program (ENRP).

Lastly, the thoughtful encouragement, feedback and guidance provided by Faculty Advisor, Professor William Clark, and IGA Seminar Leader, Professor Dara Lay Cohen, were essential to the completion of this PAE.

Overview

The Hindu Kush Himalayan (HKH) region includes Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. Nearly 1.9 billion people live in the HKH region and approximately 240 million live in the mountains and hills. The mountains in the region are young and still rising, which increases vulnerability to erosion, earthquakes, and landslides, in addition to the other risks associated with tectonically active zones. According to the International Disaster Database, in the past four decades (1980 - 2020), floods have killed more than 100,000 people, injured more than 870,000 people, and caused more than $370 billion USD in economic damage in the HKH region. Flood early warning systems, which transmit warning information about imminent floods to at-risk communities, are indispensable components of effective disaster risk reduction and climate change adaptation in the HKH region. While conventional early warning systems require expensive and highly sophisticated infrastructure, Community Based Flood Warning Systems (CBFEWS) leverage relatively inexpensive and user-friendly technology to reduce barriers to access and reach the most vulnerable communities. The following policy brief aims to provide a background on the CBFEWS model and its mechanics and explain the prerequisite conditions for early warning system expansion and implementation.

Community Flood Based Early Warning Systems

Per the CBFEWS Resource Manual, CBFEWS is an integrated early warning system that leverages a "system of tools and plans managed by and for communities in order to provide virtually real-time early warnings on floods to reduce risks." The system, developed by ICIMOD with support from Sustainable Eco Engineering (SEE), combines a low-cost water level monitoring instrument with a "caretaker," which is a community member assigned to validate and communicate risk levels based on water level during impending floods. The caretaker works with locally tailored communications focal points to transmit early warnings to upstream and downstream communities for timely evacuation.

CBFEWS uses wireless and/or telemetry-based technology, which costs around $1,000 to $3,800 USD with modest maintenance expenses over the equipment's life cycle. The CBFEWS model provides a low-cost means to improve communities' preparedness and protection. Policymakers should consider CBFEWS as a low-cost option to expand access to early warning systems and promote climate change adaptation. When assessing the feasibility of early warning system implementation, policymakers can focus efforts on the following three mechanisms for establishing an appropriate enabling environment.

Research indicates that the following three tactics can create conditions where early warning systems can be effectively developed and scaled: 1) improve local, national, and regional information sharing and coordination, 2) explore mechanisms for financial innovation to sustain infrastructure, and 3) expand the roles and responsibilities of private sector actors.

Research methodology

This report relies on a combination of primary and secondary research collection methods including desktop research, a literature review, elite and community interviews, and qualitative data analysis. In-depth interviews to CBFEWS' processes and procedures were conducted to understand its successful deployment in Nepal and in the three HKH countries (Afghanistan, India, Pakistan). Key informant interviews were conducted with experts from ICIMOD, SEE, UNFCCC, and other NGO partners. Field visits to ICIMOD's Godavari Knowledge Park and to Ratu and Khando rivers in Nepal were conducted to get in-depth interviews from the local community members and beneficiaries of CBFEWS, caretakers, local government officials, and local partners. Based on the data collected, a two-stage qualitative coding analysis using predetermined codes and emergent codes were conducted. Both the data collected in interviews and secondary literature sources supported the identification of barriers specific to the HKH region and ultimately framed the final recommendations.

Major Findings

Vulnerable communities used to rely on a 'watch and warn' system to disseminate flood information, which involved a community member physically monitoring river water levels on or near the embankment or river. They expressed their relief after the implementation of CBFEWS, which introduced a safer, faster, and less labor-intensive end-to-end system of transmitting flood information to vulnerable communities, thereby extending lead-time for communities to prepare and respond before a flood. It also helped women members of the vulnerable family to feel safer as the system would trigger the alarm if the water level rises in the river and they get sufficient time to prepare themselves. The findings of the research is divided for existing and prospective CBFEWS sites.

Existing CBFEWS Sites

1. **The people-centered approach of CBFEWS enables its effectiveness and ownership.** CBFEWS leverages a people-centered approach and relatively simple and low-cost technology, which collectively enable true community ownership and governance.

The system is not an externally imposed asset that requires outside management and extensive funding. Instead, it is something that the impacted community itself can help design, manage, fund, and control for its sustainability.

2. **Early warning communication must be locally-tailored and multi-layered**. To be successful, the system must leverage multiple modes of early warning information dissemination. The CBFEWS model leverages mobile phone technologies, sirens/speakers, local focal points, in-person volunteers, and other means to ensure that people throughout the vulnerable community receive the warning on time. Risk communication should have a multi-layered and multi-mode approach to prevent a singular blockage point that could result in system communication failure. CBFEWS technology is given a human face by appointing system caretakers. Additionally, CBFEWS adapts its communications methods to the unique needs of each community, using speakers in mosques or temples, depending on the culture and customs of the local residents.
3. **Private sector collaboration is essential**. The private sector is a crucial collaborator in the early warning system domain. Hindu-Kush-Himalaya stakeholders should seek support from private sectors at the local or national level to transfer technology by using local expertise resulting in cost-effectiveness as well as additional financial support from private sectors.

Prospective CBFEWS Sites

1. **CBFEWS expansion in communities that are technically feasible and politically receptive can decrease vulnerability and enhance resilience in HKH.** In order for a community to successfully adopt CBFEWS, it must identify a feasible location for the technical equipment, which partially depends on internet-enabled infrastructure. Secondly, the chosen location must have a sufficient level of community receptiveness and buy-in, demonstrated by cooperative NGOs or government officials willing to support the system's implementation and maintenance. It is easy to focus on physical or technical requirements for CBFEWS, but the importance of the socio-political context for CBFEWS should not be overlooked.
2. **Understanding the needs of the most vulnerable groups within each community is essential for effective CBFEWS implementation.** Each community contains unique dimensions of vulnerability and marginalization due to its social structure as well as the nature of the river and the geographical terrain. There is no one-size-fits-all approach to addressing the most vulnerable in flood-prone communities. A prospective CBFEWS site must consider not only who is vulnerable but how to actively include them in the planning and implementation processes.
3. **All actors like local governments, national governments, and intergovernmental organizations all have important roles to play.** While this system is distinctively

"community-based," national governments and other supranational actors still can support the scaling and financing of CBFEWS. For example, national governments can enable cooperation with military/police, emergency management authorities, and other, relevant government agencies (e.g. Department of Hydrology and Meteorology). Likewise, regional or intergovernmental organizations can share best practices for establishing CBFEWS, improve information sharing and coordination related to CBFEWS, and convene private, public, and civic stakeholders who are all interested in reducing flood-related damages.

Recommendations for Policymakers

For a policymaker looking to strengthen existing CBFEWS or implement new CBFEWS sites, there are three main recommended actions for saving lives and livelihood of vulnerable communities.

1. Improve information sharing and coordination

ICIMOD is working on improving information sharing and coordination with the HKH-Hydrological Cycle Observing System, which works with the World Meteorological Organization to improve hydrometeorological data collection, transmission, analysis, and dissemination for early warning systems. It has also worked on the Regional Flood Information System for the same regional initiative, which has the additional benefit of involving capacity-building/training activities for pertinent stakeholders (e.g. employees of disaster management authorities, emergency response, etc.). However, more can be done at the national and local levels to improve the integration and dissemination of flood information. Likewise, there are smaller ways that local agencies can facilitate inter/intra-agency and cross-sector information sharing and collaboration, ranging from focus groups and virtual discussions to joint training exercises / mock drills.

Policy Recommendation 1: It is important to overcome the obstacles to streamlined and efficient coordination and information sharing necessary for timely end-to-end early warning system functioning. In addition to focusing on improving intra-governmental communication at national and transboundary level, an institutional and governance mechanism should be created to share the information coming from modeling and satellite technologies that reaches the local vulnerable communities, who need the most for preparedness for the upcoming flood. Therefore, this hi-tech data and the information from CBFEWS need to be wisely used to save the lives and livelihood of the vulnerable communities.

2. Explore Mechanisms for Financial Innovation and sustainability

In December 2019, Tilathi Koiladi Rural Municipality Chairman in Nepal, Mr Satish Singh, initiated the creation of a sustainable financing model to facilitate Community Based Flood Early Warning System implementation. ICIMOD, the NGO Sabal Nepal, Ideal Society Saving and Credit Co-operative Limited, Tilathi Koiladi rural municipality, Rajbiraj municipality, Rupani municipality, and Prabhakar Yadav (a district-level governing body) all worked together to create a local basket fund to sustain the operation and maintenance of the CBFEWS along the Khando River, Nepal in their communities. Chairman Singh worked to bring stakeholders together from neighboring municipalities, so that they could fundraise across jurisdictions and establish an early warning system that improved their collective safety. The municipalities successfully combined an initial investment of public funding with Corporate Social Responsibility funding from the local cooperative. Chairman Singh also negotiated a high enough interest rate (14%) to cover annual costs and also grow the fund over time. This basket fund will not only fund operations and maintenance of the system but will also compensate the caretaker who monitors the system and alerts the rest of the community. This is an excellent model for other local policymakers who want to establish an early warning system in their communities but may not know how to sustain the financial costs over time. Another example in Gilgit Baltistan, Pakistan is handing over the CBFEWS to the Disaster Management Authority, who then committed to expand it in more than 40 tributaries in their district.

Policy Recommendation 2: A common barrier for establishing an early warning system is the upfront cost of equipment and then maintenance and operations costs over time. While CBFEWS is significantly less expensive than hi-tech systems, communities may still struggle to make the initial investment. It is important to explore ways of pooling resources from multiple jurisdictions that would benefit from CBFEWS implementation, dedicating government funding explicitly for CBFEWS implementation by including it in annual disaster management plans at the local level, and/or targeting donor funding for disaster risk reduction and climate change adaptation. It is important to think about the upfront costs but also about the maintenance and other operations costs over time to ensure the sustainability of the early warning system.

3. Expand the Roles and Responsibilities of Private Sector Actors

Over the past few years, ICIMOD has worked with two private companies, Sustainable Eco Engineering (SEE) in Nepal and Buraq Integrated Solutions (BIS) in Pakistan, to manufacture and maintain the technology used in the CBFEWS system. When facing an initial barrier to importing the monitoring instrument for CBFEWS into Pakistan from Nepal, ICIMOD helped to transfer the technology to Pakistani stakeholders and launch the local company, BIS, to take over the manufacturing of the technology. Looking outside the Hindu Kush Himalayan region, the United States also heavily involves the private sector in its early warning system infrastructure. The Federal Emergency Management Agency (FEMA) runs the Integrated Public Alert and Warning System (IPAWS) that functions as the national early warning system for all hazards, natural and manmade. FEMA collaborates with various private entities, including radio and television broadcast agencies in order to create a multi-layer approach to disseminating warnings through subscription and non-subscription-based services. It also collaborates with 462 unique wireless providers. FEMA tries to remain on the cutting edge of technology by issuing Request for Information (RFIs) to private technology vendors to learn about emerging solutions to problems or obstacles that they have, regularly attending private exhibitions and trade shows for various technologies (e.g. consumer electronics), and sending representatives to conferences, such as those by the International Association of Emergency Managers. In conclusion, the private sector actors in the HKH countries need to be engaged for collaboration and coordination at the local level to transfer the technology and strengthen early warning system infrastructure.

Policy Recommendation 3: Private sectors need to be engaged to implement and strengthen early warning systems. More specifically, there is an urgent need to create spaces to share learnings about emerging technologies, exchange expert inputs, and engage in partnerships to strengthen private sector participation in early warning systems. The type of engagement with the private sector actor depends on the area targeted for support. For example, in order to collect the disaster risk knowledge relevant for mapping and assessing hydrological hazards, hydropower companies and/or companies using GPS technologies need to be targeted. For the instrument support, monitoring, analysis, and forecasting, it is important to work with technology manufacturers and vendors. The mobile service providers or mobile application companies could be involved to support the communication of the early warnings to vulnerable communities and information on disaster response.

Next Steps

Possible next steps for implementing CBFEWS and enhancing disaster preparedness

Actors	*Good Practices*	*Example Actions*
Local E.g. Village Disaster Management Authority, Village chairperson, Ward person, etc.	• Take ownership of CBFEWS and its sustainability • Promote CBFEWS for outscaling and upscaling, coordination and timely communication with Provincial government and local vulnerable communities for required action and preparedness • Integrate CBFEWS in local level plans • Share knowledge and learn from others	• Conduct a District DRR and LEOC meeting with local manufacturing company • Design and implement the CBFEWS sustainability model • Take ownership of CBFEWS • Coordinate with implementing partners, such as Red Cross and Red Crescent, Lutheran World Relief, and Oxfam to identify early warning systems that could be expanded to the local-level
Provincial E.g. Line agencies, such as the district disaster management authority	• Promote CBFEWS for outscaling and upscaling, coordination and timely communication with local and national government for required action and preparedness, • Build capacity of local line agencies to deal with floods • Integrate CBFEWS in provincial policy and plans • Integrate private sectors for Early warning information • Organize meetings for sharing and learning opportunities	• Create a partnership between a technology company, University, and DEOC, private sector • Outscale and upscale CBFEWS in the vulnerable tributaries in the district • Liaise with National authorities for investment and implementation of CBFEWS • Engage Provincial Disaster Management Commission and Authorities in the Province of Punjab, Pakistan about their experience implementing Pakistan's National Multi-Hazard Early Warning Plan.
National E.g. National line agencies, such as the national disaster management authority or the Department of Hydrology and Meteorology	• Integrate private sectors for Early warning information • Provide timely flood information from hydrological and meteorological modeling • Coordinate with relevant financial agencies for funding availability • Improve domestic and regional information sharing • Integrate CBFEWS in national policy and plans	• Issue an RFI by hydromet agency • Link with relevant private sector and other donor agencies for funding opportunities • Liaise with Provincial government for upscaling and outscaling of CBFEWS • Engage the Ministry of Environment Protection and Agriculture of Georgia to draw insights from their "Scaling-up multi-hazard early warning system and the use of climate information in Georgia" UNDP project for applicability in the HKH region.

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