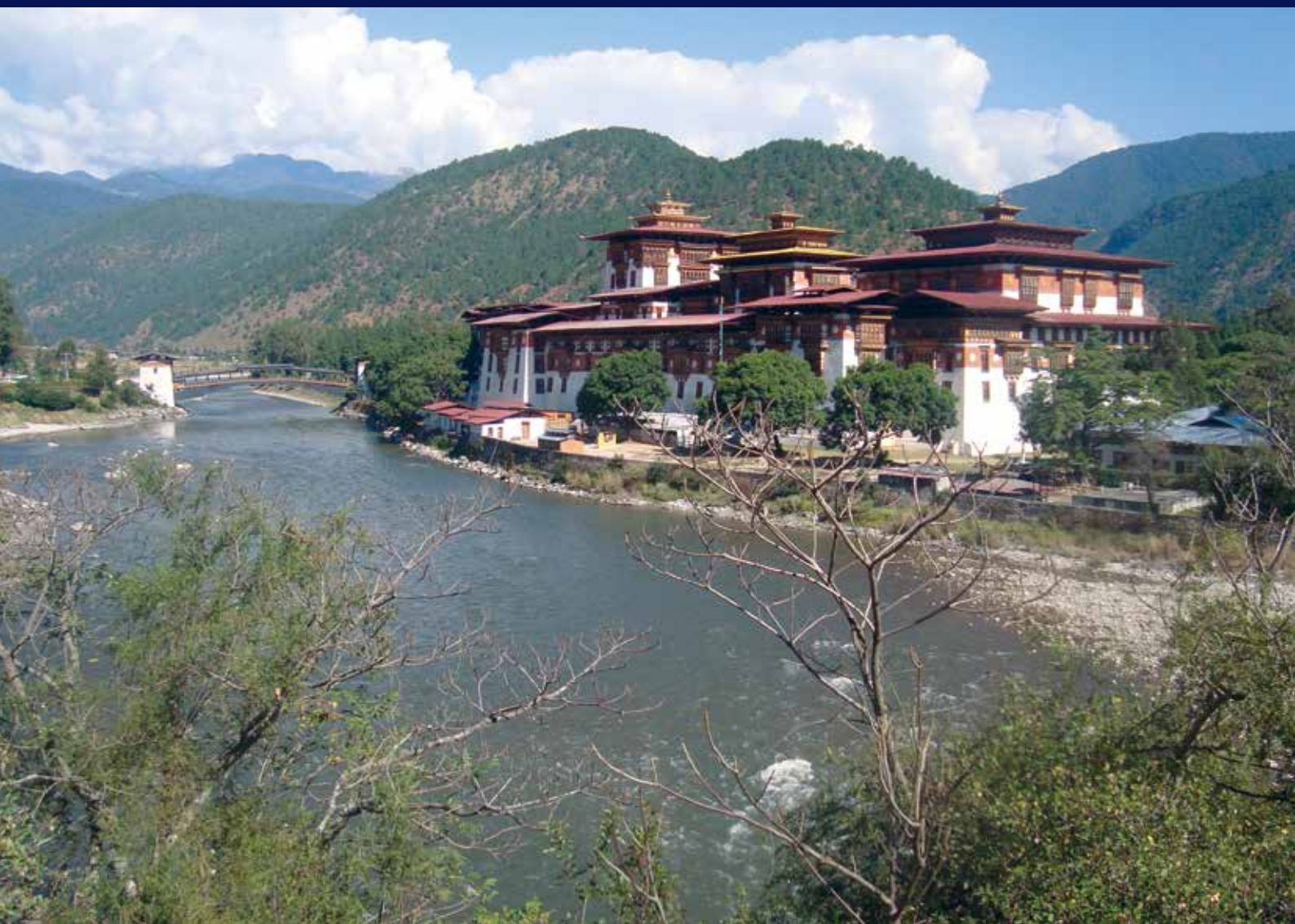


Flood Early Warning Systems in Bhutan

A Gendered Perspective



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The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.



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Flood Early Warning Systems in Bhutan

A Gendered Perspective

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Contents

Foreword	v
Acknowledgements	vi
Acronyms and Abbreviations	vii
Glossary	viii
Executive Summary	ix
Chapter 1 Introduction	1
Floods in Bhutan	2
Flood early warning system	2
Evolution of early warning system in Bhutan	3
Gender equality in Bhutan	5
Women’s vulnerability to floods	6
The importance of a gender perspective in EWS	6
Chapter 2 Assessing Flood EWS in Bhutan from a Gender Perspective	9
Study objectives and scope	10
Research questions	10
Methodology	10
Conceptual framework	12
Structure of this report	12
Chapter 3 Policies and Laws on Disaster Risk Reduction and Early Warning System	15
Water Vision 2025 and Bhutan Water Policy, 2003	16
National Disaster Risk Management Framework, 2006	16
Bhutan Water Act, 2011	16
National Adaptation Programme of Action, 2012	17
Disaster Management Act, 2013	17
Discussion	19
Chapter 4 Organizations Working in Disaster Risk Reduction and Early Warning System	21
Government organizations	22
International organizations	28
State-owned enterprises/corporations	29
National non-government organizations	30
Discussion	30
Chapter 5 Case Study: EWS in Punakha Dzongkhag, Punatsangchhu River Basin	33
Early warning system installed in the basin	34
Study areas	34
Risk knowledge at community level	38
Monitoring and warning	39
Dissemination and communication	40
Response capacity	41
Early warning systems implementing agencies	43
Summary of findings and discussion	44

Chapter 6 Conclusion, Recommendations and Opportunities	45
Conclusion	45
Recommendations	46
Opportunities	47
References	48
Annexes	
Annex 1: Survey questionnaire	53
Annex 2: Checklist for key informant interviews	58
Annex 3: Checklist for focus group discussions	61
Annex 4: List of stakeholders consulted	63
List of Tables	
Table 1: Flood disasters in Bhutan (1957–2015)	2
Table 2: Gender analysis of DRR and EWS policies and regulations in Bhutan	19
Table 3: Involvement of organizations in the key elements of people-centred early warning systems in Bhutan	23
Table 4: Responses by women and men when asked who are the technicians/caretakers of the EWS station in their village	43
Table 5: Summary of gender analysis of EWS at community level	44
List of Figures	
Figure 1: Components of a flood early warning system	4
Figure 2: Location of real-time hydrometeorological stations in Bhutan with HYCOS support	5
Figure 3: Methodological framework	11
Figure 4: The four elements of an early warning system	13
Figure 5: Types of organizations consulted	22
Figure 6: Percentage of male and female staff in the civil service	23
Figure 7: Percentage of female and male staff in government organizations	24
Figure 8: Map of case study area and the Punatsangchhu river basin	35
Figure 9: Occupation of respondents by gender	36
Figure 10: Education of respondents in Samdingkha by gender	36
Figure 11: Perception of women and men’s knowledge of flood risk	39
Figure 12: Women and men’s perceptions of groups vulnerable to flood	40
Figure 13: Women and men’s preferred mode of risk communication during floods	41
Figure 14: Participation of women and men in flood-related training and meetings	42

Foreword

ICIMOD has been committed to reducing disaster risk and enhancing community resilience in the Hindu Kush Himalayan (HKH) region for many years. The Centre has prioritized strengthening resilience to climatic risks and hydrological hazards, particularly high intensity rainfall events, glacial lake outburst floods (GLOFs), regional floods, and flash floods. It focuses on research, knowledge, education, policy, capacity building, community resilience, and regional cooperation. In order to help mountain communities better understand and mitigate the risks posed by flood hazards and promote regional cooperation, ICIMOD has initiated a long-term programme on flood risk reduction. The aim of the programme is to make information travel faster than flood waters.

South Asia accounts for a third of floods in Asia, half of those killed, and more than a third of those affected. During the three decades from 1985 to 2014, 1,766 natural disasters were reported in South Asia, of which a third were caused by floods, primarily in the Indus, Ganges, and Brahmaputra basins. More women than men die during such disasters because of lack of information, mobility, participation in decision making, and access to resources. The International Panel on Climate Change (IPCC) has warned that floods of the kind experienced in Pakistan in 2010 may become more frequent and more intense in the HKH region and other parts of the world because of climate change. At the same time vulnerability and exposure are also increasing. As a regional knowledge centre and through its HKH-Hydrological Cycle Observing System (HYCOS) programme, ICIMOD provides a regional platform to assist mountain people in implementing improved flood forecasting at national and regional levels, while addressing upstream-downstream linkages, to save lives and livelihoods.

To improve the understanding of existing early warning systems (EWSs) in the region and their effectiveness, ICIMOD has conducted an assessment of flood EWS in four countries (Bangladesh, Bhutan, Nepal, and Pakistan) from a gendered perspective. The objective is to support the development of timely, reliable, and effective systems that can save lives and livelihoods. The assessments examined the status of flood EWS, conducted gender analysis to understand the participation of women in these systems, and made recommendations for developing more effective systems. Through such studies, ICIMOD aims to sensitize those involved in EWS on the need to integrate gender into flood EWS and develop policies that encourage the participation and awareness of men and women, thereby reducing the loss of lives and livelihoods. This report presents the findings from Bhutan.

David J Molden, PhD
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ICIMOD

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Acronyms and Abbreviations

AWLS	automatic water level sensor
AWS	automatic weather station
DDM	Department of Disaster Management
DHMS	Department of Hydro-Met Services
DRR	disaster risk reduction
EWS	early warning system
GLOF	glacial lake outburst flood
GNH	gross national happiness
GNHC	Gross National Happiness Commission
HKH	Hindu Kush Himalayas/Himalayan
HYCOS	Hydrological Cycle Observing System
ICIMOD	International Centre for Integrated Mountain Development
INGO	international non-government organization
ISDR	International Strategy for Disaster Reduction
JICA	Japan International Cooperation Agency
NAPA	National Adaptation Programme for Action
NCWC	National Commission for Women and Children
NDMA	National Disaster Management Authority
NEC	National Environment Commission
NGO	non-government organization
PRA	participatory rural appraisal
RGoB	Royal Government of Bhutan
RRA	rapid rural appraisal
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction

Glossary

Chhu	River
Chorten	A Buddhist shrine, typically a saint's tomb or a monument to the Buddha.
Dungkhag	Sub-district of a dzongkhag
Dzong	fortress, which usually functions as the district headquarters for public administration as well as for monastic affairs
Dzongkhag	District
Gewog	Smallest geographic unit of public administration made up of group of villages
Thromde	Third-level administrative division

Executive Summary

Bhutan experiences frequent hydrometeorological disasters. In terms of relative exposure to flood risk as a percentage of population, Bhutan ranks fourth highest in the Asia-Pacific region, with 1.7% of its total population exposed to flood risk. It is likely that climate change will increase the frequency and severity of flood disasters in Bhutan. Inequalities in society are often amplified at the times of disaster and people living in poverty, especially women, the elderly, and children, are particularly vulnerable to flood hazards. Timely and reliable flood forecasting and early warnings that consider the needs of both women and men can contribute to saving lives and property. Early warning systems (EWSs) that are people-centred, accurate, timely, and understandable to communities at risk and that recommend the appropriate action to be taken by vulnerable communities can save people more effectively.

The Hindu Kush Himalayan-Hydrological Cycle Observing System (HKH-HYCOS) initiative, which is implemented by the International Centre for Integrated Mountain Development (ICIMOD) and its regional member countries in collaboration with the World Meteorological Organization (WMO), aims to address the challenges of providing end-to-end flood early warning systems in the region, including data collection, transmission, and analysis and the dissemination of information to communities at risk. For flood early warning systems to be fully effective, they must reach the end users, meet the different needs of women and men, and consider the differential impacts of floods on men and women. It is essential that they benefit women and men equally and, for this, a gender perspective is required. Thus, a study on flood early warning systems from a gender perspective was conducted in four countries of the HKH (Bangladesh, Bhutan, Nepal, and Pakistan) as a part of the HYCOS initiative. This report presents the findings of the study in Bhutan.

The study assessed the policies and laws, implementing organizations, and coordination and linkage mechanisms for flood early warning in Bhutan with respect to four key elements of flood EWS (risk knowledge, monitoring and warning services, dissemination and communication, and response capacity). In relation to policies and laws, five documents were reviewed: The Water Vision 2025 and Bhutan Water Policy, 2003; the National Disaster Risk Management Framework, 2006; Bhutan Water Act, 2011; National Adaptation Programme of Action, 2012; and Disaster Management Act, 2013. The policy review revealed a gap in terms of gender integration at the various stages of early warning systems. The Disaster Management Act, a key document for implementing early warning systems, makes specific reference to including women in disaster risk reduction, as well as in response and recovery. However, none of the policy documents talk about the differential experiences, needs, and roles of women and men with respect to EWS, nor do they discuss why we need to consider gender in disaster risk reduction (DRR).

A total of 23 organizations working in disaster risk reduction and EWS in Bhutan were consulted. The assessment found that these implementing organizations adopt a gender neutral approach and the level of gender sensitivity of projects with EWS components is low. Most of these organizations are dominated by men and women are not sufficiently included in decision-making processes or implementing activities for EWS. Ensuring a greater gender balance among staff could create a healthy environment for gender integration. There is also a need for better coordination and linkages among organizations engaged in disaster management and EWS and those involved in addressing gender equality and social justice.

As well as the review of policy and implementing organizations, a detailed case study was conducted in 2014 of the EWS in the Punatsangchhu river basin. Two settlements in the basin, Samdingkha and Khuruthang, one located in the upstream and the other downstream from the Punakha Dzong, both prone to floods and GLOFs, were selected as study sites. A household survey was carried out, together with focus group discussions and key informants interviews. The case study revealed that the current EWS is gender neutral as it does not consider the different needs and requirements of men and women. While most community members are aware of the hazard zonation maps (men and women), the majority of women surveyed were unaware of the safety routes and evacuation sites. More efforts are needed to ensure that EWS information on floods reaches all end users, including women and specific social groups, especially those who are illiterate. The study also found that the methods used to disseminate warnings need to consider the needs of different members of the community. Some of the women who participated

in the survey preferred receiving flood warnings by mobile phone, rather than siren (which are only sounded in public places); hence, an integrated warning system consisting of both mobile alerts and sirens should be considered in EWS design.

The EWS in Bhutan was limited to the Punakha-Wangdue valley at the time of the stakeholder consultations and focus group discussions in 2014, however, the coverage of this system has now been expanded to Mangde chhu and Chamkhar chhu valleys of Bhutan. Based on the study findings it is clear the concept of an early warning system in relation to flood hazards needs to be broadened to integrate gender issues, particularly in relation to new systems being developed to maximise their effectiveness.

Recommendations

The following recommendations are made to ensure that flood early warning systems are gender sensitive, gender responsive, and effective.

- **Involve women in all aspects of EWS:** Ensure that disaster management activities are gender sensitive at all stages of the disaster cycle, by involving both women and men in the design, administration, and implementation of EWS.
- **Link organizations in EWS with those working for gender equality:** Link policies and organizations for disaster management and EWS with those for gender equality and social justice (such as the National Commission for Women and Children, the Gross National Happiness Commission, and INGO/NGOs working on gender and social issues) to help achieve gender integration in EWS.
- **Amend policies and laws to be gender sensitive:** Amend policies and laws to make it mandatory to consider the differential experiences, needs, and roles of women and men in disaster management.
- **Bring about a gender balance in the staffing of EWS implementing agencies:** Bring about a gender balance in the staffing of agencies implementing disaster management and EWS to improve the gender sensitivity and responsiveness of EWS. For this, affirmative action in recruitment and incentive structures for women should be considered to facilitate the promotion of women to higher positions.
- **Strengthen the capacity of communities for EWS:** Continuously strengthen the capacity of communities for EWS, with particular attention to the involvement of women in risk knowledge, monitoring and warning, dissemination and communication, and response capacity, to ensure the sustainability of the EWS. Affirmative action should be used to ensure women's involvement in capacity building activities, such as training and exposure visits, to enhance their capacity to respond to floods. Women should also be involved in infrastructure management teams for local early warning systems to enhance women's leadership in EWS.
- **Use gender responsive materials in capacity building and EWS technology:** Ensure that the materials used in capacity building activities and technology for EWS are responsive to the needs of all community members. For example, illustrative communication materials are more effective for illiterate community members, among whom women constitute the majority. Similarly, the preference for mobile phones as tool for receiving flood warnings (over sirens) is higher among women; hence, consider integrating both sirens and mobile phones as part of the alert system. The sound of siren for flood warning also needs to be differentiated from other warnings, such as those for ambulances.
- **Increase community ownership of EWS for greater sustainability and effectiveness:** Consult stakeholders while planning, designing, and implementing EWS to avoid any mismatch between the needs of different social groups, including women, and to instil ownership of the system in local communities.
- **Conduct further research on gender issues:** Conduct further research on gender issues in disasters to inform policies and programmes. There is a need for the increased documentation of successful gender strategies used by communities living in disaster-prone areas. There is also a need to focus on gender-based vulnerabilities and capacities, rather than physical exposure to technological and environmental hazards.

It is expected that the future flood early warning systems will benefit from the findings and recommendations of this assessment.

Chapter 1
Introduction

Floods in Bhutan

Bhutan is a landlocked country situated between India (in the east, west, and south) and China (in the north). It has a rugged and steep topography with a total population of less than 800,000 (World Bank nd). The climate of Bhutan is influenced by the south-westerly monsoon, which comes in from the Bay of Bengal. There is a high seasonal variability in precipitation with about 70% of rainfall occurring in the four months from June to September. Bhutan is vulnerable to a number of hazards, due to its fragile geological conditions, vulnerable ecosystems, and climatic conditions. Hydrometeorological disasters are frequent and include glacial lake outburst floods (GLOF), flash floods, and landslides. The country ranks fourth highest in the Asia-Pacific region in terms of relative exposure to flood risk as a percentage of population, with 1.7% of its total population exposed to such risks (UNESCAP and UNISDR 2010).

Bhutan has been affected by several flood disasters in the past (Table 1), affecting thousands of hectares of land, irrigation channels, roads, pasturelands, and livestock throughout the country. In May 2009, incessant rainfall due to the Cyclone Aila caused all major rivers to swell, resulting in damage across 17 districts, killing 12 people, and destroying both government and private infrastructure (including houses, bridges, dzongs, chortens, agricultural land, and hydropower projects). The total damage was estimated at USD 17 million (RGoB and UNDP 2011). In 2004, heavy rainfall in the eastern part killed 9 people, completely destroyed 29 houses, and damaged infrastructure and service facilities (Ministry of Agriculture 2004). The 2000 floods in Phuentsholing killed 49 people, destroyed 46 houses, and washed away 664 acres of land. In 1994, a GLOF swept through the Punakha-Wangdue valley killing 21 people, damaging 12 houses, and ruining more than 728 hectares of land (Levaque 2005).

Table 1: Flood disasters in Bhutan (1957–2015)

Year	Flood event
1957	In 1957, a GLOF from the Tarina Tsho (glacial lake) in Western Lunana affected the Punakha-Wangdue valley and destroyed part of Punakha dzong.
1994	On 7 October 1994, a GLOF from the Luggye Tsho (glacial lake) caused the Pho-chhu river to flood causing extensive damage to infrastructure in the Punakha-Wangdue valley and the loss of 21 lives.
2000	In August 2000, a flash flood in the industrial town of Pasakha in Chhukha district caused severe damage to the town and nearby infrastructure.
2004	In 2004, severe flash floods occurred in the six eastern dzongkhags of Bhutan killed 9 people and washed away 29 houses. In Rangjung in Trashigang district, many houses, roads and the Rangjung hydro-power infrastructure were washed away.
2009	In May 2009, Cyclone Aila caused torrential rainfall, resulting in many flash floods throughout the country, especially in the western region around Thimphu. Twelve lives were lost and damage to property (farmland, infrastructure, etc.) amounted to USD 17 million.
2010	In 2010, flash floods and landslides caused damage to 809 hectares of farmland and irrigation channels and 16 hectares of pastureland, affecting nearly 4,800 households and killing 1,000 livestock throughout the country.
2011	In 2011, flash floods and landslides caused extensive loss of property in the industrial estates and residential areas of Phuentsholing and Pasakha in the south of the country.
2012	On 20 June 2012, a flood in Gasa caused damage of over USD 5 million to infrastructure, irrigation channels, houses, and government buildings
2015	On 28 June 2015, a GLOF was triggered from Memari Tsho (also known as Lemthang Tsho) and washed away four bridges, four horses, affected an acre of land, and caused three major landslides downstream, damaging the horse trails between Gasa and Laya.

Sources: Levaque (2005); RGoB (2006); RGoB and UNDP (2011); Lotay (2015); Kuensel (2015)

Flood early warning system

As in many other regions, climate change is likely to increase the frequency and intensity of extreme weather events in Bhutan, as indicated by the International Panel on Climate Change (IPCC 2012). To minimize the adverse impacts of floods, early warning systems are essential. Early warning systems can prevent loss of life and

reduce the economic and material impact of disasters. The effectiveness of any EWS depends on its capacity to enable individuals and communities threatened by flood hazard to reduce the risk of disaster by taking action at the appropriate time. An EWS must actively involve communities at risk, educate the public to raise awareness of risks, effectively disseminate messages and warnings, and ensure a constant state of preparedness (UN 2006). In its 'Global Survey of Early Warning Systems', the UN highlights the significant progress that has been made in assessing risks and generating and communicating predictions and warnings (UN 2006). The report recommends building people-centred early warning systems. Advances in science and technology during the last decade (since 2006) have improved the ability of flood early warning systems to save lives (UN Women 2012; UNISDR 2015b). However, even a sophisticated warning system loses its significance if it fails to reach to vulnerable members of the community like women, children, the elderly, and people with disabilities.

The Hyogo Framework of Action, 2005–2015, which was endorsed by 168 national governments, including Bhutan, at the 2005 World Conference on Disaster Reduction, recognizes early warning systems as an important element of disaster risk reduction, and, hence, of sustainable development and sustainable livelihoods. The Framework emphasises that the “gender perspective should be integrated into all disaster risk management policies, plans, and decision-making processes, including those related to risk assessment, early warning, information management, and education and training” (UNISDR 2005). The framework also stresses the importance of early warning and encourages the development of early warning systems that are people-centred, that give timely warnings that are understandable to those at risk, and that include guidance on how to act upon warnings. Following the Hyogo Framework for Action, the Sendai Framework, 2015–2030, emphasized that “women and their participation are critical to effectively managing disaster risk and designing, resourcing and implementing gender-sensitive disaster risk reduction policies, plans and programmes; and adequate capacity building measures need to be taken to empower women for preparedness as well as build their capacity for alternate livelihood means in post-disaster situations” (UNISDR 2015a).

On a practical level, flood early warning systems consist of a chain of activities, namely: understanding and mapping flood vulnerability, monitoring rainfall and water levels, forecasting impending events, and disseminating and communicating understandable warnings to decision makers and the general public so that they can take appropriate and timely action. Figure 1 shows the four main pillars of a flood EWS: risk knowledge, monitoring and warning, dissemination and communication, and response capability.

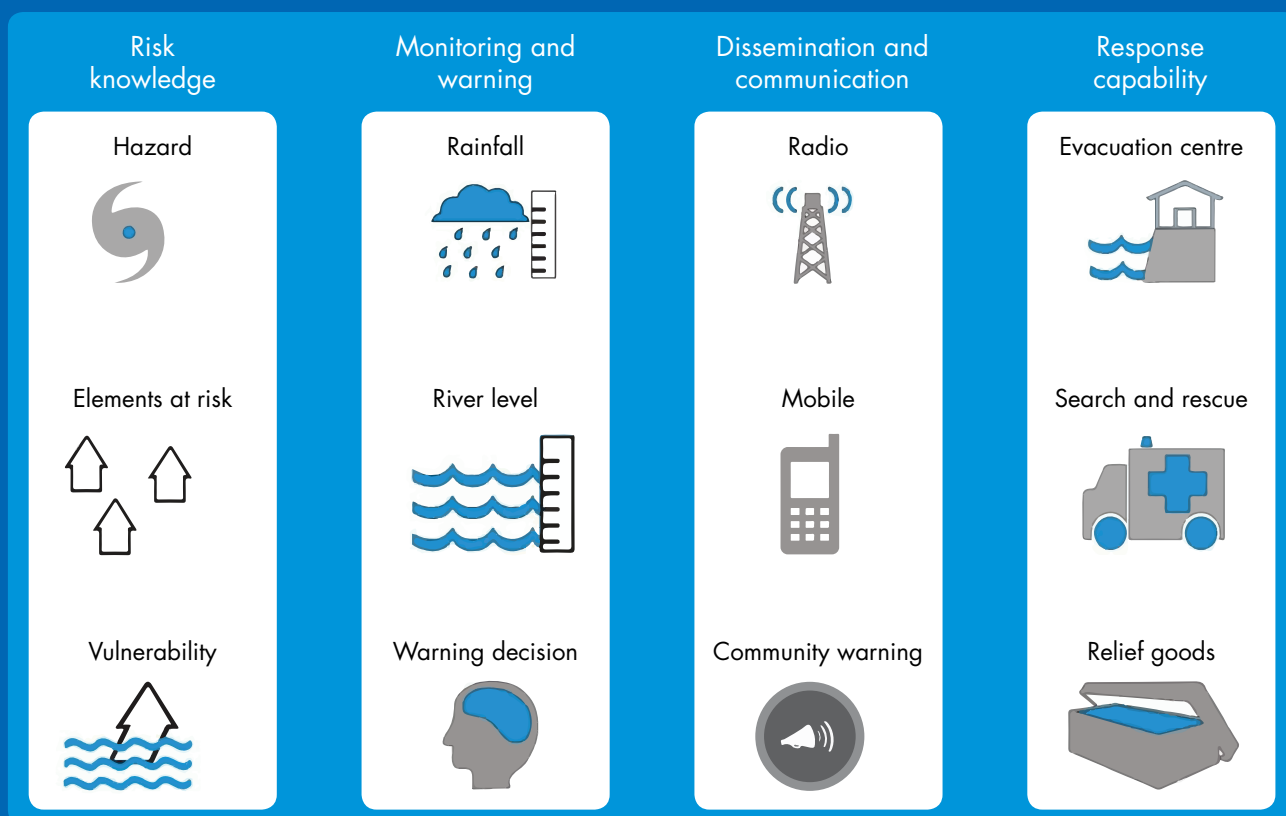
Evolution of early warning system in Bhutan

Early warning systems were first introduced in Bhutan in 1988 by the Department of Hydro-Met Services (DHMS), under the Ministry of Economic Affairs (DHMS 2013b). In joint collaboration with the Central Water Commission (CWC) of India, a total of 28 flood warning stations were equipped with a staff gauge to monitor water levels, which were communicated through a network of VHF radios to India for flood forecasting and warning in the downstream areas of Assam and West Bengal. Since then, manual early warning systems have developed into rather sophisticated web-based telemetry early warning systems for flood monitoring and warning.

Although major flooding had occurred in the past, it was the 1994 GLOF from Lake Luggye that made the Government of Bhutan prioritize GLOF risk mitigation (Tagg 2010). The National Adaptation Programme for Action (NAPA I) 2006 also identifies GLOF risk reduction as a high priority adaptation need (RGoB 2006b). In response to this, a project called 'Reducing Climate Change-Induced Risks and Vulnerabilities from Glacial Lake Outburst Flood in the Punakha-Wangdue and Chamkhar valleys' was funded by the United Nations Development Programme-Global Environment Fund (UNDP-GEF) Least Developed Countries Fund (LDCF). In 2008, the Department of Disaster Management (DDM) was established under the Ministry of Home and Cultural Affairs to lead disaster risk management activities in Bhutan (Tshering 2013) and, in 2011, a GLOF early warning system was put in place in the Punakha-Wangdue valley (UNDP 2012a; DHMS 2013a; DHMS 2013b).

In 2009, Cyclone Aila increased commitment to the development of early warning systems in Bhutan and created a sense of urgency. With advancements in technology, the existing hydro-met observation network was upgraded to transmit real-time data. There are currently 15 stations transmitting real-time data at a pre-set intervals of 15

Figure 1: Components of a flood early warning system

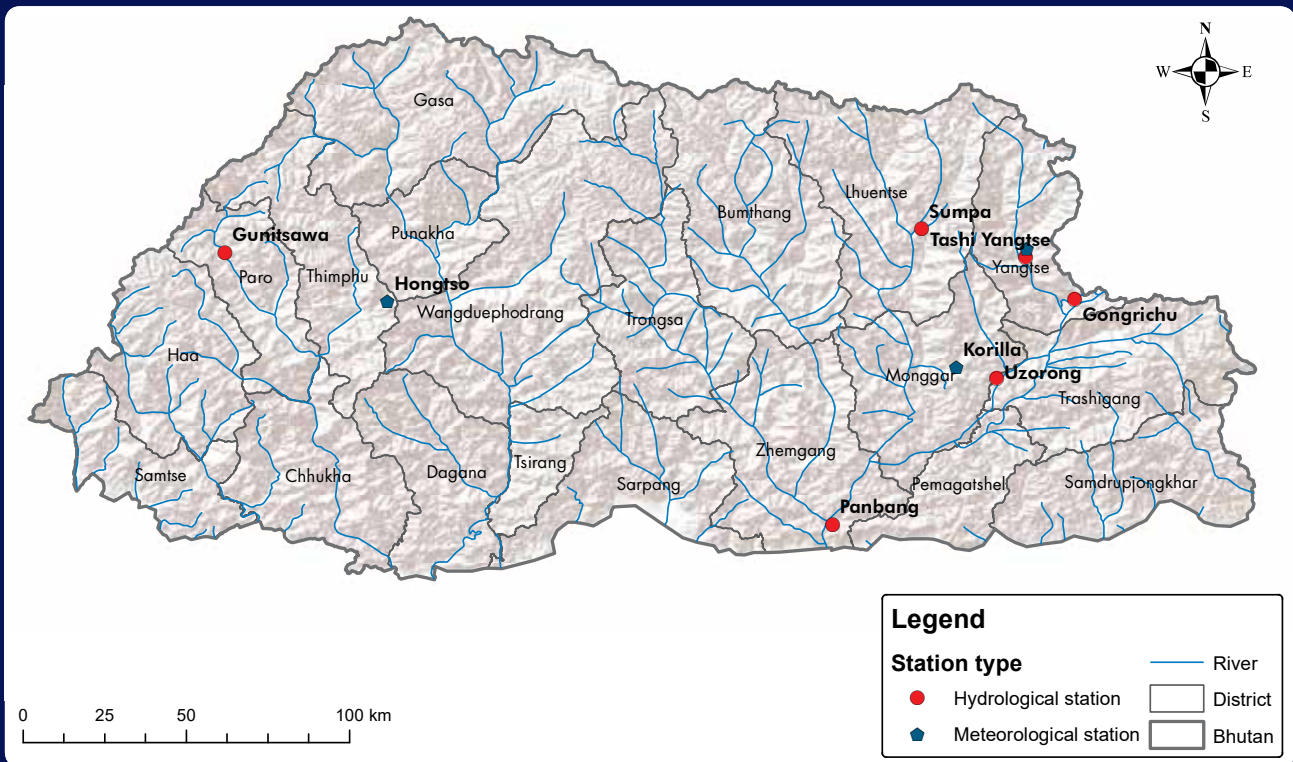


Source: Adapted from Neussner (2009)

minutes to the DHMS servers at the control room of the National Weather and Flood Forecasting and Warning Centre (NWFFWC). In 2011, as part of the project ‘Enhancing Adaptive Capacity to Climate Change’, three automatic weather stations (AWS) were installed at Semtokha (Thimphu), Chamkhar (Bumthang), and Kanglung (Trashigang) and two automatic water level sensors (AWLS) were installed at Tamchhu (Chhukha) on the Wang-chhu river and at Yebesha (Punakha) on the Mo-chhu river. Between 2011 and 2012, with the support of HYCOS, the DHMS installed nine stations: three AWS stations at Hongtsho (Punakha), Korila (Mongar), and Trashiyangtse and six AWLS stations at Gunitsawa (on Pa-chhu river), Sumpa (on Kuri-chhu river), Trashi-yangtse (on Kholong-chhu river), Uzorong (on Gongri-chhu river), Panbang (on Manas river), and Gongrichhu (on Gongrichhu river) (Figure 2). The water level in the rivers is monitored using automatic sensors based on pressure and radar technologies and data is transmitted via the Internet using the Global System for Mobile Communication (GSM) technology from two service providers: Bhutan Telecom and Tashi Cell. The Iridium satellite is used as a backup to transmit data when all communication systems fail. The data from these stations are available in the national flood information system.

There is strong policy support for the DHMS’s plans to expand the hydrometeorological monitoring network throughout the country to reach all 205 gewogs. The Department of Disaster Management has set up a Risk Management Division to identify areas that are vulnerable to flood risk. New EWS projects include JICA’s support for an EWS, similar to that in the Punatsangchu river basin, which has been installed on the Mangdechhu and Chamkharchu rivers in Bumthang in central Bhutan. Under the second Least Developed Countries Fund-project, it is planned to strengthen hydromet infrastructure at various strategic, high-risk locations across all dzongkhags in the country, including the addition of at least 70 AWS (including real-time communication equipment), 25 AWLS (including real-time communication equipment), 8 landslide monitoring devices, and 35 sets of integrated early warning systems. This will enable the most vulnerable locations in Bhutan to be placed under the 24/7 integrated early warning system (covering multi-hazards especially flash floods and landslides).

Figure 2: Location of real-time hydrometeorological stations in Bhutan with HYCOS support



Gender equality in Bhutan

Women make up 49% of the population in Bhutan and have the same legal rights as men. They face no overt discrimination and have equal access to health, education, and public services (Black and Stalker 2006). Many communities, particularly in the western part of the country, practice matrilineal inheritance (NCWC and World Bank 2013). However, a dichotomy is visible in the gendered roles of women and men in household work and official/political work in Bhutan, with a high rate of men engaged in the latter and women in the former.

Bhutan ranks third in the region and 92nd out of 186 countries in the world in its gender inequality index (UNDP 2013). The prevalence of anaemia among Bhutanese women is considerably higher than among men (70% compared to 25.9%), raising questions about women's wellbeing (GNHC 2011). Although the Government of Bhutan encourages women's participation in administrative and political arenas, in reality, women's participation in this sector is significantly lower than that of men. Conversely, women participation in the labour force is higher than that of men: there were 2.2% more women than men in the labour force in 2012. However, only 25% of women are involved in non-agricultural employment (RGoB 2012b).

The literacy scenario is similar: between the ages of 15 to 24 the literary rate for females is 68% compared to 80% for males (UNICEF 2013). Although the adult literacy rate increased from 52.8 % in 2005 to 55% in 2012, male adult literacy was higher at 66% than female adult literacy at 45% (RGoB 2013b). Although Bhutan has made remarkable progress in last few decades in providing access to education to its citizen, the poor performance of girls in the final two years of basic education, especially in maths and science, reduces their chances of qualifying for publicly-funded higher education (ADB 2014). Their low rate of literacy and lack of awareness and opportunities make Bhutanese women highly vulnerable during natural disasters.

Women's vulnerability to floods

Women are often more vulnerable to disasters than men due to social and gender structures and power relations, which result in the inequitable distribution of rights, assets, resources, and power, which, combined with repressive cultural rules and norms and women's greater care responsibilities, often leave women poorer and less educated than men and with less access to information. Women are also often excluded from political and household decision-making processes that affect their lives. Thus, disasters such as floods have differential impacts and effects on women and men, because such disasters interact with gendered power differentials to create situations in which men and women cope, experience, and suffer differently. Added to this is the increase in household and community responsibilities borne by women due to high rates of male out-migration in the Hindu Kush Himalayas (HKH) (Mehta 2007; Ariabandhu 2009; Nellesmann et al. 2011).

Women are, therefore, often more vulnerable to extreme events like floods (Brody et al. 2008; Dankelman et al. 2008), and there is ample evidence from the region that show that women and girls' mortality during disaster is higher than that of men and boys. For instance, in the South Asian Tsunami in 2004 more women died than men. In Indonesia, male survivors outnumbered female survivors by a ratio of almost 3: 1 (OXFAM 2005). In Nepal, flood-related fatalities were found to be significantly higher for women and girls, at 13.3 per 1,000 for girls aged between 2 and 9 years, compared to 9.4 per 1,000 for boys of the same age and 6.1 per 1,000 for adult women, compared to 4.1 per 1,000 for adult men (WHO 2005; Bartlett 2008). Similarly, in Bangladesh, in the 1991 cyclone and floods, the female mortality rate was higher than that of men and, among girls and women over the age of ten, it was three times higher than for boys and men of the same age (Twigg 2004; Parikh 2007; Röhr 2007). In contrast, the mortality rate of men in both flood- and salinity-prone areas was only 17% of the total (Rabbani et al. 2009).

Even relief activities do not reach women equally and there are gendered differences in the rehabilitation and recovery phases after disasters. Inequalities that already exist in society become magnified at times of disaster (Lynn 2005; Neumayer and Plumper 2007). Women and girls are particularly vulnerable in post-disaster situations, because they lack land and other assets that could help them to cope, making them more likely to face food shortages, sexual harassment, unwanted pregnancy, trafficking, and disease, which can lead them to drop out of school or marry early (Enarson 2000; Vincent et al. 2010).

However, women are not merely 'helpless victims', as often represented (Bretherton 1998; Arora-Jonsson 2011). Both women and men have valuable, but different, knowledge, skills, and coping strategies acquired through their work, understanding, and experiences (WEDO 2007). But, the strengths and capabilities of women are often ignored in policy decisions, which pay little attention to gender-based differences in men and women's situations, their perceptions of threats and vulnerabilities, and experiences. Policy makers and planners have historically paid little attention to the social and gender barriers and constraints that prevent women from building capacity and accessing relevant information for better preparedness. A gender perspective in programmes and projects can help people to better understand social processes, thereby ensuring that gender differences do not inadvertently perpetuate inequality (UNDP 2010).

The importance of a gender perspective in EWS

To increase the effectiveness of early warning systems, it is essential to ensure that women and men benefit equally, and, for this we need to integrate a gender perspective. The different threats that impact on men and women as a result of natural hazards must be taken into account, and both men and women must participate in the design, development, and implementation of early warning systems. The integration of a gender perspective into early warning systems improves their effectiveness by ensuring that more specific information is gathered and by enabling more detailed analysis, which, in turn, can ensure more accurate and measurable responses (OSCE 2009).

A common criticism of most early warning systems is that they fail to reach the end users due to bureaucratic protocols and, as a result, do not serve the purpose of early response and evacuation. In most cases women are last to receive such information. This is because the social structure of societies like Bhutan make women dependent on men for receiving disaster information, preparedness, and evacuation (Dhungel and Ojha 2012;

Shrestha et al. 2012). Studies from Bangladesh and Nepal show that women do not receive information in time, making them more susceptible to injury and death than men in times of disaster (World Bank 2010). In Bangladesh, early warning signals often do not reach large numbers of women, because the information is disseminated primarily in public places, which are not frequented by many women. Even when women do receive warnings, they are constrained from taking action by cultural norms that restrict their freedom of movement in public, meaning that they often move too late waiting for permission (UNEP 1997; Parikh 2007; Sharmin and Islam 2013).

Recently, there has been increasing emphasis on involving and empowering end users (affected communities) in the entire EWS transmission loop, from the collection of data to dissemination and reception of warnings. Box 1 outlines a case in the Philippines where attention has been paid to integrating gender into geo-hazard assessment and mapping. However, making EWS gender inclusive is not straight forward, due to the complex nature of social and gender structures, which are interlinked with economic, political, geographical, and environmental conditions and contexts. Gender inclusive EWS includes empowering women, along with men, in the use of early warning technologies, managing early warning mechanisms, receiving early warning messages, and, most importantly, in decision making.

Box 1: Government bureau working with women and men to map risk

'Engendering Geohazard Assessment and Mapping Project', funded by the United Nations, was first implemented in 2004-2005 as a pilot initiative of the Department of Environment and Natural Resources in the Philippines. The project aims to provide women and men with equal access to information that indicates the geohazard susceptibility of pilot communities. Key lessons learnt from the project are that it is important for both men and women to undertake geohazard surveys, assessment, and mapping, but it is even more important, in the context of a vulnerable community, to provide women and men with equal access to information.

Source: UNISDR (2007)

Interviews with farmers from Samdingkha





EWS in flood warning office, Wangdue

Chapter 2

Assessing Flood Early Warning
System in Bhutan from a
Gender Perspective

This study assesses the flood EWS in Bhutan from a gender perspective. It is part of the Hindu Kush Himalayan-Hydrological Cycle Observing System (HKH-HYCOS) project developed by ICIMOD and its regional member countries, in collaboration with the World Meteorological Organization (WMO), to support disaster prevention and flood management at the regional level by enhancing regional cooperation and technical capacity for the collection, transmission, and sharing of hydrometeorological data. The project established a regional flood information system (RFIS) to facilitate the transboundary exchange of real-time and near-real-time data, best practices, and know-how in support of flood management. The project has upgraded 38 hydrometeorological stations in 4 countries to transmit real-time data on river level and rainfall using advanced technologies for data collection and transmission (Shrestha et al. 2015). The project recognizes the importance of assessing existing flood early warning systems from a gender perspective as a basis for the development of an effective flood early warning system, with flood information made available to vulnerable communities. Such assessments have been conducted in four countries: Bangladesh, Bhutan, Nepal, and Pakistan. This report presents the findings of the study in Bhutan.

Study objectives and scope

The objectives of the study were to:

- gain knowledge about the status and effectiveness of existing early warning systems (policies and institutions) for flood risk management in Bhutan
- analyse the strengths, gaps, and needs of the various organizations and agencies at the different levels (including communities) involved in flood early warning systems in Bhutan in terms of their technical capacity to carry out functions related to early warning systems, commitment to the system, networking and coordination among different institutions, and responsiveness to gender and social inclusion
- look into the opportunities and challenges for gender integration in current systems to identify issues to be addressed in order to make current early warning systems more gender responsive and people-centred

To meet the objectives, the study conducted the following analyses:

- Policy analysis: National and local policies and strategies were identified and reviewed.
- Stakeholders analysis: Key organizations involved in flood early warning systems in Bhutan were identified, together with their functions and roles.
- Gender analysis: The quality of the inputs and involvement of organizations working in flood EWS was analysed in terms of their contribution to effective and gender-responsive EWS in Bhutan.
- Networking and linkages analysis: Networking and coordination among the organizations working in EWS were investigated.

Based on the above analyses, strengths and gaps were identified and ways to promote gender integration in flood EWS in Bhutan suggested.

Research questions

The main research question was: How are gender considerations integrated into existing flood early warning systems and what improvements are needed to make these systems more inclusive?

To answer the main research question, the following operational research questions were framed:

- What is the status and effectiveness of existing early warning systems (policies, other instruments, and organizations) for flood disaster risk reduction?
- What are the gendered implications of planned EWS at the community level?

Methodology

The research design was based around a disaster risk reduction framework consisting of four key elements of an early warning system (see Figure 4). The study comprised a literature review, field case study (focus group discussions and key informant interviews), and data analysis (Figure 3). Data were collected from both primary and

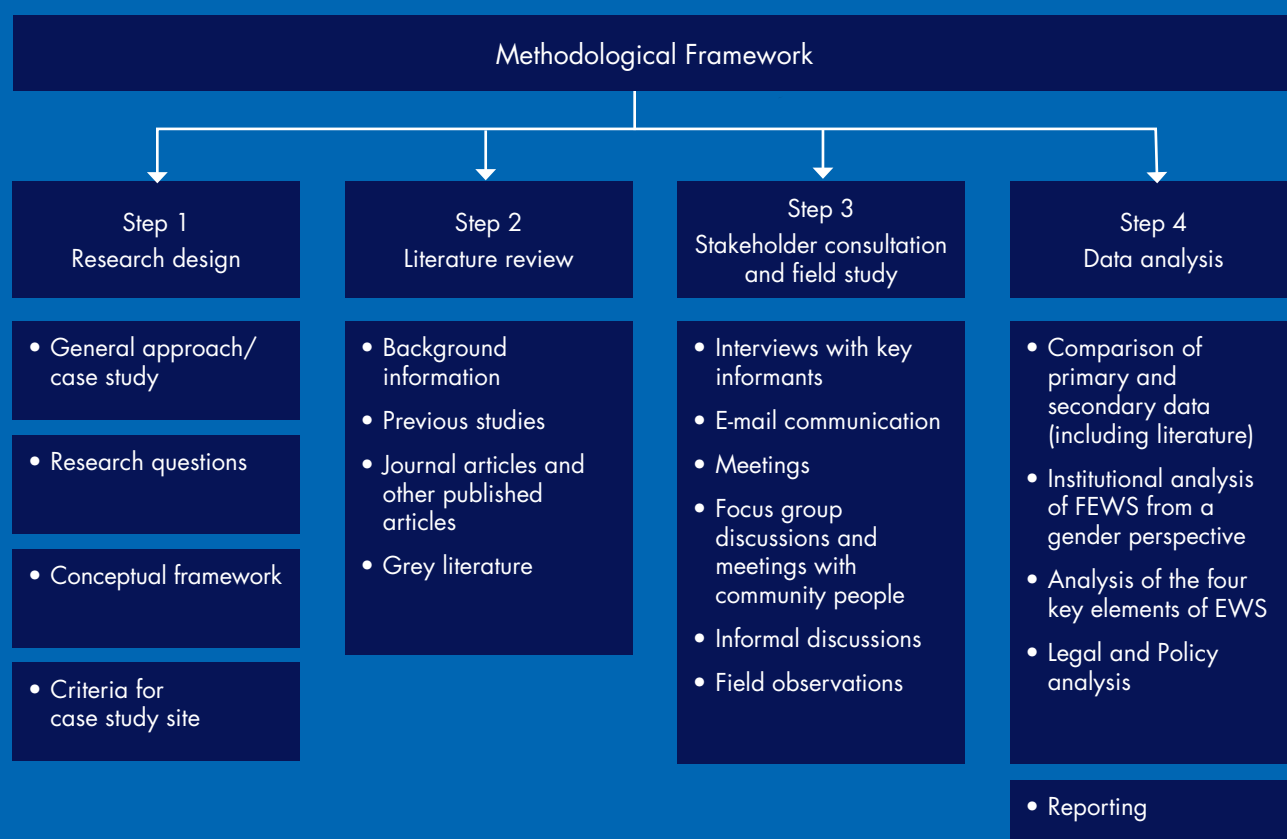
secondary sources. Criteria were developed for site selection for the case study and guiding questions and checklists formulated for the focus group discussions and key informant interviews. The methodological framework is given in Figure 3.

A detailed literature review of research publications, policy documents, case study reports, post-disaster reports, articles, databases, factsheets, and electronic sources was conducted. Based on the summary of existing early warning systems provided in Shrestha et al. (2014), a structured methodology was developed to understand and analyse flood EWS systems in Nepal from a gender perspective. This methodology was also followed for this study in Bhutan

Primary data and information was collected using various methods and tools, namely: stakeholder consultations, in-depth individual interviews, informal discussions, telephone conversations and e-mail communications. Stakeholder consultations were conducted with key agencies related to EWS including government, non-government, civil society, and international organizations (see Annex 4 for a list of stakeholders consulted). The checklist used to guide the interviews with organizations is provided in Annex 2. In May 2014, after preparation of the draft report, another stakeholder consultation was held with representatives of all relevant organizations working in EWS in Bhutan. The participants provided critical feedback on the preliminary draft of the report and recommended a revision to include recent policy documents as well as in-depth information from communities.

At the local level, a case study was conducted in the Punatsangchhu basin in Samdingkha, Toewang Gewog of Punakha Dzongkhag in November 2014. For this, a structured questionnaire survey was administered to households in Samdingkha. In total, 44 respondents (22 male and 22 female) were interviewed. The survey questionnaire used is given in Annex 1. Sex-disaggregated focus group discussions were also held in Khuruthang and Samdingkha villages in Punakha valley. The checklist used to guide these discussion is provided in Annex 3.

Figure 3: **Methodological framework**





Interview with people from Samdingkha village

Conceptual framework

While reviewing and analysing the organizations involved in EWS and the implementation process at the community level, the study considered four inter-related elements of early warning system: risk knowledge, monitoring and warning service, dissemination and communication, and response capability (Figure 4). Women and men have different life experiences and needs in each of these elements. A weakness or failure to be gender sensitive in any part could result in failure of the system to reach the most vulnerable (UN 2006).

The analysis included an assessment of the different roles and responsibilities, participation, and decision making of women and men in every element of the system. At the community level, the analysis included differences between men and women in understanding hazards, monitoring and forecasting impending events, processing and disseminating understandable warnings, and taking appropriate and timely action in response to the warnings. Key points for each of the four elements were prepared to guide the analysis, for example: Are vulnerabilities and risks known to both women and men? Do warnings reach both women and men? All qualitative data emerging out of the key informant interviews and focus group discussions were evaluated using this framework. An important element in the analysis is the consideration of the norms and beliefs of the society in which the EWS is embedded. These norms and beliefs play a major role in shaping the identities of men and women, which, in reality, may or may not be true, but are taken/believed/perceived to be 'truth' or 'fact'.

Structure of this report

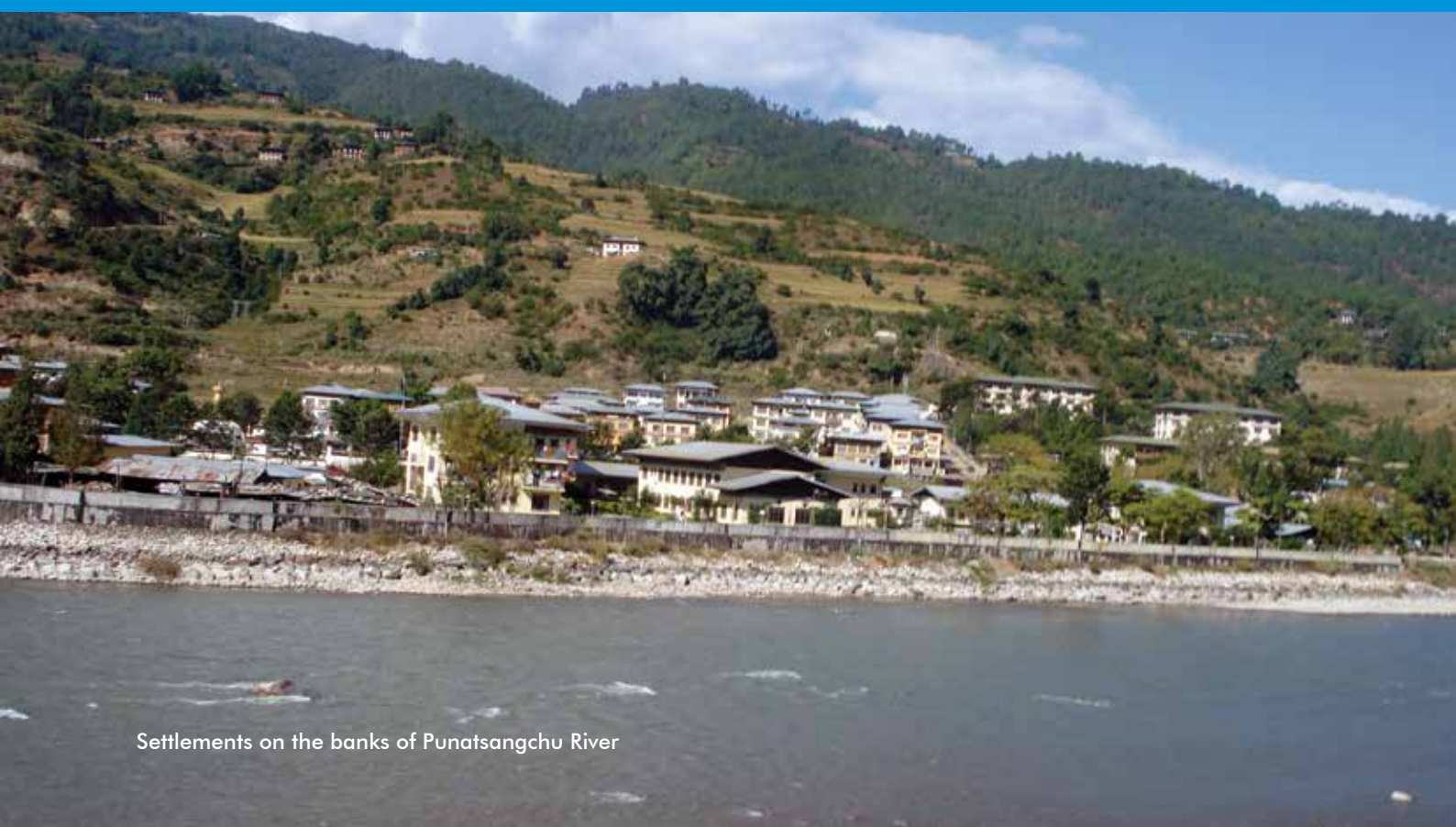
The report is divided into six chapters. Chapter 1 introduces the background and rationale for the study. Chapter 2, outlines the study objectives and scope, research questions, methodology, and conceptual framework for the analysis. Chapter 3 analyses Bhutan's policies and legislation for disaster management and EWS from a gender

perspective. Chapter 4 looks at the gender sensitivity of organizations working in disaster management and EWS in Bhutan and the cross linkages between them. Chapter 5 presents the findings of the case study on the flood early warning system in Punakha Dzongkhag in the Punatsangchu river basin from a gender perspective. Finally, Chapter 6 presents a brief conclusion and recommendations on how to integrate gender to make EWS in Bhutan more effective.

Figure 4: The four elements of an early warning system



Source: UN (2006)



Settlements on the banks of Punatsangchu River



EWS on the Phochhu river downstream of Samdingkha

Chapter 3

Policies and Laws on Disaster Risk Reduction and Early Warning System

National policies and laws have the capacity to either perpetuate or eliminate discrimination and gender inequality, as “all policies impact on men and women’s lives in one way or another”. Policy consequences, whether intended or unintended, often vary along gender lines due to the economic and social differences between men and women (Chappell et al. 2012). Therefore, promoting gender equality through policy is now a globally-accepted development strategy for reducing poverty, improving health and living standards, enhancing the efficiency of public investment, and good governance. The Royal Government of Bhutan (RGoB) has put in place a number of policies and laws to protect property and ensure the safety and security of people by addressing disaster risk reduction (DRR) (Dema 2014; ADB 2014). This chapter reviews five national policies and acts on disaster management to see how gender issues have been incorporated.

Water Vision 2025 and Bhutan Water Policy, 2003

The Water Vision 2025 and Bhutan Water Policy, 2003 focus on disaster management highlighting the need for forecasting and the prevention of disasters caused by water, including floods and landslides (NEC 2003). The Bhutan Water Policy states that water in Bhutan is a common good, but that the State has the right to regulate water resources. Under this policy, water is to be managed with the involvement of all stakeholders through a consultative process. It emphasizes the government’s commitment to the conservation, development, and management of the country’s water resources, recognizing the preciousness of this natural resource for all aspects of social, economic, and environmental wellbeing. The policy makes provision for the conservation of water, encompassing all forms of water: snow, glaciers, lakes, streams, rainwater, wetlands, and rivers (NEC 2003). It also recognizes the adverse impacts of GLOFs and flash floods and recommends that information be gathered on mitigation measures by participating in international fora and learning from best practices elsewhere.

Gender dimensions are directly (and significantly) included in this document in Article 6.2.5, which recognizes the importance of gender equity and stresses the role of women and men and the equal sharing of burdens and benefits in water resource management. This article highlights the gender dimension and goes beyond dealing with gender roles to encompass benefit sharing. This recognition paves the way for far-reaching changes in gender roles and relations, if interpreted and implemented in its true sense. No other article in the policy deals with gender, although mention is made of ‘integrated’ water management and ‘coordinated approaches’. Despite recognizing the importance of gender, this document fails to make specific provision for the integration of gender dimensions and perspectives into disaster management, which has significant implications for the operationalization and implementation of the policy, particularly as most of the implementing organizations are male dominated.

National Disaster Risk Management Framework, 2006

The National Disaster Risk Management Framework, 2006 is the most important document for disaster risk management in Bhutan. It mandates the Department of Disaster Management to execute all disaster-related activities in the Bhutan (RGoB 2006a). Although the Framework provides comprehensive guidelines on different aspects of DRR, including operationalizing pre-disaster and post-disaster recovery and re-construction, it is gender neutral. The eight components of the Framework (Box 2) do not specifically deal with gender integration into disaster risk management. Although reference is made to the involvement of local communities, there is no mention of women and men’s different needs, roles, capacities, and knowledge. The word ‘women’ appears only once on page 69 of the framework, where it states that: “Women and children who are the most vulnerable to trauma after a disaster also need to be represented”.

Bhutan Water Act, 2011

The Bhutan Water Act, 2011 has 17 chapters. Chapter 2, Article 4 of the Water Act states the purpose of the Act as to ensure that water resources are protected, conserved and/or managed in an economically efficient, socially equitable, and environmentally sustainable manner and to establish suitable institutions (NEC 2011). Although the Act mentions ‘socially equitable’ as one of the conditions for managing and conserving water resources, it does

Box 2: Eight components of National Disaster Risk Management Framework, 2006

Clear institutional mandates and coordination mechanisms for disaster management, including appropriate financial arrangements for relief efforts

Hazard zonation and vulnerability assessments for the country as a whole

Early warning systems for floods, landslides, and earthquakes

Disaster preparedness planning at all levels from local to the national

Disaster risk mitigation measures and mandatory requirements for disaster risk assessments for all new development projects

Effective awareness raising and education of general public and in the school system on disaster risks and preparedness

Capacity development of disaster management practitioners in the country

Development of multi-modal communication and transportation networks with adequate redundancy in times of disasters, especially for remote communities

not define this, leaving it open for people and organizations to define what socially equitable should encompass from their own perspective. Although gender equity is part of social equity, this leaves a loophole for gender to be ignored.

Some suitable institutions have come into existence under the Act and much effort has been put into conserving and managing water by organizations like the National Environment Commission (NEC), Department of Forests and Department of Disaster Management, but there is no mention of gender or women in the Act. Chapter 6 talks about the river basin management committees, their establishment and functions without any reference to women being included in the committees, which points to why women's representation is very low in these committees. The document, therefore, fails to address gender issues and does not consider the differential experiences, needs, and knowledge of women and men.

National Adaptation Programme of Action, 2012

The National Adaptation Programme of Action (NAPA II), 2012 clearly identifies the perils of GLOFs and flash floods and recommends the action needed to prevent floods in the section titled 'Updates of Projects and Profiles' (RGoB 2012a). The document gives an update on the urgent and immediate adaptation needs of the country identified in NAPA I (NEC 2006) and covers new climate risks such as windstorms and cyclones. Four out of the eight priorities in NAPA II deal with flood risk reduction, the setting up of early warning systems, and improving weather and flood forecasting capabilities. However, none of these priorities mention anything about gender differential needs and capacities. Section 5 of the document recognizes that rural communities, particularly women, children, and the elderly, are the most vulnerable to climate change impacts. Apart from this, the document does not make any particular mention of actions for women or gender integration into DRR. Again, women are perceived primarily as victims, obscuring women's vital role as key agents of adaptation and mitigation (McLaughlin and Dietz 2008; Dankelman 2010).

Disaster Management Act, 2013

The Disaster Management Act, 2013 provides for the establishment of early warning systems for all types of natural hazards, including floods. The National Disaster Management Authority (NDMA) is established under the Act, with its secretariat at the DDM. The Act outlines the functions and roles of the NDMA, which include ensuring that agencies mainstream disaster risk reduction into their development plans, policies, programmes, and projects. The



Focus group discussion in Samdingkha

Act requires the NDMA to develop and implement public education, awareness, and capacity building programmes on disaster management. The Act states that the NDMA shall institute a system of disaster alerts, determine the resources needed for response and relief operations, and take any other necessary action for DRR. The NDMA may authorize the use of any audio/audio visual media or such other means of communication available to communicate warnings and advisories regarding potential or imminent disaster situations (RGoB 2013a).

The Act also describes the functions of the dzongkhag disaster management committee, which is responsible for coordinating and managing all disaster management operations in the dzongkhag (district) under the direction and supervision of the NDMA. The committee may, if it thinks necessary, constitute a sub-committee at the dungkhag, thromde or gewog level to assist the committee.

Chapter 10 of the Act states that the NDMA shall direct relevant agencies to put in place early warning systems as a monitoring and advisory tool to identify hazards and notify all vulnerable populations and responding agencies of the threat disaster. Although vulnerable groups are mentioned, the Act does not list which groups are considered vulnerable, leaving a wide array of interpretations up to the implementers.

Under Chapter 13, Articles 133 and 134, specific reference is made to the “encouragement of women” in DRR and in response and recovery. But these articles do not elaborate what this means. Again women seem to be perceived primarily as victims needing assistance and not as decision makers and holders of valuable traditional knowledge that can be used as inputs into disaster preparedness and planning. The gender perspective could have been strengthened here by relating this article to the other chapters, for example, by reserving seats for women and other marginalized groups in the committees and sub-committees for disaster management.

Discussion

Although four out of the five documents mention the issue of women and gender, none provide any clear direction on how disaster risk reduction can be made gender sensitive and gender responsive. Only the Water Vision 2025 and Bhutan Water Policy, 2003 address the equal sharing of burdens and benefits in water resources. The other documents either refer to women as victims of disasters or follow a functional/efficiency approach, in which the emphasis is to involve women in response and recovery for the programme's efficiency and success. The Disaster Management Act, 2013, a key document for the implementation of early warning systems, specifically refers to 'encouraging' women in DRR and in response and recovery. This indicates that the government is aware of the need to improve the participation of women.

Unfortunately, the provisions contained in these documents are not specific enough to integrate gender into disaster management. Almost all fail to talk about the different experiences, needs and roles of women and men with respect to EWS and fail to recognize why we need to consider gender in DRR. Women are discussed in these documents in a compartmentalized way, mainly as victims, rather than as an integral part of the disaster management cycle. What is needed in these documents is to provide a vision and direction on how to integrate gender into the various stages of disaster risk reduction and management. A summary of the policy review is presented in Table 2.

Table 2: Gender analysis of DRR and EWS policies and regulations in Bhutan

Policies and acts	Purpose of the document	Description of specific reference to gender issues
Water Vision 2025 and Bhutan Water Policy, 2003	For the development and management of water resources with an integrated approach; article 6.5 of the Bhutan Water Policy is on flood control and management	Article 6.2.5 of the Bhutan Water Policy recognizes the importance of gender equity and stresses not only the roles of women and men, but also the equal sharing of burdens and benefits in terms of water resources.
National Disaster Risk Management Framework, 2006	To promote disaster risk management and establish linkages with other sectors; EWS is a component of the framework	The Framework focuses on generating advance warnings and improving the capacity of decision makers to take action prior to the occurrence of a disaster. However, all of the components are gender blind in approach, with no recognition of the differential experiences, needs, roles, capacities, and knowledge of women and men.
Water Act, 2011	To ensure that water resources are protected, conserved, and managed in an economically efficient, socially equitable, and environmentally sustainable manner, and to establish suitable institutions for this	The Act does not mention 'gender' or 'women' anywhere. The only place it comes close to having a gender perspective is when it mentions 'socially equitable' as one of the conditions for managing and conserving water resources. However, it does not define this, thus leaving it open for people/institutions to define it according to their perspective. Although gender equity is part of social equity, this leaves a loophole for gender to be ignored.
National Adaptation Programme of Action (NAPA II), 2012	To address the urgent and immediate adaptation needs in relation to climate change; updates projects and profiles since NAPA I (2006); four out of the six priorities in NAPA II are related to EWS and DRR	There are proposed adaptation options for natural disaster and infrastructure focusing on EWS. This document recognizes that women and children are the most vulnerable to natural disasters.
Disaster Management Act, 2013	To establish and strengthen institutional capacity for disaster management; mainstream disaster risk reduction; and ensure integrated and coordinated disaster management, with a focus on community participation	Chapter 13, Articles 133 and 134 of the Act make specific reference to encouraging women in DRR and in response and recovery. However, as in other documents, there is no mention or recognition of the differential experiences, needs, and roles of women and men.

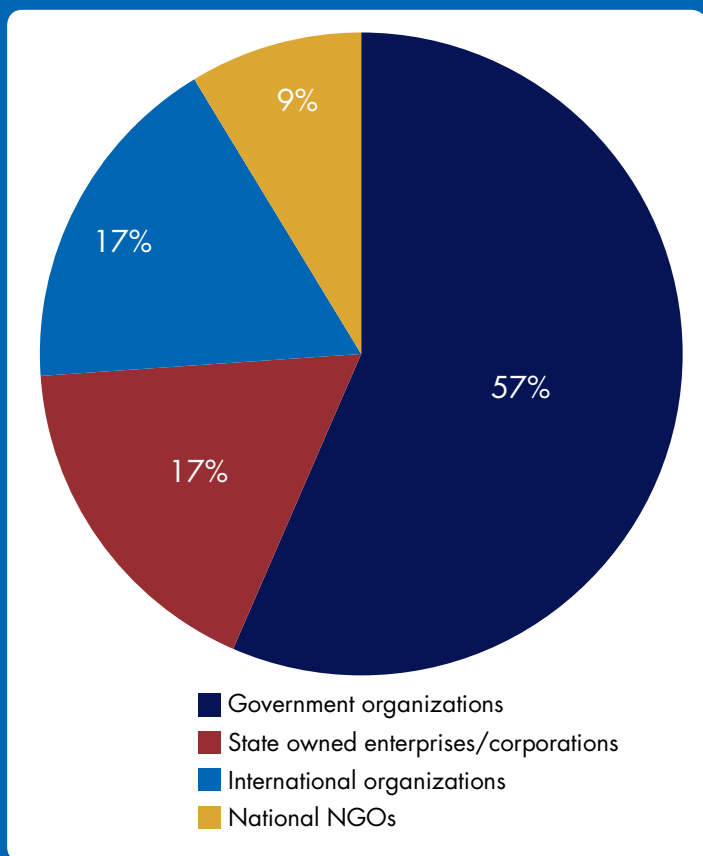


Elders interviewed from Samdingkha

Chapter 4

Organizations Working in
Disaster Risk Reduction and
Early Warning System

Figure 5: Types of organizations consulted



Early warning systems involve a wide range of actors and institutions, including local communities, national governments, regional organizations, NGOs, the private sector, and the science community (UN 2006; IPCC 2012). These organizations vary in terms of their practices and perceptions of gender roles, impacting on how gender is translated into their rules, regulations, and activities. Government organizations dealing with water management are often dominated by engineers, most of whom are men, as the engineering profession is male-dominated (Udas 2014), which is reflected in their gender dynamics and gender balance in staffing, as well as job satisfaction, promotion opportunities, visibility, networking, leadership, and the influence of staff. The profession’s mainly masculine character restricts women’s representation in the leadership of such organizations and leads to a gender blind perspective in their work (Udas and Zwarteveen 2010; Liebrand 2014).

A total of 23 organizations involved in different aspects of disaster risk reduction in Bhutan were consulted by the research team as part of this assessment, including government organizations; state-owned enterprises/corporations; international non-government organizations (INGOs); and national non-government organizations (NGOs) (Figure 5).

The organizations were analysed in relation to their engagement in the four key elements of people-centred early warning systems (Table 3). The study found that most organizations (82.6%) work in ‘risk knowledge’ and some aspect of early warning. For example, the Flood Engineering Management Department prepares hazard maps based on hydrological information. The lowest percentage of organizations (8.7%) are involved in the monitoring and warning services component of EWS, as this is primarily the responsibility of the Department of Hydro-Met Services.

This chapter identifies and analyses the functions, roles and staff composition in 2014 of organizations involved in disaster management and EWS from a gender perspective.

Government organizations

There are few women working in the civil service in Bhutan (Figure 6) and this holds true for government organizations involved in disaster risk reduction, mitigation, management, and recovery.

Of the 11 organizations studied, the National Commission of Women and Children had the highest proportion of female staff (53%) (Figure 7), while the Department of Geology and Mines, and Ministry of Agriculture and Forests had the least (22% and 17%, respectively).

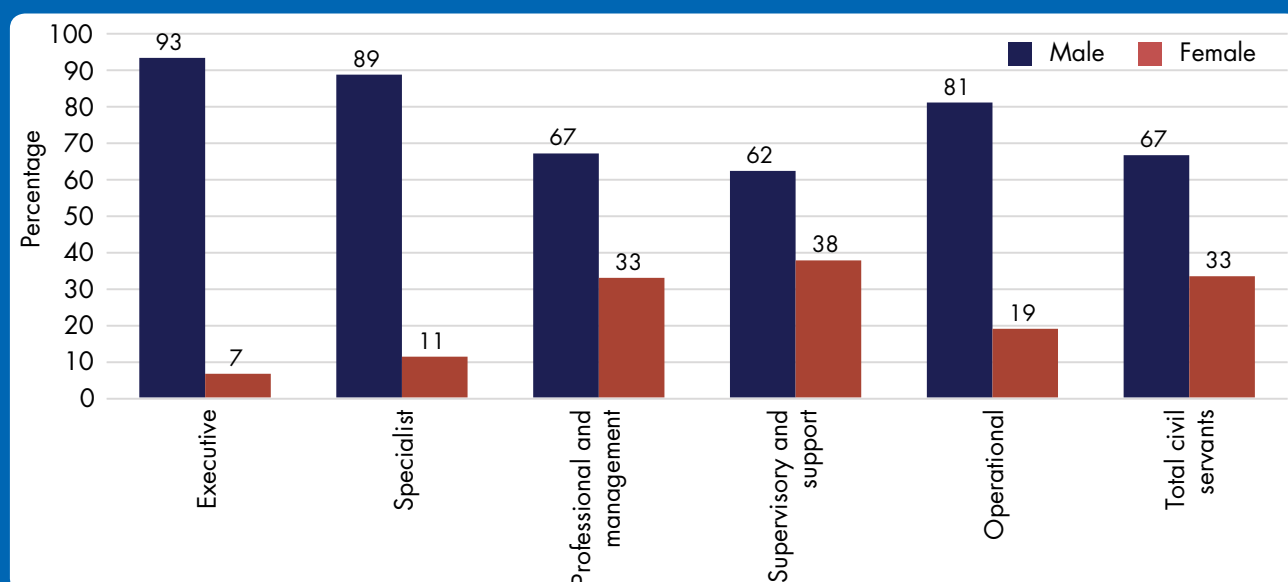
Department of Hydro-Met Services

The Department of Hydro-Met Services (DHMS) is the technical focal point within the Royal Government of Bhutan for all hydrological, weather, climate, and water resources-related data. The Department provides weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy (DHMS 2013c). It is mandated to monitor, collect, and analyse data and provide reliable and timely hydrometeorological information for early warning to various agencies. One of its key functions is to establish and

Table 3: Involvement of organizations in the key elements of people-centred early warning systems in Bhutan

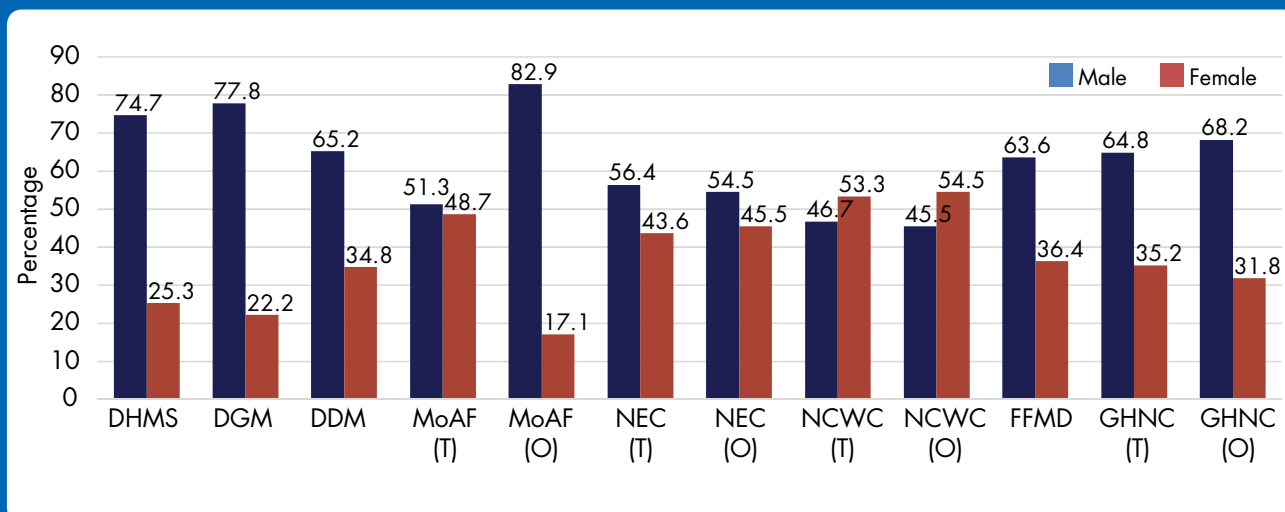
SN	Organizations	Key elements of people-centred EWS			
		Risk knowledge	Monitoring and warning services	Dissemination and communication	Response capacity
Government organizations					
1.	Department of Hydro-Met Services	√	√	√	
2.	Department of Geology and Mines	√			
3.	Department of Disaster Management	√		√	√
4.	Department of Roads	√			
5.	Department of Civil Aviation	√			√
6.	Ministry of Agriculture and Forest	√		√	
7.	National Environment Commission	√			
8.	National Commission for Women and Children	√			
9.	Flood Engineering Management Division, Ministry of Works and Human Settlement	√		√	
10.	Department of Local Governance	√			√
11.	Gross National Happiness Commission (GNHC)	√			
12.	Royal Bhutan Army	√			√
13.	Royal Bhutan Police				√
State-owned organizations enterprises/corporations					
14.	Bhutan Chamber of Commerce and Industry			√	
15.	Bhutan Telecom			√	
16.	Bhutan Power Corporation	√			
17.	Kuensel Corporation			√	
International NGOs					
18.	Save the Children	√		√	
19.	UNDP	√		√	√
20.	UNICEF	√			
21.	Japan International Cooperation Association	√	√		√
National NGOs					
22.	Tarayana Foundation	√		√	
23.	Loden Foundation	√			
% of organizations per element		19 (82.6%)	2 (8.7%)	10 (43.5%)	7 (30.4%)

Figure 6: Percentage of male and female staff in the civil service



Source: Royal Civil Service Commission (2013)

Figure 7: Percentage of female and male staff in government organizations



Note: T represents total, O represents staff at officer level; data on the NEC is for head office

operate a national hydrometeorological network for data collection, including setting up a flood/GLOF EWS. The DHMS coordinates and conducts research related to hydrology, meteorology, climatology, water resources, snow, glaciers, and climate change, among other things. In 2011, recognizing the importance of data, information, and early warning the government upgraded the DHMS from a division to a department to enable it to carry out its increasingly important and specialized technical mandates. The DHMS has four functional divisions: Planning, Coordination and Research Division (PCRD); Hydrological Division; Meteorological Division; and Snow and Glacier Division, and is involved in three elements of EWS: risk knowledge, monitoring and warning, and dissemination and communication.

In terms of staffing, out of a total of 87 technicians, 22 are women. The Department encourages women to work as gauge readers and currently has 8 female meteorological observers and 8 female hydrological gauge observers. The existing EWS in the Punakha-Wangdue valley, which was initiated by the DHMS, has a female technician in the control room located in the Flood Warning office in Wangdue. This technician has also been appointed by the DHMS as a focal person in the Punakha-Wangdue valley. The second female focal point is an elected local civil servant. However, the working practices are structured and official, with limited local-level consultation and gender sensitivity. This is evident from the case study (see Chapter 5), which mentions that the alert sound (siren) was chosen and set by DHMS with little consultation with, or involvement of, people from the local community.

Department of Geology and Mines

The Department of Geology and Mines is the nodal agency for geology and mineral resource development in Bhutan. The Department carries out studies to assess flood hazard and vulnerability. It is mainly involved in the first element of EWS, risk knowledge, and has carried out hazard zone demarcation and identified safe evacuation sites on the left bank of the Pho-chhu and Puna-Tsangchu, starting from Samdingkha (in the north) to Hesothangkha village (in the south). The DDM is using these hazard zone demarcation maps to raise awareness and for preparedness activities involving community members in flood affected areas.

The Department has only 40 female staff members out of 180. However, there is evidence that the Department's practices are inclusive and that it reaches out to women, evidenced by the fact that women in the local area had knowledge of hazard zonation maps (see Chapter 5).

Department of Disaster Management

The Department of Disaster Management (DDM) is the national agency responsible for overall disaster management and the coordination of various sectors and stakeholders in the country. The DDM is responsible for disseminating warnings, as well as for education and public awareness raising. The agency develops and coordinates awareness raising and building capacities on disaster risk reduction, preparedness, and response. It facilitates effective disaster management through the development of various guidelines and legislative frameworks. The DDM has established national emergency operation centres, and disaster management committees at the dzongkhag and gewog levels, as well as prepared preparedness and response plans. The DDM has three divisions: Risk Prevention and Reduction Division; Preparedness and Response Division, and Rehabilitation and Reconstruction Division. The response and early warning division is responsible for liaising with other relevant sectors and agencies to institute early warning systems for various natural hazards and disaster risks. It is responsible for ensuring the 'last mile' communication by enhancing community participation during the development of EWS. Accordingly, the DDM is involved in three elements of EWS: risk knowledge, dissemination and communication, and response capacity.

Of the DDM's 23 staff members, 8 are female (34.78%), 4 of which are officers. The chief at the Risk Prevention and Reduction Division is also a woman who looks after community awareness and education. In the state-owned enterprises and corporations, consideration of gender is not mandatory. As regards its work practices, it reaches out to women, evidenced by the fact that women in the local area had knowledge of hazard zonation maps through awareness programmes (see Chapter 5). However, although public consultations were done with the general public, including both men and women, no deliberate efforts were made to identify or address men and women's needs separately. The case study shows that although women were familiar with flood hazard maps, they were not aware of the safety routes and evacuation sites identified by the DDM as part of its disaster preparedness plan. Communities generally seem to be passive receivers of information delivered by the DDM during awareness raising and drills. This indicates that they have little interaction with the operators of the early warning system and had little input into the development of the mechanisms for its operation.

Ministry of Agriculture and Forests

The Ministry of Agriculture and Forests is primarily interested in the impact of floods on fertile agricultural land. It is also a major user of the climate forecasting data products and services of the DHMS. Long-term and short-term weather forecasts are communicated by the DHMS to farmers to enable them to plan their cropping patterns. The Ministry is also responsible for irrigation infrastructure, which is directly affected by flood events.

In regard to staffing, the overall female composition is 48.72%. However, the majority of female employees are found at the support level (70.08%). At the officer level, women constitute only 17.08% (54 female officers, 262 male officers). This low number of female staff at the higher level may contribute to underrepresentation of the specific needs of women in planning, designing, and implementing plans for disaster risk reduction and EWS.

National Environment Commission

The National Environment Commission (NEC) is the focal agency for climate change and the environment at the national level and responsible for the formulation and implementation of laws related to the environment and development in Bhutan. The NEC collaborates closely with other relevant agencies and facilitated the NAPA I & II formulation processes to address the impacts of climate change.

The NEC is involved in the first element of EWS, risk knowledge, and has been working together with other organizations to prepare hazard maps, lower the water levels of glacier lakes, improve land degradation, harvest and store water, manage waste, manage forest fires, and mainstream gender in all projects and initiatives.

The staffing of the NEC is more gender balanced than other government organizations. At the head office the percentage of female employees is 43.63% (31 men and 24 women), with the percentage of female officers slightly higher at 45.45% (15 female officers and 18 male officers) (NEC nd). However, it is not mandatory for the NEC to considering gender in all actions and projects, only in specific gender-related meetings, which are generally dominated by women.

National Commission for Women and Children

The National Commission for Women and Children (NCWC), established in 2004, is responsible for mainstreaming gender concerns into national development policies, plans, and programmes. It has the mandate to integrate gender issues across agencies, ministries, departments, and local government bodies, and even in private sector organizations. It monitors and coordinate all policies and activities related to protection of the rights of women and children. The NCWC also protects, promotes, and reports on the rights of women and children in Bhutan. The NCWC has been promoting awareness of its women and children's protection agenda through various programme at the local, national, and regional levels, including by co-hosting events like the Bhutan +10 International Conference on Women and Sustainable Mountain Development, which was held in Thimphu in October 2012. Although the NCWC is not directly involved in early warning systems, one of its important functions is to review and formulate the child and gender responsiveness and sensitivity of policies.

Not surprisingly, its focus on women is reflected in its staffing; the NCWC has 53.33% female employees (16 women and 14 men). There are also more female officers than male officers at 54.54% (12 women and 10 men). However, it was reported by the officials that they are faced with challenges when it comes to incorporating gender issues across all sectors, as gender issues are taken with some reservation. Consequently, the NCWC's efforts to mainstream the gender issues in plans and programmes has always been challenging. Disaster management is one of the sectors that the NCWC would like to work in, but collaboration has been minimal. This is not surprising given the evidence on the staffing patterns and working practices of the agencies involved in disaster management.

Flood Engineering Management Division

The Flood Engineering Management Division was established in 2012 under the Ministry of Works and Human Settlements. The role of the Division is to understand and reduce the vulnerability of communities to floods and

Automatic weather station installation at Trashiyangtse





Real-time hydrological station in Trashiyangtse

manage the flood risk through ‘engineered construction’ (MoWHS 2016). The Division is involved in two elements of EWS: risk knowledge and dissemination and communication. It is responsible for the identification and hazard assessment of all flood-prone areas in the country. The Division has developed flood hazard scenario for 100 years using computer modelling, which is used to demarcate flood hazard zones and identify evacuation routes and safe sites during floods. Using the flood risk assessment, it designs structural mitigation measures, such as river diversion work, flood protection walls, and other engineering interventions. Based on the hazard maps, the Division is preparing a national database of flood prone areas in Bhutan. Out of 11 staff members, 4 are women (36.36%).

Department of Local Governance

The Department of Local Governance, under the Ministry of Cultural Affairs, provides advisory services and works to enhance the capacity of the local governments. It is responsible for the overall coordination, management, and evaluation of development activities in Bhutan’s 20 dzongkhags (districts) and 205 gewogs (sub-districts), which includes initiatives on EWS and flood management. According to Article 261 of the Local Government Act (2009), during a natural disaster and emergencies, the dzongdag, who is the chief executive of the dzongkhag, shall organize relief measures in coordination with the DDM and local government. The Department is involved in two elements of EWS: risk knowledge and dissemination and communication. It works together with the dzongkhag disaster management committees and other relevant organizations, along with marginalized groups including women, for disaster risk management and related activities. The Department tries to mainstream gender in its work. For example, through the implementation of two major projects, i.e., the local sustainable development project and local government support project, the Department is contributing to mainstreaming gender and disaster risk reduction into different projects and programme in the districts.

Gross National Happiness Commission

The Gross National Happiness Commission (GNHC) is a guiding principal policy agency in Bhutan formed to steer the country towards more holistic and inclusive development. This encompasses measuring both economic and social variables. The GNHC coordinates the formulation of policies, plans, and programmes to ensure that gross national happiness (GNH) is mainstreamed into all planning, policy making, and implementation processes. The GNHC facilitates sectors and programmes to integrate cross-cutting issues such as gender, disaster risk reduction, the environment, poverty, and climate by screening policies. There are nine GNH domains and twenty two variables. Gender is one of the variables of the GNH. Each proposed policy has to be screened by the GNHC to ensure that it supports the domains and variables of GNH policy. Since 2010, there have been a total of 20 policies approved for implementation, but none on disaster risk management. As of July 2015, the GNHC had 35.16% female employees (59 men and 32 women) and 31.81% women officers (45 men and 21 women).

International organizations

Save the Children

Save the Children has been in Bhutan since 1982. Its programmes reach children throughout the country and it has become a trusted partner of the government and the community. In 2011, Save the Children started a multi-hazard programme, focusing on the safety of schools, school children, and teachers. Save the Children is involved in two elements of EWS: risk knowledge and dissemination and communication of the disaster information. Save the Children works closely with the DDM and government agencies for implementation. Schools and monastic schools are two direct beneficiaries of Save the Children's school-based multi-hazard plans. Save the Children encourages equality in gender participation by inviting an equal number of male and female participants in its programmes, with provision for equal representation, although there are times when fewer women than men attend trainings on disaster management.

United Nations Development Programme, Bhutan

The United Nations Development Programme (UNDP) is a major partner in the development of the country and in creating an enabling environment to alleviate poverty. Over the past decade it has been providing technical and financial support for disaster risk management and recovery activities. It has been working on different development activities, including climate change adaptation and disaster risk reduction projects using a participatory and inclusive approach, working together with relevant stakeholders at different levels and local communities.

UNDP is involved in three elements of EWS: risk knowledge, dissemination and communication, and response and recovery. Being actively engaged in supporting disaster response, relief, and rehabilitation activities, UNDP helps communities in Bhutan to prevent and recover from natural disasters through advocacy, capacity building, the development of tools and methodologies, gender equality, knowledge networking, strategic planning and programming, and policy and standard setting. As a part of NAPA II, UNDP has facilitated the national weather and flood forecasting centre through building capacity to analyse, manage, and disseminate climate information to end users in a timely manner. In partnership with the NEC secretariat and UNDP, international and local agencies are conducting detailed geo-technical investigation and engineering design for the mitigation of four landslides in Phuentsholing Thromde and flood and watershed management work at Barsachu at Pasakha (UNDP 2012b). UNDP, in close collaboration with the DDM, has developed a project on 'Disaster Response and Recovery Preparedness (2014–2016)'.

Building the capacities of relevant stakeholders on disaster and climate change resilient activities is one of the key working areas of UNDP in Bhutan. Gender is a core subject for UNDP. It has been working to identify gender issues and challenges within projects related to the environment, energy, and disaster risk management. It has also been working to mainstream gender into integrated risk hazard assessment and mapping in critical landslide and flash flood prone areas. UNDP works with different national partner organizations in preparing gender action plans, highlighting the commitments made on gender mainstreaming in the different programmes and projects in Bhutan.

UNICEF

UNICEF's Bhutan office has been working to protect the rights of children, youth and women in Bhutan. Empowering women through non-formal education is one of its interventions to fulfil this objective. UNICEF is involved in the first element of EWS, risk knowledge. UNICEF Bhutan, in partnership with agencies like the DDM, Asian Development Bank, UNDP, has been assisting the Royal Government of Bhutan to mainstream disaster risk reduction by making schools safe and disaster resilient. To achieve this objective, UNICEF has trained at least one teacher from each school in Bhutan's 20 districts on education in emergencies and school safety. All schools in Bhutan have a disaster management plan in place. Education and skills on disaster risk reduction are also included in the curriculum of non-formal education. Disaster risk reduction measures are being up-scaled through youth networks at the local level, linking with district administrations. UNICEF is a gender-sensitive organization that places more emphasis on girls' education and supports government institutions to mainstream gender and disaster issues into development plans and projects.

Japan International Cooperation Agency

Japan International Cooperation Agency's (JICA's) Bhutan office is working closely with the Department of Hydro-Met Services, under the Ministry of Economic Affairs, to implement a project for 'Capacity Development of Glacial Lake Outburst Floods and Rainstorm Flood Forecasting and Early Warning System' (2013–2016) in Bhutan. Through this project, JICA is building the capacity of the DHMS and other relevant stakeholders to improve disaster resilience against GLOFs and rainstorm floods. JICA has assisted relevant organizations in the policy-making process, including mainstreaming disaster risk reduction into all development projects and programmes. Although a gender perspective is not mandatory in each and every stage of the project cycle, gender specific information is required when submitting project proposals. In addition, JICA considers a project's environmental and social impacts from a gender perspective when screening projects.

State-owned enterprises/corporations

Bhutan Chamber of Commerce and Industry

The Bhutan Chamber of Commerce and Industry is involved in the dissemination and communication of early warnings and information on impending floods to its business members, whose enterprises may be located in risk zones. Although it has a disaster management focal person, there are no activities or policies in place regarding disaster management, except for trainings received as part of Desuung (a para military training received by volunteer citizens). This training gives trainees holistic knowledge on topics such as disaster management, leadership, and search and rescue, to name a few. The Bhutan Chamber of Commerce and Industry has a relatively good gender balance in its staffing composition, with 16 out of 33 officer-level staff women and 5 out of 10 support staff women. Of the heads of the departments at the executive level, 3 are men and 2 are women.

Bhutan Telecom

Bhutan Telecom Limited was established in the mid-2000 as a fully state-owned company and is the leading provider of telecommunication and Internet services in Bhutan. Although individual subscribers have been using mobile phones to inform and share flood-related information, Bhutan Telecom has yet to venture into disaster management initiatives. Text messages (SMS) could be vital for informing communities about impending floods.

Druk Green Power Corporation

Druk Green Power Corporation maintains and operates four of the oldest hydropower plants in Bhutan: Chhukha, Basochhu, Kurichhu, and Tala. It was formed in 2008 with the vision "to promote, develop efficient, responsible and sustainable manner, and to maximize wealth and revenue to the nation" (Druk Green 2016). The company is responsible for the hydropower generation sector in the country and is also constructing the Dagachhu hydroelectric project. The risk of major flood damage to existing and planned hydropower dams and infrastructure is a major concern of the Corporation.

Kuensel Corporation

Kuensel Corporation is a state-owned daily newspaper. It is the main source of news on disasters, such as Cyclone Aila in 2009, the windstorms of 2011, and the June 2015 GLOF from Memari Tsho. Thus Kuensel Corporation is involved in the third element of EWS: dissemination and communication.

National non-government organizations

Tarayana Foundation

Tarayana Foundation is a non-profit organization working to uplift and enhance the lives of vulnerable communities in rural Bhutan. It was established in 2003 by Her Majesty the Queen, Ashi Dorji Wangmo Wangchuck, as a potential solution to the problems of disadvantaged people. The Foundation complements and supplements the efforts of the Royal Government of Bhutan to reduce poverty by adopting the national goal of taking “special measures in support of disadvantaged and vulnerable groups as well as efforts to ensure that those who have been largely bypassed by the benefits of development are drawn more fully into the mainstream of the development process” (Planning Commission, Royal Government of Bhutan 1999). The Foundation works in collaboration with schools in 10 districts and 105 villages. It disseminates information to communities regarding disaster preparedness initiatives and is involved in creating awareness and advocacy about disaster management. There is one field officer for this. Although there are no gender-specific activities, the Foundation considers the disabled and senior citizens to be the most vulnerable while carrying out disaster preparedness activities and these groups are given preference in evacuation drills. The Foundation is headed by a woman and has an equal number of male and female employees (Tarayana foundation 2016).

Loden Foundation

Loden Foundation’s core area of focus is promoting education and learning in Bhutan. It fosters education, entrepreneurship, literary, and an intellectual culture in Bhutan. It aims to help Bhutanese youth obtain an education in preschool, school and post-school settings and cultivates an enlightened ethos in Bhutanese society. It also promotes Bhutanese culture and traditions in other parts of the world and undertakes charitable activities that contribute to the welfare of the people (Loden Foundation 2016). Of the four key elements of EWS, Loden contributes to risk knowledge. Although Loden says it is not involved in any disaster management activities or projects, it is mindful of the safety of Early Learning Centres. These centres are located in the safest possible places, away from rivers and streams, as the students are toddlers. And because these Early Learning Centres are charitable institutions, Loden ensures the best possible safety for its students.

Discussion

As Bhutan’s policies and laws are mostly gender neutral it is almost entirely up to the implementing organizations and agencies to define and integrate gender into disaster management and EWS. This means that the implementing organizations and agencies need to be gender sensitive and have a certain amount of expertise in this area. Policies can be effective only if there are enough financial and human resources allocated to the monitoring and evaluation process. Effective structures and mechanisms need to be put in place to link organizations mandated to implement gender equality and social justice policies and programmes (such as the National Commission for Women and Children, the Gross National Happiness Commission and other INGOs/NGOs that work on gender and social issues) with organizations working in disaster management (such as the DHMS and DDM) to ensure that they integrate gender issues (including collecting, using, and analysing gender disaggregated data).

Most of the government organizations involved in disaster management and EWS (except for the National Commission for Women and Children and the Gross National Happiness Commission) are male-dominated, which is expected given the professional history of the sector (as dominated by engineers) and how ‘science’ is defined (Harding 1991). Female staff are represented more in non-government organizations, where men and women are almost equal in number.

A major reason for the low number of women in government jobs is the selection process, which is based on merit, with no positive discrimination for women. As women in Bhutan have less education and training than men due to the socio-cultural norms and practices, this results in less opportunities for them in government organizations.

Furthermore, the proportion of women at higher levels of authority is generally lower than that of men. This is demonstrated by the Civil Service Statistics (Royal Civil Service Commission 2013), which provide disaggregated data for the civil service at various levels. Although women make up 33.37% of civil service employees, at the executive level this drops to only 6.5% (Figure 6). This pattern reflects how unwritten and unspoken rules, arrangements, practices and norms, which are elements of the organizational culture, govern workplace structure and gender dynamics, thus limiting women's promotional opportunities and resulting in less representation at decision-making levels (Meyerson and Fletcher 2000; Liff and Ward 2001). Thus, even in though these organizations which seem gender neutral, gender discrimination is "so deeply embedded in organizational life, as to be virtually indiscernible" (Piterman 2008).

The absence of women in decision-making positions means that women's needs, concerns, and opportunities are under-represented in strategic and operational decisions. From a development perspective, the underrepresentation of women negatively impacts on development effectiveness and diversity goals. The Beijing Platform for Action considers the inequality of women in the sharing of power and decision-making at all levels as one of the critical areas of concern for the empowerment of women. It states (UN 1996):

Women's equal participation in decision-making is not only a demand for simple justice or democracy but can also be seen as a necessary condition for women's interests to be taken into account. Without the active participation of women and the incorporation of women's perspective at all levels of decision-making, the goals of equality, development and peace cannot be achieved.

The lack of women in decision-making roles has significant implications for the implementation processes of disaster management and EWS activities (see Chapter 5). Although there have been sporadic attempts to include women and their perspectives, these are not enough. The inclusion of women in all stages of EWS implementation needs to be systematized and a gender balance brought about in the staff composition involved in implementation.

The low representation of women also has links to policy and it is argued that the persistent lack of gender-sensitive policy measures has resulted in gendered patterns in institutions and the administrative set-up for disaster management. The substantial representation of women is required in decision-making positions for impact on policy formulation and implementation. Studies have shown that when women hold decision-making positions they play a crucial role in developing meaningful gender mainstreaming strategies, ensuring a focus on gender equality in all policy areas (United Nations Division for the Advancement of Women 2005). The international organizations reviewed show a more positive picture of gender integration in terms of their commitment. However, it must be mentioned that a full gender audit of these organizations and their programmes was beyond the scope of this assessment.

On a positive note, it is clear that female staff are increasing and steps are being taken to include women in EWS activities, although the perception of gender roles still needs to be changed. The case study in Chapter 5 provides evidence that the work practices and culture in most of the institutions for disaster EWS is not very inclusive or gender sensitive. This means that further efforts are needed to promote a gender-sensitive and gender-responsive culture in policy planning and in the implementation of EWS.



EWS overlooking Khuruthang

Chapter 5

Case Study: Early Warning
System in Punakha Dzongkhag,
Punatsangchhu River Basin

This chapter analyses the flood early warning system in Punakha Dzongkhag (district) of Punatsangchhu river basin from a gender perspective. Punakha, the capital of the district, has historic importance as the location of the winter palace of Bhutan's royal family. It is also famous for the production of red rice. Floods have affected the Punakha-Wangdue valley many times, including major floods in 1957 and 1994, the later caused by a GLOF. In 2001, ICIMOD identified 24 glacial lakes in Bhutan as potentially dangerous, 8 of which are located at the headwaters of the Punakha-Wangdue valley. A GLOF early warning system was put in place in the Punakha-Wangdue valley in 2011 (UNDP 2012a). This case study documents the experiences with the flood early warning system in two settlements in the basin, Samdingkha and Khuruthang, one located in the upstream and the other downstream, both prone to floods and GLOFs.

Early warning system installed in the basin

Hazard mapping of the Punakha-Wangdue valley was conducted by the Department of Geology and Mines, followed by the zonation of the flood plains where the EWS is installed. The early warning system along the Punatsangchhu river basin consists of real-time hydrometeorological stations and a GLOF EWS control room in Wangdue, as well as sirens to alert communities in case of a flood event. The DHMS has installed a total of 6 automatic water level sensors (AWLS) and 2 automatic weather stations (AWS) with 17 sirens in the basin (in Wangdue and Punakha dzongkhags) to monitor the level in the Pho-chhu river (DHMS 2013a).

The EWS relies on sirens to alert target communities and personnel at infrastructure, such as the Punatsangchhu hydropower dam, in case of a GLOF. The sirens are sounded automatic if the water level rises beyond the control level in the AWLS. However, before the sirens are sounded, the control room located in the Flood Warning office in Wangdue receives the information and passes it on to the DHMS headquarters in Thimphu. The DHMS informs the National Disaster Management Authority, the secretariat of which is at the Department of Disaster Management. Once the Authority gives the 'go signal' to the DHMS, the control centre at Wangdue receives a directive to turn off the sirens. It is calculated that it will take about eight hours for flood waters to reach Punakha after the lake at Thorthormi bursts.

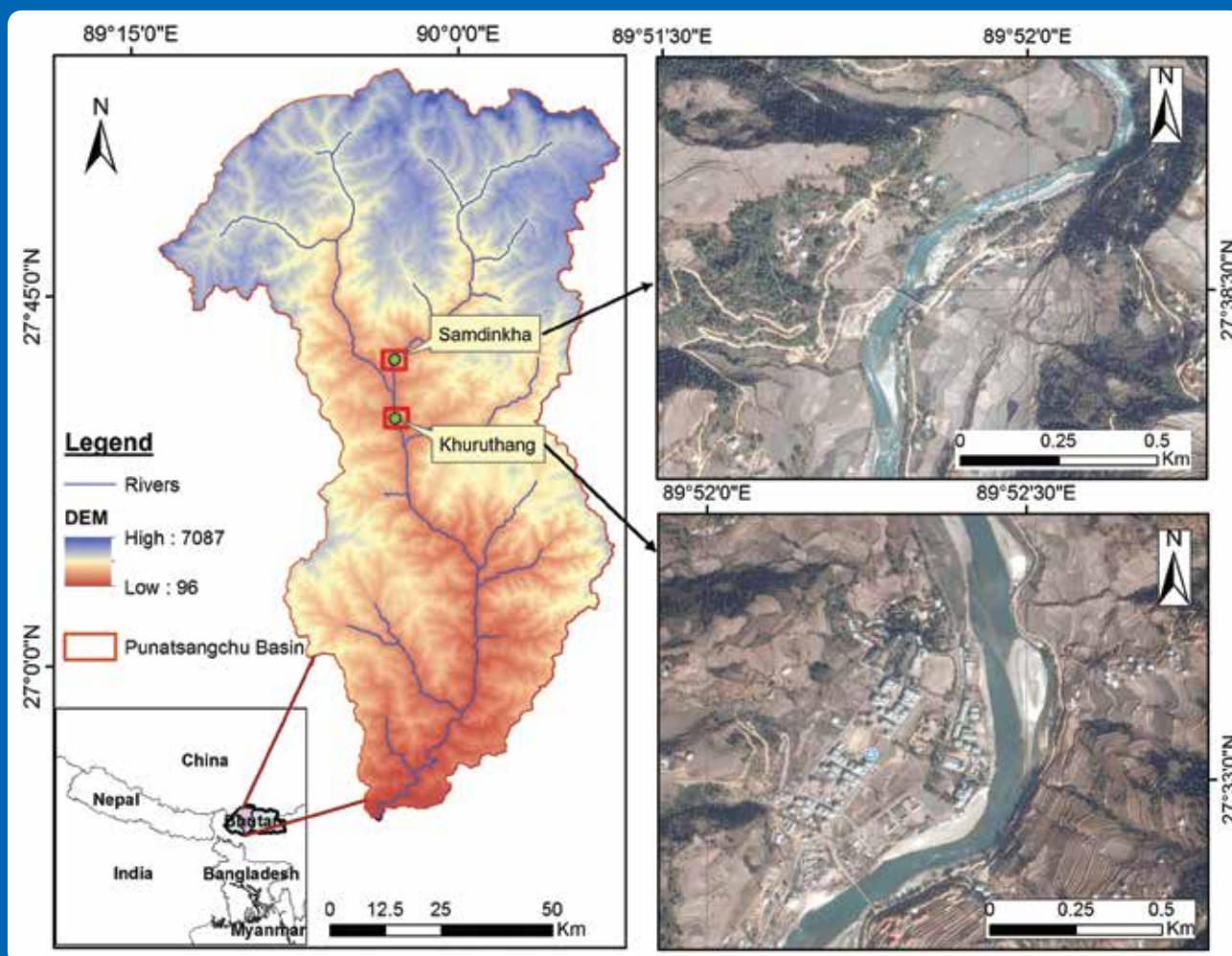
The DDM has organized a number of education and awareness programmes for vulnerable communities and institutions related to GLOF EWS in the Punatsangchhu river basin. The system has had positive results. On 28 June 2015, a GLOF was triggered from Memari Tsho (also known as Lemthang Tsho), due to the sudden draining of supraglacial ponds above the lake. The EWS alerted communities of the impending danger. The GLOF resulted in a rise of around 0.25 metres above normal water level at Punakha. The flood washed away four bridges, four horses, affected an acre of land, and caused three major landslides downstream, damaging the horse trails between Gasa and Laya. Due to the timely warning there was no loss of life in the Punakha valley (Kuensel 2015).

Study areas

One village in the upstream (Samdingkha) and one emerging town in the downstream (Khuruthang) in Punakha Dzongkhag in the Punatsangchhu river basin (Figure 8) were selected for the study of the EWS in the Punakha-Wangdue valley. Punakha Dzongkhag is located at the confluence of two rivers, the Mo Chhu in the west and the Pho Chhu in the east. The Mo Chhu originates in the hills of Lingsi and Laya in Bhutan and in Tibet, whereas the Pho Chhu is fed by glaciers in Lunana region in the north. Floods are one of the major disasters affecting this area.

To prepare communities to respond to floods in the study area, the Department of Geology and Mines has demarcated areas near the river as red, yellow, and green zones. Red zones are those at risk of total submersion in a flood, yellow areas may be affected by some water, and green areas are safe zones. Communities in the Punatsangchhu river basin have been informed of this zoning and shown evacuation sites. In Punakha, there is an emergency operation centre (EOC) equipped with family kits, life jackets, and corrugated galvanized iron (CGI) sheets, among other things, to be distributed to victims who experience total loss of their belongings in a flood. Focal persons have been appointed and equipped with cell phones so that they can inform downstream settlements whenever they see the water level rising. In addition, sirens have been installed in different locations to warn people of impending floods.

Figure 8: Map of case study area and the Punatsangchu river basin



The purpose of the case study was to understand the existing flood early warning system in the valley and the roles and responsibilities of communities for operating and managing the system. In addition, it sought to understand the level of awareness among community members, particularly women, about the flood early warning system. The study focused on determining the familiarity of communities with the early warning system established in their area and their preparedness to act on the warnings received. The field study was conducted in November 2014 and included a household survey (in Samdingkha village) and focus group discussions (in Khuruthang and Samdingkha) at the community level and key informant interviews with stakeholders at the district level. The survey questionnaire and checklists used for the focus group discussions and key informant interview stakeholders can be found in annexes 1, 2, and 3, respectively.

Samdingkha, Toewang

Samdingkha village in Toewang Gewog has a population of 120 and is located about 16 km north of Khuruthang. This village was selected for the case study as it has been identified by the government as highly vulnerable to floods. All of the 27 households in the village are located in the red zone demarcated by the Department of Geology and Mines.

Focus group discussions were conducted separately with women and men in the village, as well as a household survey. The household survey covered 37% of the total population. An equal proportion of male and female

respondents were surveyed (22 each; 44 in total). The average family size in the village is 4.4. The mean age of the respondents was 45, with the youngest being 20 and the oldest 80. The socioeconomic profile of the village, based on the household survey, is presented in Figures 9 and 10.

The data indicates a typical South Asian gender division of roles. None of the male respondents in Samdingkha reported being in charge of household chores and care responsibilities and none of the female respondents were employed in the private sector. However, women in the village appear to be engaged in microenterprises. The overall educational attainment of women is lower than that of men (Figure 10).

More men than women are engaged in off-farm activities: Men are employed as civil servants, in the private sector, and in the armed forces (Figure 9). Of the total female respondents, 32% reported being home carers, 23% farmers, 18% civil servants, and 27% were engaged in local businesses, such as small grocery shops. It is remarkable that nearly a fifth of female respondents reported working as civil servants. The NCWC and World Bank

Figure 9: Occupation of respondents by gender

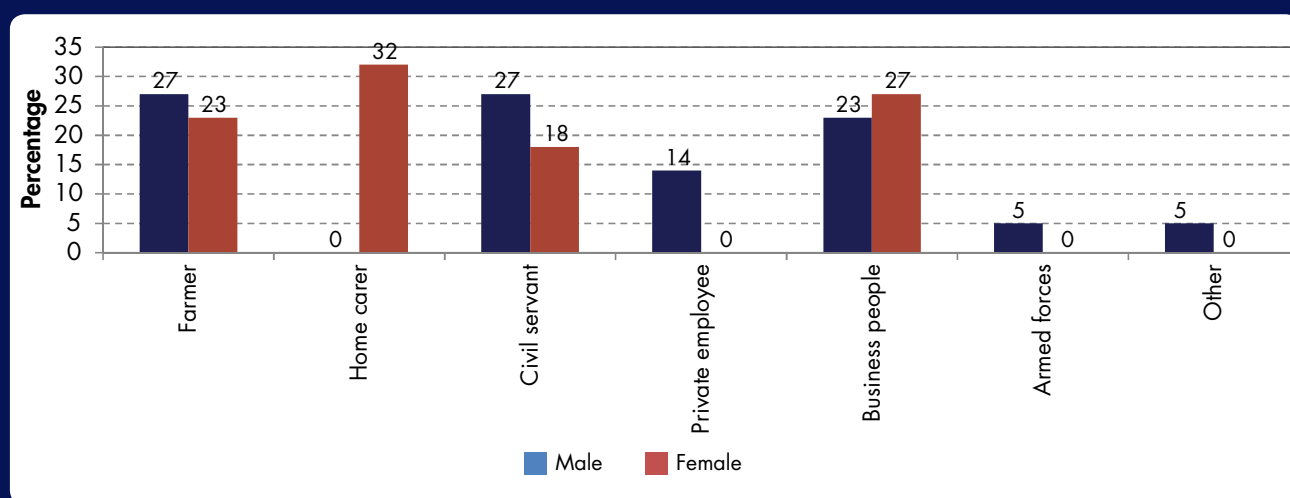
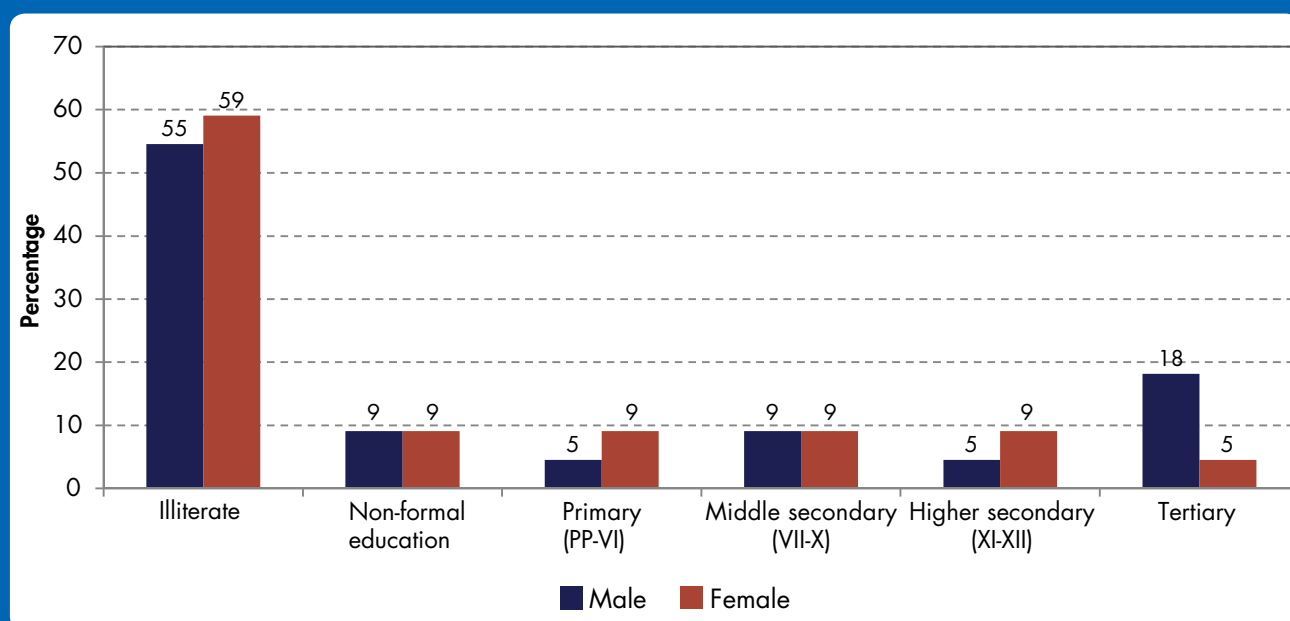


Figure 10: Education of respondents in Samdingkha by gender





Cultivated land in the Samdingkha village

(2013) also notes a gender disparity in housework and indicates that norms related to gender roles in households take time to change. Around 14% of men, but none of the women, reported being employed in the private sector. Regarding literacy, 54% of all respondents were illiterate, rising to 59% when disaggregated for women (Figure 10). Around 18% of male respondents reported having a bachelor's degree, whereas only 5% of female respondents had attained the same level.

Khuruthang

Khuruthang town is located in Punakha Dzongkhag the western part of the country, about 75 km from Thimphu. It is in the middle of the Punakha-Wangdue valley, about 6 km downstream from Punakha Dzong. The population of Khuruthang increased after the floods in Punakha in the 1960s and it absorbed the retail section of the former capital Punakha in 1999 (Walcott 2009). It is the business centre of Punakha Dzongkhag, with schools, a technical institute, hotels, and resorts. Small in size, this town was developed in the early 2000s and has about 100 permanent households with a population of about 500. The main livelihood is retail businesses (shops), hotels and taxis, which cater for tourists. It is centrally located between Punakha and Wangdue Phodrang and connects with Gasa district in the north. The nearest river is Punatsangchhu.

Two separate focus group discussions were organized in Khuruthang, one with men and one with women, to determine the community's experiences with floods and their knowledge about the early warning system. A total of six women and six men participated in the discussions. Each focus group discussion was an hour long and held in the evening, after participants were free from other engagements. Most participants were farmers, shopkeepers, and students. The disaster risk management focal person from the Punakha Dzongkhag Administration office and a village representative also participated in the men's focus group discussion. The participants in the men's group were aged 25 to 55 years, whereas the participants in the women's group were aged 30 to 50 years. The majority of respondents were permanent residents of the village.



Khuruthang town

Risk knowledge at community level

Knowledge and awareness about floods are important for preparedness for water induced disasters. The study found that people in Samdingkha and Khuruthang were aware of the flood early warning system installed in their locations. Many had already experienced a flood and heard the sound of the siren signalling the need for evacuation. Three respondents had lost their homes, while others had lost cattle, their source of drinking water, or faced a road blockage due to a flood. Only a third of respondents from Samdingkha mentioned that floods are due to the rapid melting of glaciers. During the focus group discussions in both study sites participants said that they are familiar with GLOFs.

There was a varied gendered response regarding what to do in case a siren alert is sounded. According to a report by the Department of Geology and Mines (2010), an evacuation plan was prepared for Samdingkha identifying five evacuation areas for different groups of settlements. However, women participants of the focus group discussion in Samdingkha were ignorant of the safety routes and evacuation sites identified by the DDM in the disaster preparedness plan, although they did know about that a flood hazard map existed and had attended a mock drill organized by the DDM. In Khuruthang women participants of the focus group discussions were not aware of the flood hazard maps, safety routes or evacuations sites identified by the DDM. This indicates that the information on flood preparedness has not reached all women members of the community. In contrast, male respondents knew about the disaster preparedness plan.

In Samdingkha, all community focal persons for GLOF EWS are men who are connected to emergency response agencies outside the village. Men mentioned that all neighbours should come together before they walk towards nearby higher ground during an evacuation, however, their female counterparts express ignorance about what to do. This illustrates the different ability of men and women to tackle flood hazards, which needs to be addressed during preparedness programmes, as well as in technology design.

The gendered differential knowledge about floods of men and women is also reflected in the household survey for Samdingkha. When asked about their perceptions of men and women’s knowledge about flood risk, 82% of the male respondents claimed that men have better knowledge about floods than women (Figure 11). Little more than half (55%) of female respondents claimed that women have knowledge about floods. A third of the female respondents mentioned that both men and women have knowledge about floods. This could be a reflection of gendered perceptions about women and men’s knowledge. Women often claim to know less about things than they actually do, while men tend to be more confident and claim to know more about things, whether in fact they do or not (Harding 1991). Regardless, this response indicates that EWS preparedness programmes need to focus on those women and men who do not feel confident about their knowledge about floods and what to do in case evacuation is needed.

Regarding knowledge about risk monitoring, older male respondents shared traditional knowledge about flood warning signs, such as changes in the sound of the river, people tending to sleep more, and the unusual movement of birds and insects. The respondents who had experienced floods were more aware of such signs than the younger generation. One of the male respondents said that, “one day, the China king will surely send more water to us so we need to prepare ourselves to save ourselves from floods in the future,” expressing a local belief that there is a ‘Chinese King’ who holds the water in the north and releases it occasionally.

The research team also assessed people’s perceptions of who is vulnerable to floods, as this impacts on collective efforts for flood preparedness and response. When the respondents in Samdingkha village were asked who is most vulnerable to floods, the majority of respondents considered people with disabilities as the most vulnerable. About half of the male respondents said that women and children are the most vulnerable. In contrast to men’s view, only 27% of women considered women and children as the most vulnerable (Figure 12). This reflects the general perception of women as victims, although women were less likely to perceive themselves as victims indicates women’s altruistic characteristics (Kabeer 1994). Only a few respondents viewed senior citizens as vulnerable. This response might be due to the fact that old people in the study area are on the whole healthy and active.

Monitoring and warning

Monitoring possible flood hazard and developing warning services for early warning is a sociotechnical effort as it includes technical means mobilised through and managed by people. The participants of the focus group discussions at Khuruthang mentioned that the community is indirectly engaged in risk monitoring. Instruments are installed in the lakes and water levels are monitored in the GLOF EWS control room. One of the participants of the

Figure 11: Perception of women and men’s knowledge of flood risk

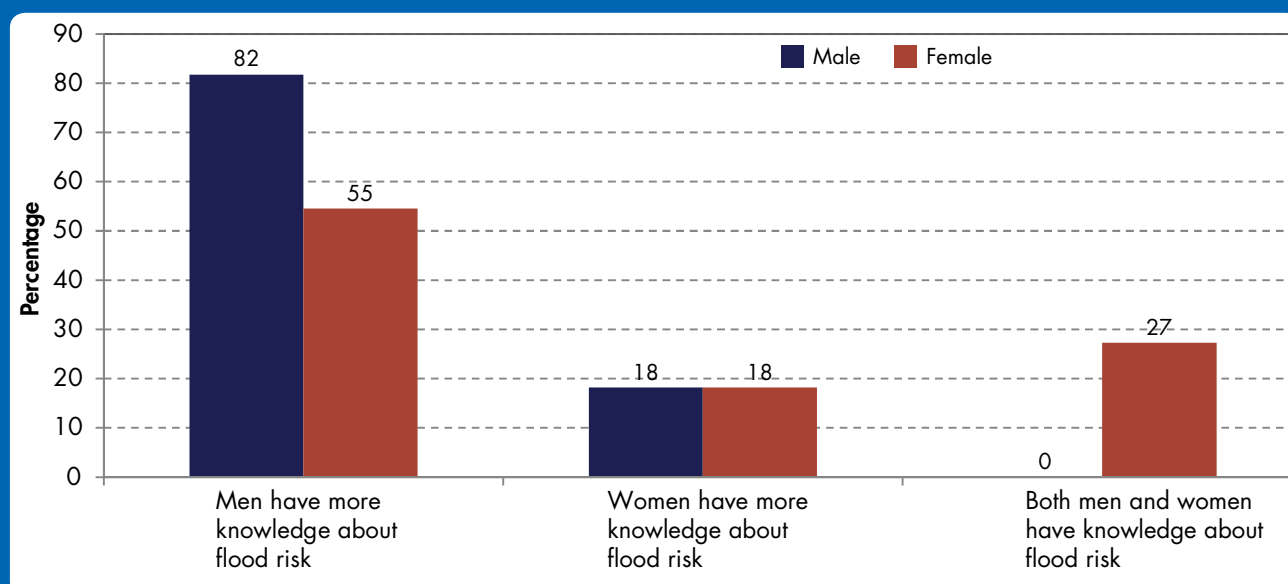
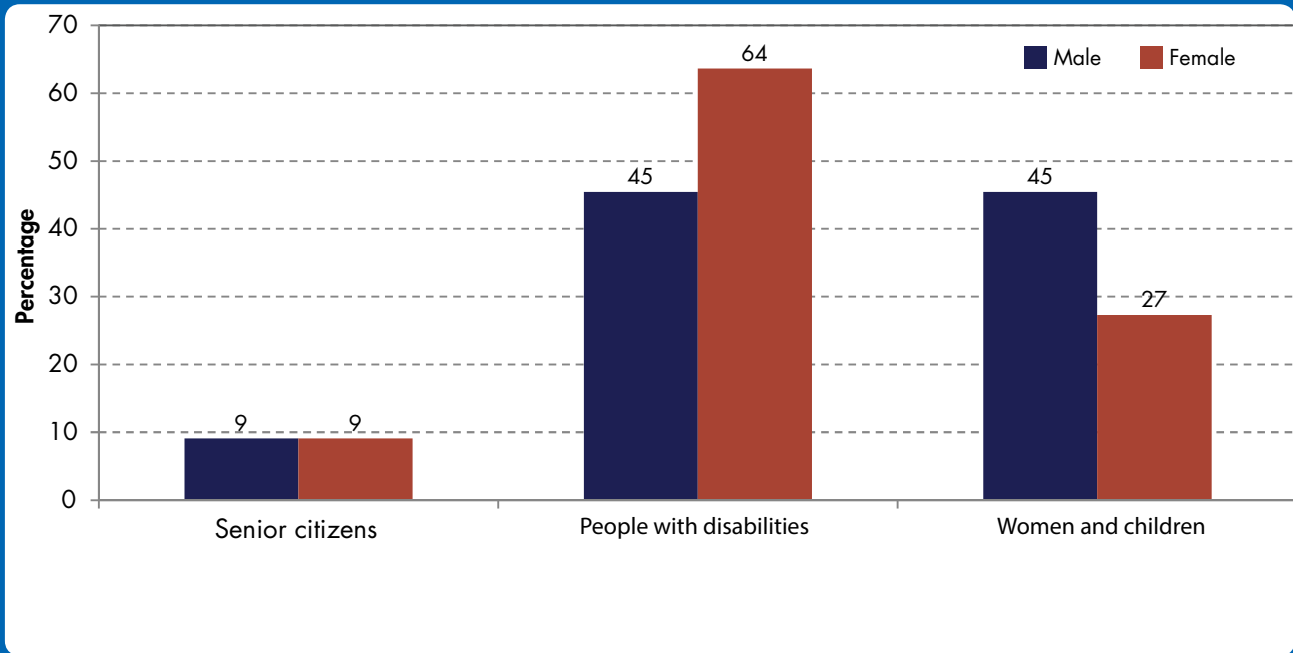


Figure 12: Women and men's perceptions of groups vulnerable to flood



focus group discussion used to be a gauge reader during the rainy season. He was equipped with a cell phone and instructed to inform downstream settlements about rising water levels. The siren is the only way of alerting people in the community about rising water levels. There were different responses on awareness and use of the siren, which is discussed in detail below.

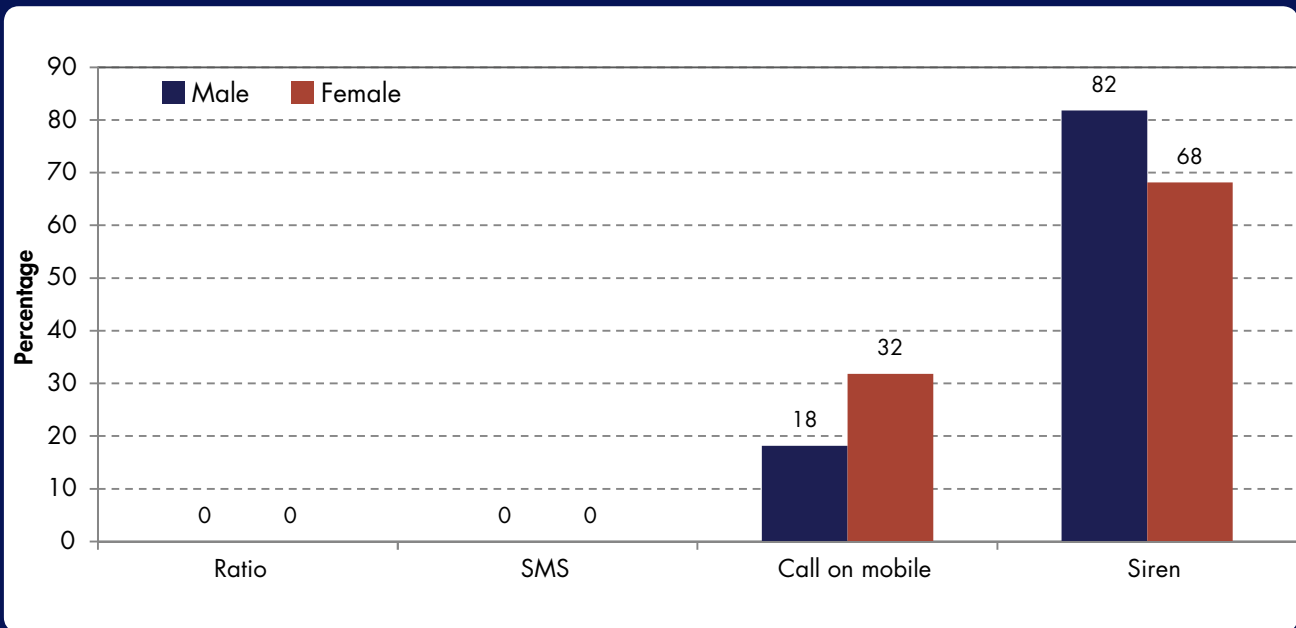
Dissemination and communication

Warnings about floods in the study area are disseminated by siren. The research team asked respondents what they thought about this method. In Samdingkha, 75% of respondent said that they prefer siren for alert warnings about flood. However, 32% of women (compared to 18% of men) said that they preferred to receive risk information via mobile phone (Figure 13). This is possibly due to the multiple engagement of women in domestic and non-domestic work, which may mean that they may miss an alert by siren if they are not located in range of the siren. Or, some women's preference for alerts by mobile phone may be due to lack of educational qualification and confidence among women to deal with outside world as well as their restricted mobility. These women might find direct mobile contact more accessible than the siren warning system. The National Commission for Women and Children and World Bank (2013) recommends improving literacy among women to encourage women's adoption and use of new technology. At the same time, there is also a need for dissemination and communication materials and methods to be sensitive to women's needs. For instance, flood risk information could be more pictorial than text to suit the needs of illiterate community members.

The data on men's preference for siren-based warnings reflects men's mobility outside the home, which makes it easy for them to hear the siren. Considering the gendered differences between women and men with respect to mobility and illiteracy, which restricts some women from actively participate in EWS activities at the community level, affirmative action is needed to enhance their capacity and support women to make better use of EWS services and save their lives during disasters.

In both of the study areas, sirens are the only source of flood alerts. In some flood-prone villages, local volunteers help the community to verify the correctness of siren alerts by contacting concerned authorities outside their village. There used to be a person in Samdingkha village equipped with a simple cell phone who was responsible for communicating rising water levels to downstream settlements. However, mobile phone systems are not always

Figure 13: Women and men's preferred mode of risk communication during floods



reliable, as phone connectivity can become jammed in times of disaster. However, this system was said to be no longer in operation, which needs attention.

Participants of the focus group discussions expressed their awareness of the early warning system in their community, including who had installed the system and how it functions. Most of the participants had heard the sound of the siren, but they did not know what to do next, which raises concerns about their response capacity. There was mixed opinion among participants about whether or not the siren was functional at the moment. Some of them have mistaken the sound of an ambulance for the siren. This is due to lack of the involvement of communities in choosing an alert sound that everyone in the community can understand and respond to. The siren was chosen and set by the DHMS. A variation in the sound of the siren from other alerts, such as ambulance, would great people to understand the meaning of siren alerts.

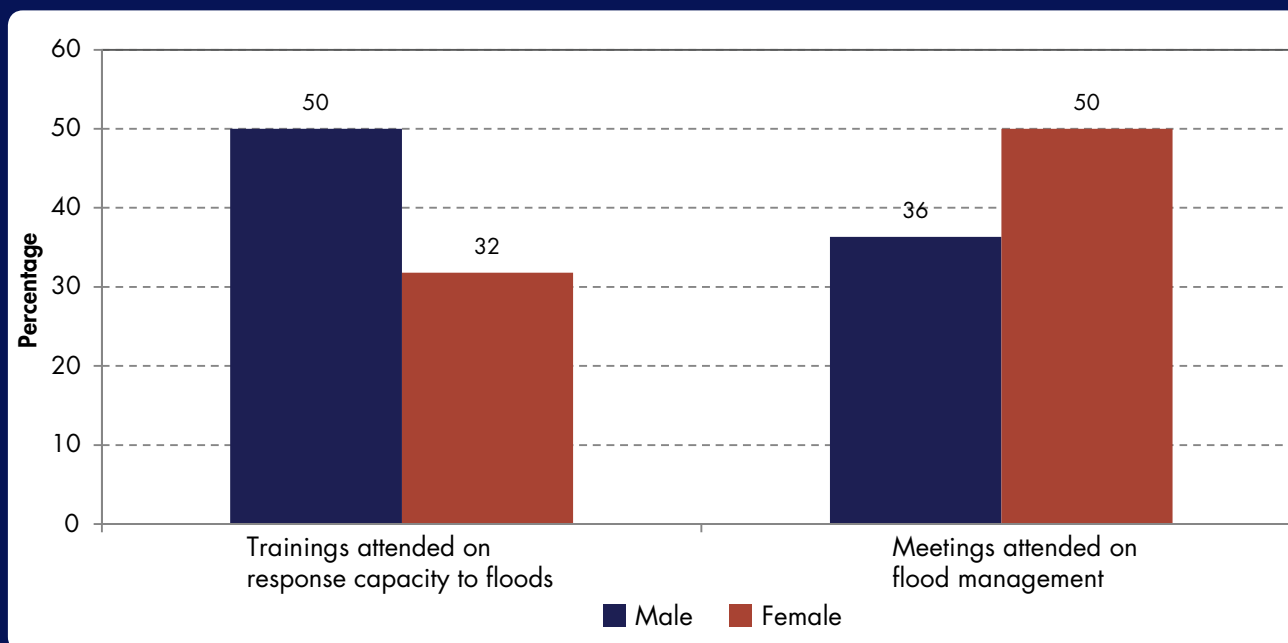
Response capacity

The DDM, in collaboration with the DHMS, the Department of Geology and Mines, and communities, has been involved in developing flood hazard maps for the demarcation of risk and safe zones and to help in the identification of safety routes and evacuation sites during disasters. These are being used for drills, which the DDM organizes once a year. However, the communities studied do not have a response plan in place that they can follow after the siren is sounded. This indicates that the EWS installed by the DHMS is not as effective as it could be. This could be improved by more meaningful participation by communities in the preparation of response mechanisms.

The research team made a gendered analysis of flood preparedness at the community level. Of the 44 respondents who took part in the household survey in Samdingkha, only 41% have had training on response capacity for floods (half of the men and one-third of the women), which indicates that there is a need to expand capacity building activities (Figure 14). The unequal number of men and women who have received the training indicates that there is a need to review the DDM policy for selecting participants for training to ensure a gender balance in capacity building activities.

Overall, only 43% of respondents in both villages had attended meetings on flood management at the community level. Of them, more women had attended such meetings than men. This shows that women do get involved in EWS activities if it happens in their immediate vicinity. However, their lower participatin in training raises questions

Figure 14: Participation of women and men in flood-related training and meetings



about their equal access to opportunities. Similarly, only 36% of respondents reported being knowledgeable about the hazard zonation maps and identification of risk areas, as prepared and marked by the Department of Geology and Mines. Here too, more women reported being familiar with maps, indicating that, provided women are in the meetings, they do absorb the learning, perhaps even more than men. However, more women attending meetings and being aware of hazard zonation maps does not mean that they are prepared for flood hazards. The focus group discussions in both places found that not all women are aware of the hazard zonation maps and safety routes, as mentioned earlier.

In Khuruthang, participants of the focus group discussions said that they had heard the sound of the siren and could not distinguish it from an ambulance siren. On further interrogation, lack of awareness about the flood early warning system among respondents was found to be due to the fact that many of them had settled in the town after installation of the EWS in 2011. This indicates that EWS community awareness activities either do not take place regularly enough or everyone is not included in these activities, which requires the attention of concerned authorities and community insitutions.

The participants of the focus group discussions in Samdingkha said that the community is aware of the flood hazard maps and evacuation site identified as part of the DDM flood preparedness programme and the participation of women in the drills organized by the DDM once a year is high. However, it is not mandatory that women participate in these drills and Samdingkha does not have a flood response plan in place that they can follow after the siren sounds. This affects their response capacity.

Most male participants of the focus group discussion said that when they hear the siren, they immediately try to bring all family members and neighbours together in one place before moving together to the safe place. They expressed the view that the action at the time of disasters does not take gender into account, which makes the vulnerable more vulnerable. Hence, those rescued by community leaders in times of disaster are often those who are physically fit and receive information the fastest. Generally, women do not participate in the information dissemination process within the village, nor are they community volunteers for flood disasters, hence, they may be missed in the rescue process. This indicates that there is a need for gender sensitization training at the community level.

The responses of women and men also differed on the gender of the technicians/caretakers of the EWS station in their location (Table 4). Around 50% of male respondents said men are the technicians/caretakers of the EWS stations, while only 20% of women respondents agreed. However, 45% of female respondents and 36% of male

Table 4: Responses by women and men when asked who are the technicians/caretakers of the EWS station in their village

Technicians/caretakers of the EWS stations	Response number (and %)		
	Men	Women	Total
Male caretakers	11 (50)	4 (20)	15 (36)
No idea which gender the caretaker of EWS station is	8 (36)	9 (45)	17 (40)
No one in the village	3 (14)	7 (35)	10 (24)

respondents said that they do not know. This is consistent with the fact that more men are informed or have access to such information. This calls for more involvement of women in EWS.

Some of the common reasons mentioned by respondents for not having women technicians/caretakers of the EWS stations were that women were not interested and they cannot walk as much as men do or travel alone, are slow in decision making, do not have much idea about disasters, do not have the capacity, and cannot take as many risks as men. All of the reasons cited reveal a stereotypical view of women as weak and unable (or unwilling) to take up responsible jobs in the community. However, on the other hand, the data indicates that women themselves do not necessarily think that they cannot do such work.

With respect to the community taking ownership of EWS structures in the study area, the participants in the survey and focus group discussions expressed willingness to do so if the facilities were handed over to them. They also showed willingness to be trained. It is possible that community involvement in and responsibility for the EWS could enhance its efficiency, if managed properly.

Early warning systems implementing agencies

Interviews and discussions with government and non-government organizations working in Punakha and Wangdue were held to understand the gender dimensions of implementing agencies. The officers consulted were the DDM officer in Punakha and the Chief Planning Officer of the DDM, district engineers, district agriculture officer, and forest officer in Wangdue.

The research found that the DDM's approach to disaster management encourages women's participation at the community level. The existing EWS in the Punakha-Wangdue valley, which was initiated by the DHMS, has one female technician in the control room located in the Flood Warning office in Wangdue and a female engineer. Except for these female staff, all other staff are men. In addition, the project proposals are not gender sensitive in their approach.

However, regarding the approach to working with the community, it is not mandatory for the DDM or DHMS to address gender concerns. Public consultations are often gender neutral, although they are envisioned to be inclusive of both male and female participants. No deliberate effort is made to address men and women's needs separately. Regarding project design and public consultations for the planned EWS, analysis of their gender sensitivity was beyond the scope of this study.

Involvement of women in implementing agencies

Female technicians: There is only one female technician who plays the role of a caretaker in the control room located in the Flood Warning office in Wangdue. The centre has a total of three staff who take shifts in order to keep watch around the clock after receiving computerized data from Thanza, Lunana, the site where the first sensor is located. However, there are an encouraging number of gauge readers – the DHMS has eight female meteorological gauge readers and eight female hydrological gauge readers.

Female implementers: There are two female focal persons nominated by the DDM and DHMS in the Punakha-Wangdue valley: One of them is a 'tshogpa' (elected local government civil servant), who coordinates meetings, updates the community on government activities, and reports to the local governance head, known as the 'gup'. The other is a technician, who is part of the staff managing the Flood Warning Centre control room in Wangdue town. The chief at the DDM is also a woman, and she looks after community awareness and education, which is quite encouraging.

Summary of findings and discussion

The major findings of the gender assessment of the EWS at the community level are summarized in Table 5.

Table 5: Summary of gender analysis of EWS at community level

Risk knowledge	Monitoring and warning services
<ul style="list-style-type: none"> The majority of women are not aware of safety routes and evacuation sites. Women perceive that they do have knowledge about floods. Risk zones have been identified and marked in the villages. However, not all community members are aware of this. 	<ul style="list-style-type: none"> Less women than men are involved in monitoring and warning services for the flood EWS in Bhutan. Only those women working in the flood management divisions and departments are involved in the monitoring and warning services for the flood EWS. Low representation of women (less than 20%) is found in organization working in this area.
Communication and dissemination	Response capability
<ul style="list-style-type: none"> There is a need to design communication materials with picture and illustrations to disseminate information on the flood EWS to the 40% of community members who are illiterate, as many were unaware of the hazard zonation maps and safety routes. Women preferred mobile phones as a means of communication rather than sirens. This reflects the fact that sirens may not be heard by women who do not frequent public places. This gendered need should be considered in EWS design (which could combine both sirens and mobile alerts). 	<ul style="list-style-type: none"> A gender balance needs to be brought about in capacity building activities through affirmative action for women (as well as and disadvantaged men and women). There is a need to make people aware of the hazard zonation maps, as only 36% reported being aware of such maps in their local area. Not all respondents were aware of what the siren sounds like and many reported being confused with an ambulance siren. There is a need to differentiate the siren for EWS from those for other emergencies.

Although efforts have been made to reach to all community members in Samdingkha and Khuruthang with EWS information, the review of the system revealed that there are areas that need to be improved to make the EWS more effective and responsive to all categories and groups in society. Specifically, women and illiterate community members (of whom women constitute the majority) were not aware of safety routes and evacuation sites – information that is critical to save lives during floods. This indicates the need for rigorous and inclusive implementation procedures to engage women and illiterate community members in all stages of EWS implementation. Affirmative action is required to involve women and people living in the most hazardous areas in EWS activities, especially capacity building. An effort needs to be made to bring about a gender balance among participants in such activities so that both men and women have equal opportunities.

The communication devices used for alerts also need to cater to the different needs of women and illiterate community members. The preference for alerts by mobile phone among some women requires urgent attention in the design of community early warning systems. This is more applicable to women living in places far from where sirens are installed. Furthermore, the majority of respondents expressed difficulties with identifying the sound of the siren. Hence, the sound of the siren needs to be different from other sirens, such as ambulance sirens.

The study of the two settlements also showed there are gendered perceptions about who is most vulnerable in times of floods, who the technicians/caretakers of EWS stations are (men or women), and women and men's knowledgeable about floods. These perceptions will have an effect on how people interact with each other and what actions, strategies, and risks they will take during a flood event and in saving their lives. One of the remarkable findings of this study is that women reported being unaware of the various information on EWS, but do not consider themselves as the most vulnerable during times of flood. Being aware about gendered experiences and expression could help EWS implementing staff to be more sensitive to women and men during EWS implementation in the field.

Chapter 6

Conclusion, Recommendations and Opportunities

Conclusion

Since the GLOF of 1994, the Royal Government of Bhutan has given high priority to the implementation of flood early warning systems. Bhutan has moved from a manual early warning system (in 1988) to a web-based telemetry flood early warning system. ICIMOD has identified 24 of Bhutan's glacial lakes as potentially dangerous. The first GLOF early warning system was established in the Punatsangchhu river basin in 2011 and the government aims to implement a similar system in other areas at risk.

In this context, this study reviewed disaster risk reduction and EWS-related policies, organizations, and practices at the community level in the Punatsangchhu river basin from a gender perspective to understand the gaps and challenges in establishing an effective and inclusive EWS. The review of the relevant policies with respect to disaster management and early warning systems, as well as the organizations and agencies responsible for implementing these policies, particularly government organizations, revealed a gender neutral approach that ignores the differential experiences, knowledge, needs, and capacities of women and men. Government policies, such as the Water Vision 2025 and Bhutan Water Policy, 2003 deal with the community as a homogenous group, which is a reflection of the dominant perception of disasters as affecting everyone equally. Some policy documents do talk about women, but as victims rather than contributors to the design and implementation of EWS. What is missing from these policies is the integration of gender into the four elements of EWS (risk knowledge, monitoring and warning, communication and dissemination, and response capacity) to ensure the receipt of equal benefits of EWS implementation by men and women and to minimize the unequal impact of flood disasters on men and women.

The review of the 23 organizations involved in disaster risk reduction and EWS highlighted the need for coordination and linkages among institutions to strengthen early warning practices. The study found that coordination and collaboration among the various organizations involved in 'risk knowledge' and 'information dissemination' could minimize the loss of life and property in a flood event. For instance, the National Commission for Women and Children is the only organization responsible for addressing the issues of women and children and, therefore, is in a unique position to influence implementing organizations to take a gender perspective. However, its coordination with organizations dealing with disaster management and EWS was found to be limited. In addition, organizations are mostly dominated by male staff, which can lead to less interaction with women community members during implementation.

The detailed case study of the EWS in Samdingkha and Khuruthang villages in the Punatsangchhu river basin revealed that the current EWS is gender neutral as it does not consider the different needs and requirements of men and women. While most community members are aware of the hazard zonation maps (men and women), the majority of women surveyed were unaware of the safety routes and evacuation sites. More efforts are needed to ensure that EWS information on floods reaches all end users, including women and specific social groups, especially those who are illiterate. The study also found that the methods used to disseminate warnings need to consider the needs of different members of the community. Some of the women who participated in the survey preferred receiving flood warnings by mobile phone, rather than siren (which are only sounded in public places); hence, an integrated warning system consisting of both mobile alerts and sirens should be considered in EWS design.

The EWS in Bhutan was limited to the Punakha-Wangdue valley at the time of the stakeholder consultations and focus group discussions, however, the coverage of this system has now been expanded to Mangdechu and Chamkharchu valleys of Bhutan. Based on the study findings it is clear the concept of an early warning system in relation to flood hazards needs to be broadened to integrate gender issues, particularly in relation to new systems being developed to maximise their effectiveness.

Recommendations

The findings and recommendations of this study are expected to be useful to policymakers and implementers in strengthening new EWS by integrating gender into their design and implementation. The following recommendations are made to ensure that flood early warning systems are gender sensitive, gender responsive, and effective.

- **Involve women in all aspects of EWS:** Ensure that disaster management activities are gender sensitive at all stages of the disaster cycle, by involving both women and men in the design, administration, and implementation of EWS.
- **Link organizations in EWS with those working for gender equality:** Link policies and organizations for disaster management and EWS with those for gender equality and social justice (such as the National Commission for Women and Children, the Gross National Happiness Commission, and INGO/NGOs working on gender and social issues) to help achieve gender integration in EWS.
- **Amend policies and laws to be gender sensitive:** Amend policies and laws to make it mandatory to consider the differential experiences, needs, and roles of women and men in disaster management.
- **Bring about a gender balance in the staffing of EWS implementing agencies:** Bring about a gender balance in the staffing of agencies implementing disaster management and EWS to improve the gender sensitivity and responsiveness of EWS. For this, affirmative action in recruitment and incentive structures for women should be considered to facilitate the promotion of women to higher positions.
- **Strengthen the capacity of communities for EWS:** Continuously strengthen the capacity of communities for EWS, with particular attention to the involvement of women in risk knowledge, monitoring and warning, dissemination and communication, and response capacity, to ensure the sustainability of the EWS. Affirmative action should be used to ensure women's involvement in capacity building activities, such as training and exposure visits, to enhance their capacity to respond to floods. Women should also be involved in infrastructure management teams for local early warning systems to enhance women's leadership in EWS.
- **Use gender responsive materials in capacity building and EWS technology:** Ensure that the materials used in capacity building activities and technology for EWS are responsive to the needs of all community members. For example, illustrative communication materials are more effective for illiterate community members, among whom women constitute the majority. Similarly, the preference for mobile phones as tool for receiving flood warnings (over sirens) is higher among women; hence, consider integrating both sirens and mobile phones as part of the alert system. The sound of siren for flood warning also needs to be differentiated from other warnings, such as those for ambulances.
- **Increase community ownership of EWS for greater sustainability and effectiveness:** Consult stakeholders while planning, designing, and implementing EWS to avoid any mismatch between the needs of different social groups, including women, and to instil ownership of the system in local communities.
- **Conduct further research on gender issues:** Conduct further research on gender issues in disasters to inform policies and programmes. There is a need for the increased documentation of successful gender strategies used by communities living in disaster-prone areas. There is also a need to focus on gender-based vulnerabilities and capacities, rather than physical exposure to technological and environmental hazards.

Opportunities

- The Department of Hydro-Met Services is growing in its capacity (both in terms of human resources and financial resources) to improve the technology required to work more effectively in flood EWS. Hence, there is an opportunity to integrate gender more effectively based on learning from past EWS implementation.
- The Royal Government of Bhutan's 11th Five Year Plan (2013–2018) emphasizes the need to mainstream gender in almost all areas of development, disaster management being one of them. This presents an opportunity for organizations working in disaster management and EWS to address gender concerns in their work.
- The diverse stakeholders (INGOs, NGOs, government organizations, community-based organizations) working in disaster risk reduction have different knowledge and skills, which creates possibilities for leveraging synergies to implement flood warnings more effectively.
- There is global recognition of the need to address gender in DRR work. For example, the Sendai 2015 Disaster Risk Reduction Framework provides a roadmap for disaster risk management and calls for the integration of gender issues in DRR. This creates a global environment for the integration of gender concerns into EWS.

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Annex 1: Survey questionnaire

Questionnaire for communities

This study is called 'Early Warning System (EWS), a Gendered Perspective' in Bhutan. It tries to capture the socio-cultural and environmental aspects that affect men and women differently when it comes to responding to flood disasters/hazards. It also tries to capture the gender-based resilience as part of community capacity for responding to floods.

Your answers to the questions below will help the researchers to come to a better understanding of community-based EWS from a gender perspective.

Name of interviewer: _____

Questionnaire serial #: _____

A. Sociodemographic information

A1. Name of respondent: _____

A2. Gender of respondent: 1. Male
2. Female

A3. Age:

A4. Occupation:

- 1) Farmer
- 2) Home carer
- 3) Civil servant
- 4) Private employee
- 5) Business person

- 6) Non-government organization
- 7) Corporate employee
- 8) Armed forces
- 9) Other (specify).....

A5. Education/qualification level attained:

- 1) Illiterate
- 2) Non-formal education
- 3) Primary (PP-VI)
- 4) Middle secondary (VII-X)
- 5) Higher secondary (XI-XII)

A6. Village:

A7. Gewog:

A8. Dzongkhag:

B. Knowledge About Floods

B1. Have you experienced a flood recently? (Interviewer, ask about experience of floods.)

B2. What do you think about floods? (Ask about their opinions, beliefs and folktales about floods.)

B3. How did you know about the recent flood?

- 1) SMS 2) Radio 3) Siren
4) Word of mouth 5) Phone call 6) Observed river level
7) Other (specify)

B4. What did you do after you knew that the flood was coming?

B5. Did you receive any assistance during/after the flood?

- 1) Yes 2) No

B6. What type of assistance did you receive during the flood?

B7. What type of assistance did you receive after the flood?

B8. Was the assistance received sufficient to meet your needs?

- 1) Yes 2) No

C. Hazard monitoring

C1. Who acts as flood early warners in your community?

- 1) Men 2) Women 3) Not sure

C2. What percentage of your community do you think is knowledgeable about floods?

- 1) 91–100 % 2) 81–90 % 3) 71–80 % 4) <70%
4) Less than 70%

C3. Whom do you think is more knowledgeable about floods?

- 1) Men 2) Women And why do you think so?

D. Flood preparedness

D1. Did you attend any trainings on how to respond to floods?

- 1) Yes (Go to **D2**) 2) No

D2. If yes, how many times did you attend such trainings?

- 1) 1 time 2) 2–3 times 3) More than 3 times

D3. Have you participated in any meetings related to flood management?

- 1) Yes (if yes, answer the following) 2) No

How many times have you attended such meetings?

G6. Who understands the sirens better in your homes?

1) Men

2) Women

G7. Who are the caretakers/technicians of the EWS stations? (Ask for reasons. Ask whether or not there are women as caretakers, and, if not, go to G8).

G8. According to you, why are there less women as caretakers/ technicians in the flood early warning system? (Dig further into the social, cultural and institutional set up and barriers for women to participate in such careers).

Thank you for your time.

Annex 2: Checklist for key informant interviews

Checklist for key informant interviews (organizations)

1. Name of key informant:

2. Name of organization:

3. General information

3.1. Organization

Name of the organization/institution:

Nature of work:

- Policy/strategy formulation
- Coordination
- Implementation
- Technical support
- Research
- Other, please specify

3.2. Work

Does your office have any project/activities related to early warning systems for flood hazards?

If yes:

- What are the names of the project/key activities?
- When was it started?
- What is its duration?
- What is its geographic coverage?
- Direct beneficiaries?
- Indirect beneficiaries?

3.3. Human resources in the organization

Total number of staff:

Number of female staff:

Number of female staff in decision-making positions (section chief, head, officer level staff in the organization):

4. Gender analysis of the four key elements of people-centred EWS

4.1 Risk knowledge

Are there provisions (in policies, strategies, and guidelines) to engage women and women's organizations in the capacity building of women and men, in developing standards and tools for risk assessment, and in EWS alert dissemination, training, and hazard vulnerability and capacity assessment etc.?

- Is there an organization-wide taskforce on gender to coordinate hazard identification, vulnerability and risk assessment?
- Is gender mainstreamed in the legislation or government policy?
- Are hazard and vulnerability maps for all communities in place?

- Were women and women's organizations involved in the development of national standards for the systematic collection, sharing and assessment of hazard and vulnerability data?
- Are there equal opportunities for men and women to be part of scientific and technical expert groups for EWS?
- Is there a strategy in place to actively engage women and men from communities in local hazard and vulnerability analyses?
- Are women and men equally involved in the process of reviewing and updating risk data each year?
- Are women's traditional knowledge and perceptions included in the analysis and evaluation of the characteristics of key natural hazards?
- Are women and men equally involved in the development of hazard and risk maps?
- Do risk maps reflect the gender-differentiated impacts of the risk?
- Do hazard maps include gender-differentiated data?
- Are women's needs, concerns, and knowledge included in the community vulnerability assessments conducted for floods?
- Are the gender-differentiated results of risk assessments integrated into local risk management plans and warning messages?
- Are gender-differentiated hazard and vulnerability data available to the government, the public, and the international community?

4.2 Monitoring and warning services

- Is there any provision for ensuring women's participation in all processes of EWS?
- Have institutional mechanisms been established for women's participation?
- Are gender perspectives mainstreamed in all of the processes, roles and responsibilities of all the organizations generating and issuing warnings?
- Is there equal involvement of women and men in the committee that sets up technical warning systems for all hazards?
- Has a system been established to verify that warnings reach both women and men equally,
- Have forecasting and warning services been established?
- Can the data and warnings produced be understood by both women and men?
- Are women and men trained how to forecast hazards using different resources?
- Is women and men's traditional knowledge considered equally in forecasting hazards?

4.3 Dissemination and information

Is there any provision to ensure that women receive disaster alerts/warnings on time? Are there efforts or provisions to ensure that the disseminated alerts/warnings/messages/information are gender-sensitive?

- Have organizational and decision-making processes been institutionalized?
- Does the warning dissemination chain ensure that both women and men receive information?
- Are women and men both part of a volunteer network that is trained and empowered to receive and widely disseminate hazard warnings to remote households and communities?
- Have effective communication systems and equipment been installed?
- Are communication and dissemination systems tailored to the needs and social behaviour of both women and men?
- Is warning communication technology accessible and does it reach women and men equally?
- Are gender experts or women's groups consulted to assist with the identification and procurement of appropriate equipment or mechanisms?
- Are multiple communication mediums for warning dissemination used, including those used or preferred by women?
- Do warning dissemination and communication systems consistently reach women and men equally?
- Is there a two-way and interactive communication system in place to allow for verification, so it can be determined if women and men have received warnings?
- Are women and men trained and employed to maintain equipment and upgrade back-up systems in the event of failure?

- Are warning messages recognized and understood?
- Do warning alerts and messages take into consideration the behaviour of women and men?
- Do messages incorporate an understanding of the values, concerns, and interests of women and men?
- Can warnings/alerts be understood by both women and men (e.g., have studies been undertaken to determine how women and men access and interpret early warning messages)?
- Are gender-sensitive lessons learnt incorporated into message formats and dissemination processes?

4.4 Response capability

What are the provisions/efforts/practices currently in place in your organizations to make sure that warnings/alerts received by female members of the society will be responded to promptly and properly? Have response capacity building activities been gender-sensitive?

- Do warnings distributed by credible sources reach both women and men?
- Are gender-sensitive strategies developed to build credibility and trust in warnings?
- Are disaster preparedness and response plans established?
- Are disaster preparedness and response plans gender-sensitive?
- Do hazard and risk maps include gender-differentiated variables for vulnerability and risk, and are they used to develop emergency preparedness and response plans?
- Are gender-sensitive up-to-date emergency preparedness and response plans disseminated to women and men?
- Are gender-sensitive strategies implemented to maintain preparedness for recurrent hazard events including floods?
- Is feedback from regular tests and drills collect to test if the early warning and dissemination process and responses reach women and men equally?
- Is community response capacity assessed and strengthened?
- Is women's ability to respond effectively to early warnings assessed,
- Are gender-differentiated responses to previous disasters analysed and gender-sensitive lessons learnt incorporated into future capacity building strategies?
- Are women-focused organizations engaged to assist with capacity building?
- Are gender-sensitive community and volunteer education and training programmes developed and implemented?

5. Key strengths, challenges, needs and areas for improvement

Could you please describe your experiences in relation to the key strengths, challenges and areas for improvement in EWS in Nepal, particularly in relation to the mainstreaming of the needs and concerns of women?

- Strengths
- Challenges
- Needs/areas for improvement

Annex 3: Checklist for focus group discussions

Focus group discussions (with men and women) on flood EWS in the Punakha-Wangdue valley, Bhutan

Focus group discussion: Men/women

Total members participated:

Location:

Points to be covered during focus group discussion:

Risk knowledge (individuals and institutions in the community know the threat)

1. What are the key natural hazards in the locality?
2. What hazard assessment or risk assessment has been conducted, if any?
3. What past disaster events have taken place in the locality, if any?
4. Flood information: What is the frequency, severity and duration of floods, which households are affected, what is the damage caused, and what are the coping mechanisms?
5. Mitigation measures: What are the existing practices? Is support received from local governments, NGOs?
6. Risk maps and data availability: Do hazard maps include gender-differentiated data?
7. Are there equal opportunities for men and women to be part of the scientific and technical expert groups for assessing and reviewing the accuracy of risk data and information developed?
8. Is there a strategy in place to actively engage women and men from the community in local hazard and vulnerability analysis?
9. Are women and men equally involved in the process to review and update risk data each year?

Monitoring and warning services (individuals and institutions are able to monitor and communicate change in threat)

1. Do you have any early warning system in place? (Indigenous or introduced; support from NGOs, government or any other agencies)
2. What type of EWS is in place in your locality?
3. How does it function? Who owns it? How is it sustained? Are there any committees that manage it?
4. Who are on the committee (men/women)?
5. Are there clear roles and responsibilities of the committee members? For EWS
6. Is the EWS effective and sustainable? (EWS is timely, covers all aspects of people-centred EWS, covers the majority of households, is low cost, uses locally-available technology, is affordable by local community, and human resources are locally available for repairs)
7. Do women and children participate and is training is provided to them?
8. Is the community EWS linked to government EWS?
9. Is it replicable in other areas?

Communication and dissemination (individuals and institutions disseminate information about the threat)

1. Is there any provision to make sure that women receive the disaster alerts/warnings on time?
2. Are efforts or provisions made to ensure that the disseminated warnings/messages are gender sensitive?
3. Do warning dissemination channels ensure that both men and women receive information?
4. Are both men and women volunteers trained and empowered to receive and widely disseminate hazard warnings?
5. Are communication and dissemination systems tailored to the needs and social behaviour of both men and women?

6. Is warning communication technology accessible and does it reach women and men equally?
7. Are gender experts and women's groups consulted to assist with the identification and procurement of appropriate equipment or mechanisms?
8. Are communication mediums preferred by women used for warning dissemination?
9. Are both women and men trained to maintain equipment and upgrade programmes for back-up systems?
10. Do warning messages incorporate an understanding of the values, concerns and interests of women and men?
11. Can warning messages be understood by both men and women?

Response Capacity (Individuals and Institutions in a Position to Respond)

1. What are the provisions / efforts / practices currently available in the community to make sure that warnings / alerts received by women members of the society will respond promptly and properly?
2. Has the response capacity building activities gender-sensitive?
3. Disaster preparedness and response plans established
4. Disaster preparedness and response plans are gender-sensitive,
5. Hazard and risk maps include gender differentiated variables for vulnerability and risks, and are used to develop emergency preparedness and response plans,
6. Gender-sensitive up-to-date emergency preparedness and response plans are disseminated to women and men,
7. Gender-sensitive strategies are implemented to maintain preparedness for recurrent hazard events including floods,
8. Feedback from regular tests and drills are undertaken to test if the early warning and dissemination process and responses reach women and men equally.
9. Community response capacity assessed and strengthened
10. Women's ability to responds effectively to early warnings are assessed,
11. Gender-differentiated response to previous disasters analysed and gender-sensitive lessons learned are incorporated into future capacity building strategies,
12. Women-focused organizations are engaged to assist with capacity building
13. Gender-sensitive community and volunteer education and training programs are developed and implemented.

Annex 4: List of stakeholders consulted

Name	Designation	Department/ministry	Remarks
Thimphu			
Phub Tshering	Dasho Dzongdag (governor)	Punakha Dzongkhag Administration	
Chhimi Dorji	Deputy Chief, HYCOS Project Manager	DHMS/ Ministry of Economic Affairs	Consulted in 2012
Sonam Penjore	Programme Officer	NCWC	Consulted in 2012
Pelden Zam, Ms	Chief	DDM	
Phuntsho Wangyel	Research Officer	Research and Evaluation Division, GNHC	
Tashi	Senior Research Officer	Research and Evaluation Division, GNHC	
Tshewang Lhamo, Ms		NCWC	Consulted in 2012
Tandin Dorji	Chief	Department of Forests/NDMA	
Kezang	Chief, Flood Risk Division	Department of Roads, Ministry of Works and Human Settlement	
Tenzin Drugyal	Deputy Chief Agriculture Office	Ministry of Agriculture and Forests	
Jamyang Tshomo	Program Officer	Ministry of Labour and Human Resources	
Pem Choki, Ms	Gender Focal Officer	Department of Local Governance, Ministry of Home and Cultural Affairs	
Punakha			
Tshewang Phuntsho	DDM Officer	Punakha Dzongkhag	
Touchu	Gup	Toewang Gewog	
Yonten Kafley	Gewog Administrative Officer	Toewang	
Wangdue			
Sahadev Thapa	Chief Planning Officer		Consulted in 2012
Lhapchu	District Engineer		Consulted in 2012
Kin Gyeltshen	Dzongkhag Forest Officer		Consulted in 2012
Chokey Wangchuk	Assistant District Agriculture Officer		Consulted in 2012
International organizations			
Karma Raptan	Assistant Resident Representative, Environment Unit	UNDP	
Anirudh	Child Protection Officer	UNICEF	
Krishna Subba	Programme Officer	JICA	
Tomoko Miyata, Ms	Project Formulation Officer	JICA	
Garab Penjore	Programme Officer	Save the Children	
Pema Lhamo, Ms	Programme Officer	Save the Children	
NGOs/civil society organizations			
Tshering Pelden, Ms	Programme Officer	Loden Foundation	
Deki Chhoden	Head, Business Support Development	Bhutan Chamber of Commerce and Industry	
Kezang Choden, Ms	Business Promotion Officer	Bhutan Chamber of Commerce and Industry	
Sonam Pem, Ms	Gender Focal Person/Officer	Tarayana Foundation	



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