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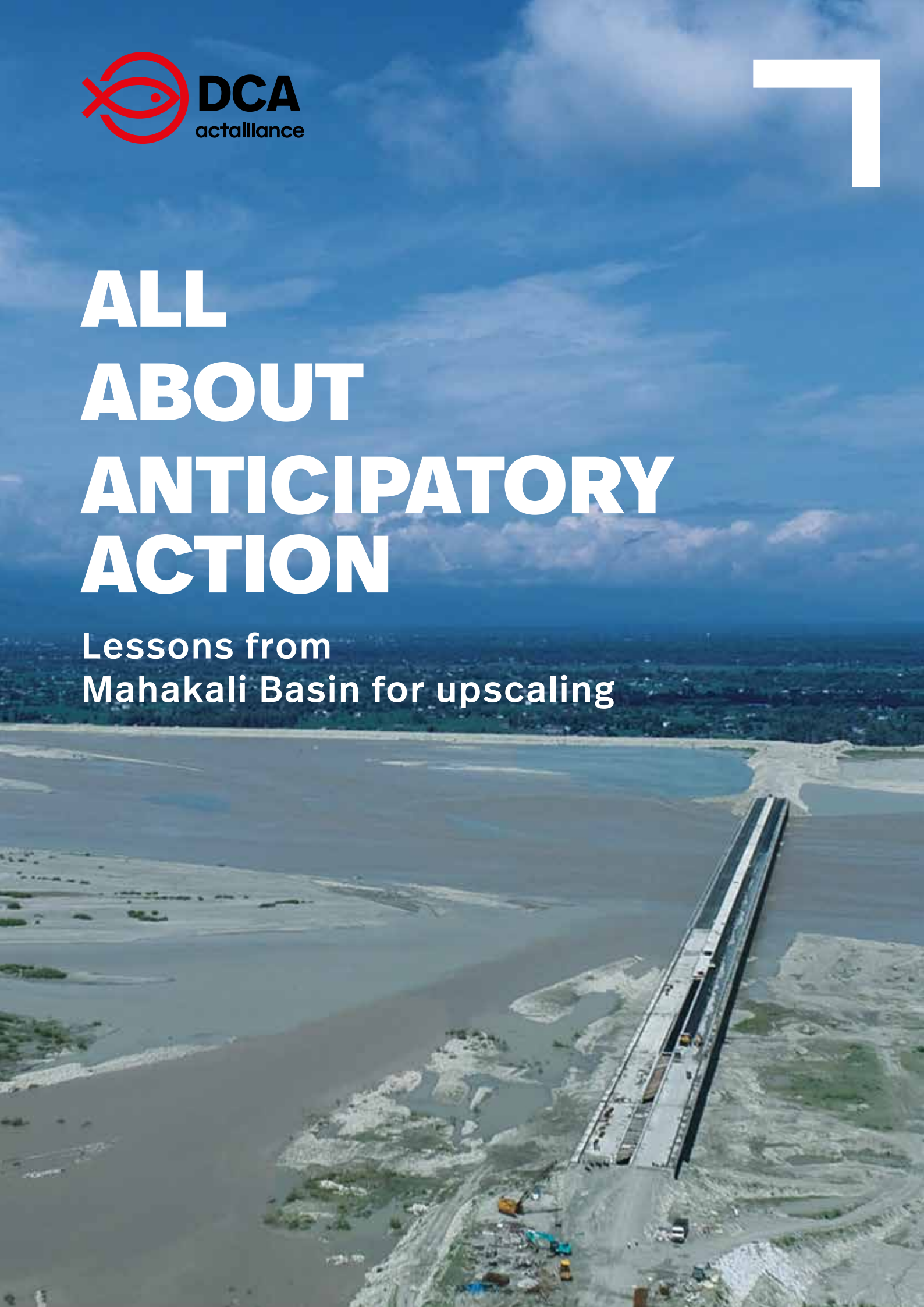
ALL ABOUT ANTICIPATORY ACTION

Lessons from Mahakali Basin for upscaling



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Executive Summary

Anticipatory Action (AA), a new concept of taking early actions before the disaster occurs, is gaining popularity among humanitarian organisations and rapidly growing over the years. United Nations Office of the Humanitarian Affairs (OCHA) has defined AA as 'acting ahead of predicted hazards to prevent or reduce acute humanitarian impacts before they fully unfold'. The Early Warning Systems (EWS) for different climate-induced hazards, such as flood and rainstorms, are evolving rapidly, helping to reduce the disaster impacts.

Highlighting the importance of AA, DCA Nepal, in coordination with Nepal National Social Welfare Association (NNSWA) and Institute of Himalayan Risk Reduction (IHRR), implemented a pilot research project titled 'B-Ready Project' in 2022 and 2023 in Dodhara Chandani Municipality in Sudurpashchim Province, Nepal. The objectives of the project were aligned with the AA, and the activities were designed and implemented in close coordination with the municipal authorities. The interventions were focused on strengthening the understanding of the climate-induced hazards and the operationalisation of early warning systems. The project piloted AAs for flooding and included early actions to issue flood warnings during times of disaster. Furthermore, the pilot research project also provided financial support to the vulnerable households to ensure preparedness and early actions.

By implementing a range of activities under a flexible approach and working with disaster risk reduction and management (DRRM) actors at the national, sub-national and local level, the project identified various gaps in the existing early warning system, including the capacity of local government and community to analyse forecasts and undertake anticipatory actions. This report highlights the key lessons drawn from the implementation of the project and the opportunities to strengthen DRRM system, specific to the project area. The coordination between the relevant stakeholders including the local government in planning and implementing the project activities was a key factor in achieving the project outputs.

The project supported review of existing flood warning system, including the flood forecasting in Mahakali River, which is a large transboundary river between India and Nepal. However, the limited availability of hydrological and topographical data of the river to assess the likelihood of flood hazard has impacted the research. Nonetheless, the study has identified barriers and challenges in developing flood early warning system in the transboundary river. Learning from these barriers and challenges, the project decided to carry out detailed cross-section survey of Mahakali River and establishing a Radar Level Sensor (RLS) with near real-time data sharing technology at newly constructed Four-Lane Bridge. The river water level monitoring at this point provides about thirty-five minutes lead-time to Kutiyakabar community at the downstream confluence of Mahakali and Jogbudha rivers.

As part of capacity development of the local government, the project supported to develop a Standard Operating Protocol (SOP) for forecast-based anticipatory actions of Dodhara Chadani Municipality. A simulation exercise was organised to test the capacity of municipality to implement the SOP. The exercise revealed a lack of capacity in the municipality to analyse the forecasts and develop advisories and determine triggers including proper alert and warning in time. Both municipality leadership and the project partners have realised need for the municipal staff's technical trainings to enhance their knowledge and skills. Similarly, strengthening the role of Local Emergency Operation Centre (LEOC) to analyse forecasts and develop advisories to the concerned communities and sectors is equally important.

The project implementing partners including the municipality understand that anticipated disaster situation may not occur, or higher order disaster may trigger. Therefore, it is always good to be prepared. The B-Ready strategies such as standing agreements with suppliers, prepositioning of rescue gears, provision of cash and its transfer mechanism in place, and allocation of funding for early actions are should be a part of regular disaster risk reduction and management policies and practices.

Photo: Nirmala Limbu

Section 1

INTRODUCTION

> The approaches of AA evolved through the graduation of early warning systems, i.e. responding based on the warnings before the disaster would hit the area. Globally, humanitarian agencies, including UN agencies have been piloting projects in different hazard and vulnerability contexts [1]. Experiences from the pilot projects show that the forecast-based actions are cost effective for disaster response and further benefit the vulnerable communities by making economic and non-economic recovery possible in the aftermath of a disaster [2], [3], [4], [5].

1.1 Background

Landslides and floods are functions of natural factors and human activities. Natural factors are geology, topography and climatic phenomena including rainfall and temperature. Human activities include changes in Land Use Land Cover (LULC), unmanaged drainage, modification of terrain slopes, and exposure of surface, among others. These factors act in tandem to develop a landslide and flooding. Intense and prolonged disasters such as rainfall in the watersheds, however, is major triggering factor for landslides and floods.

Most floods in Nepal are rainfall-induced and occur mainly during summer/monsoon (June – October). To this regard focusing on monsoon-induced disasters, the Government of Nepal has effectuated Disaster Preparedness and Response Planning Guideline, 2067 (First Amendment, 2019). This guideline mandates formation of the Disaster Preparedness and Response Plan (DPRP) across the three tiers of the government viz. the local, provincial, and federal level. At the federal and provincial level, sectoral agencies also prepare the DPRPs and lead respective humanitarian clusters[1]. Similarly, humanitarian agencies including the UN agencies and other non-profit/civil society organisations (CSOs) prepare their own DPRPs, often called as contingency plan or emergency response plan.

Technological advancement regarding weather and flood forecasting has now made it possible to provide with alert and Early Warnings (EW) to the vulnerable communities. This has also enabled disaster risk management actors to timely act on and prepare for anticipated disaster in their effort to save lives, protect assets, and livelihoods well before the hazard may hit the area. There are, however, unanticipated events because of sudden changes in climate which makes it difficult to prevent the impact of the flood. On the other hand, communities are forced, for different reasons, to live in the areas where flood is likely. Therefore, it

Photo: Nirmala Limbu

is essential to prepare for hazards thereby utilising forecasts to prevent the loss of lives and assets as well as to avoid or reduce impact of impending disaster. Such actions are called Forecast-Based Anticipatory Action (FBA), which build on Early Warning System (EWS).

DanChurchAid (DCA), Institute of Himalayan Risk Reduction (IHRR), and Nepal National Social Welfare Association (NNSWA) jointly implemented "Demonstration of scalable model of local led anticipatory humanitarian action in Mahakali River Basin, Western Nepal (B-Ready)". The pilot project was focused to develop Anticipatory Actions (AA) for the flood-prone communities in Dodhara Chandani Municipality, Sudurpaschim Province. The project worked with multiple stakeholders including local Community-Based Organisations (CBOs), municipality and relevant government agencies such as Mahakali Basin Office of the Department of Hydrology and Meteorology (DHM).

This document presents key lessons from the project. It discusses on the approach and outputs of the project including strengthening of flood EWS and a range of policy measures and practices carried out at the flood-prone communities and the municipality. By analysing barriers, challenges, and insights from stakeholders, this document provides lessons for improvement, replication, and policy uptakes to improve disaster preparedness and response through AAs.

1.2 Historical overview of anticipatory action

Forecast based actions are relatively new concept in humanitarian preparedness. They are evolving through practices in different regions and hazard contexts. All AAs have a common vision, i.e., to reduce disaster risk, avoid damages and losses, and minimise disaster impact. However, related initiatives or actions may vary, and the agencies or practitioners use different terminologies like 'anticipatory', 'early' or 'forecast-based' before 'action' with some divergence in understanding.

Photo: Nirmala Limbu

1. As per National Disaster Response Framework (First Amendment) 2075, there are 11 clusters at the federal level. Province, DDMC and Local Governments can have the clusters in different number.

The approaches of AA evolved through the graduation of early warning systems, i.e. responding based on the warnings before the disaster would hit the area. Globally, humanitarian agencies, including UN agencies have been piloting projects in different hazard and vulnerability contexts [1]. Experiences from the pilot projects show that the forecast-based actions are cost effective for disaster response and further benefit the vulnerable communities by making economic and non-economic recovery possible in the aftermath of a disaster [2], [3], [4], [5].

In Nepal, AAs comprise of providing multi-purpose cash, in-kind assistance, and services as immediately as possible once the defined triggers[2] are met. Nepal's disaster preparedness has adopted participatory approach ensuring inputs from multiple stakeholders in different stages of planning [6]. Building on the approach, Bhandari et. al. (2021) discusses a consultative and iterative process of developing and integrating the FBA into the DPRPs [7]. Over the past years, many agencies[3] have been implementing projects to pilot FBAs. The projects included various activities between a trigger and the anticipated hazard that would hit the concerned community.

1.3 Project Overview

The project was implemented for two years (2022 and 2023) in four major components:
Milestone 1: Risk assessment and early warning
Milestone 2: Early action decision-making SOP
Milestone 3: Implementation of anticipatory action including cash preparedness
Milestone 4: Community led anticipatory actions.

The goal of the project was, 'making communities resilient and enhancing their capacity to cope with disaster, respond effectively and save lives and properties'.

Photo: Nirmala Limbu

2. A trigger is a point of time to take pre-agreed action based on predefined threshold level of a phenomenon, often a hazard. For detail, please visit https://www.preventionweb.net/blog/well-designed-triggers-support-decision-making-anticipatory-action, last accessed on 20 December 2023
3. Several organisations including CARE Nepal, Danhurchaid (DCA), Mercy Corps, Nepal Red Cross Society (in association of IFRC, with support from Danish Red Cross and Finnish Red Cross), Oxfam, People In Need, Plan International Nepal, Practical Action, Save The Children, UNDP, UNFPA, UNICEF, and WFP have been implementing anticipatory actions through different projects and with partner organisations. UNRCO is taking lead for AAs implementation on behalf of UNOCHA.

To contribute to the goal, following three objectives were set:

(1) A functional, impact-based forecasting mechanism is in place to enable anticipatory action at Dodhara Chandani Municipality. In this objective, the project had strategy to co-design and test impact-based flood forecasting model for effective anticipatory action at Dodhara Chandani Municipality,
(2) Enhanced the capacity of local government and communities for taking early action by responding to the available forecast information, and
(3) Consolidated evidence and learnings to integrate forecast based early action approach into disaster preparedness and response policy framework at local to national/international levels.

In line with above objectives, the project expected to achieve following outcomes:

(1) Endorsement of AA protocols by all relevant stakeholders of Dodhara Chandani Municipality,
(2) Availability of functioning cash transfer mechanism for 567 households (HHs) ready to forecast-based action upon triggering, and
(3) Six CDMCs/CBOs demonstrably adopting anticipatory action measures to protect lives and livelihood assets through implementation of early actions.

The project provided trainings to the municipal officials, CBOs including youth volunteers and CDMC members on issues such as flood hazard and forecasting, early action and disaster response including safe evacuation, search and rescue, first aid, social counselling, and protection of vulnerable groups during emergency. The project supported the municipality to update its DPRP integrating forecast-based actions and prepare SOP to implement the FBAs. The project team also advocated at the sub-national and the federal level through policy dialogues and publications to institutionalise FBAs at a national scale.

The project conducted flood risk modelling for Mahakali river and inundation mapping of three major flood-prone wards of the municipality (Ward No. 8, 9 and 10) to identify the HHs in risks of flood. This was to strengthen impact-based flood forecasting in the flood-prone areas in the lower Mahakali River basin. Similarly, the project carried out HH vulnerability assessments with over 60 indicators. The indicators were developed with the municipal stakeholders to categorise the flood-prone area and HHs into highly vulnerable (indicated with red colour flag), moderately vulnerable (indicated by yellow colour flag) and least vulnerable (indicated by green colour flag).

The project provided trainings to the municipal officials, CBOs including youth volunteers and CDMC members on issues such as flood hazard and forecasting, early action and disaster response including safe evacuation, search and rescue, first aid, social counselling, and protection of vulnerable groups during emergency. The project supported the municipality to update its DPRP integrating forecast-based actions and prepare SOP to implement the FBAs. The project team also advocated at the sub-national and the federal level through policy dialogues and publications to institutionalise FBAs at a national scale.

Major project inputs related to the FBAs are listed in Table 1.

SN	Project Activities	Beneficiaries
1	Training to CDMCs on early warning and early action	CDMC Members - 329
2	Installation of audio added siren in one vulnerable community for hazard warning	Flood-prone communities in Ward No 10
3	Support for establishing a Radar Level Sensor (RLS) with near real-time data sharing technology at newly constructed four-lane bridge over Mahakali River in collaboration with DHM	
4	Training on mobilisation of youth volunteers on early action	308 people associated with CDMCs, Resilient Youth Network: 308
5	Design and implementation of Digital Cash Transfer System	As of 2023 December, 567 people opened bank account from Ward 10
6	Support municipality to develop the early action protocol, including SOP formulation workshops, draft review meetings	Total 39 municipalities and DRRM actors were engaged in formulating SOP
7	Simulation exercises and testing of forecast-based actions involving multiple DRRM actors	LDMC, CDMCs, Resilient Youth Network - 57
8	Identification of mass evacuation centres and establishment of basic infrastructure facilities–Safe Shelter and WASH facilities	Open spaces and safe evacuation platforms.
9	Support municipality to update DPRP including contingency plan linking to AA	The plan benefits whole municipality
10	Communication expenses to CDMCs' early warning focal persons during monsoon–mobile phone top-ups	All CDMCs in Ward 8, 9 and 10
11	Support communities to prepare anticipatory action plan	All CDMCs in Ward 8, 9 and 10

Table 1. Project activities

Section 2

METHODOLOGY

The project conducted several activities both at the national and international levels aiming at policy advocacy and facilitation of the exchange of learnings. These included sharing experiences and advocating for the institutionalisation of anticipatory actions.

2.1 The Project Area

The project focused on Dodhara Chandani Municipality, where communities are exposed and vulnerable to floods from the Mahakali and Jogbudha rivers. Therefore, the project reviewed the existing EWS to assess for its limitations and advancement potential to strengthen flood early warning capabilities thereby enabling the municipality to take necessary actions based on available messages, alerts, and warnings.

The project conducted several activities both at the national and international levels aiming at policy advocacy and facilitation of the exchange of learnings. These included sharing experiences and advocating for the institutionalisation of anticipatory actions. The project partners, including the municipality, were equally engaged at the national dialogues, while the project methodologies were disseminated at the international platforms such as Seventh Asia-Pacific Dialogue Platform on Anticipatory Actions held in June 2023 in Nepal, and the Asia-Pacific Ministerial Conference on Disaster Risk Reduction hosted in 2022 Brisbane, Australia.

Photo: Nirmala Limbu

2.2 Methodology

The learning analysis and documentation included a mixed method combining elements of quantitative and qualitative inquiry. The analysis largely depended on the review of documents (listed in Annex 2 and Bibliography), consultation with project beneficiaries and concerned actors including individuals, groups, and agencies. The project sites were visited to observe physical activities like river level sensor, hoarding boards, evacuation platform, and prepositioning stories in the project area. Major activities to learning analysis and documentation were the following:

- Review of municipal policies and plans, baselines, progress reports of disaster risk management.
- Review of project log-frame, work plan, and progress reports;
- Review of project publications including awareness raising, training materials;
- Consultation with the project team including implementing partners, concerned government agencies, NGOs, CBOs, and private sector;
- Consultation with the project beneficiaries, individuals, communities, and specific interest groups;
- Field observation; and
- Consultation with advocacy groups/networks on anticipatory action.

Photo: Suraj Gautam

Section 3

PROJECT OUTPUTS AND OUTCOMES

Considering the usefulness of the disaggregated database, the municipality requested the project to cover the whole municipality. Responding to the request, the project partners expanded HH vulnerability assessment through household survey to cover the entire municipality. The municipality officials were also facilitating the process with commitment to utilise the data and information.

Photo: Suraj Gautam

3.1 Outcomes

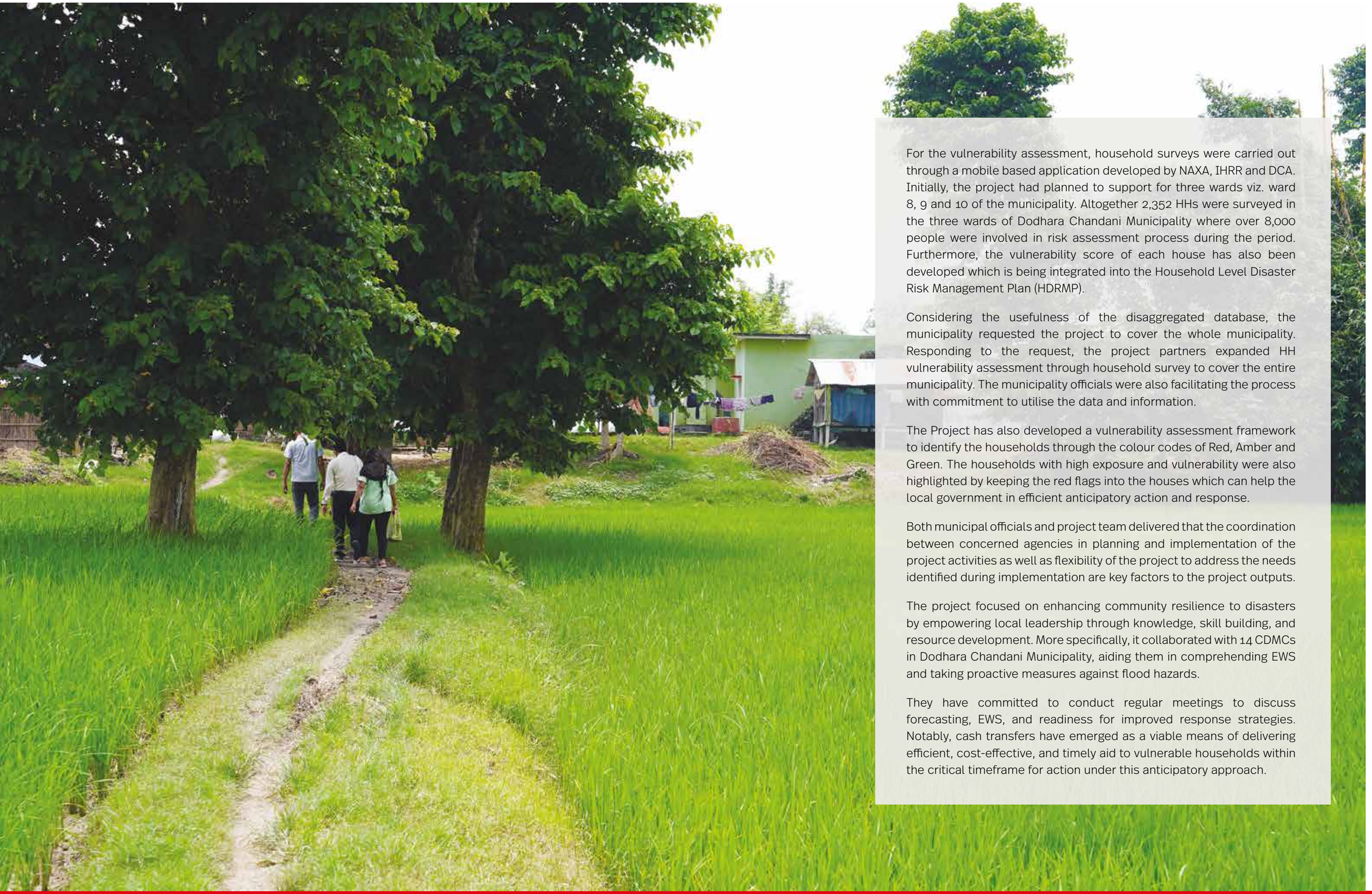
Major outcome of the project is institutionalisation of forecast-based anticipatory actions by the municipality through the endorsement of the Standard Operating Procedures (SOP) and integrating anticipatory actions into Disaster Preparedness and Response Plan (DPRP) of the municipality.

Furthermore, the DHM office for Mahakali basin realised the need to improve in the flood forecasting in Mahakali River and taking some technical initiatives and coordination despite the challenges due to the river being a border river between Nepal and India. National policy advocacy has drawn attention of policy makers at national level to institutionalise anticipatory actions in both policies and practices.

3.2 Outputs

The project developed a broad base of essential components on the AA in the municipality. This includes strengthened Flood EWS in the Lower Mahakali River and Jogbudha River in Dodhara Chandai Municipality. In this system,

- Weather forecast is received from the DHM and other sources.
- Rainfall and water/flood level in the upstream of Mahakali River is accessed respectively from rainfall stations, and water level sensors installed in the river followed by local observation at the community level. This includes both Mahakali and Jogbudha rivers.
- The likely flood forecasts made by the DHM disseminates to the community through Local Emergency Operation Centre (LEOC) of the municipality. A communication channel has been developed.
- LEOC accesses forecasts and issues advisories to the target communities, groups, and households to take necessary actions.
- Early response actions take place at individual/household, community, ward and municipal level.
- When necessary, support is sought from outside the municipality.



For the vulnerability assessment, household surveys were carried out through a mobile based application developed by NAXA, IHRR and DCA. Initially, the project had planned to support for three wards viz. ward 8, 9 and 10 of the municipality. Altogether 2,352 HHs were surveyed in the three wards of Dodhara Chandani Municipality where over 8,000 people were involved in risk assessment process during the period. Furthermore, the vulnerability score of each house has also been developed which is being integrated into the Household Level Disaster Risk Management Plan (HDRMP).

Considering the usefulness of the disaggregated database, the municipality requested the project to cover the whole municipality. Responding to the request, the project partners expanded HH vulnerability assessment through household survey to cover the entire municipality. The municipality officials were also facilitating the process with commitment to utilise the data and information.

The Project has also developed a vulnerability assessment framework to identify the households through the colour codes of Red, Amber and Green. The households with high exposure and vulnerability were also highlighted by keeping the red flags into the houses which can help the local government in efficient anticipatory action and response.

Both municipal officials and project team delivered that the coordination between concerned agencies in planning and implementation of the project activities as well as flexibility of the project to address the needs identified during implementation are key factors to the project outputs.

The project focused on enhancing community resilience to disasters by empowering local leadership through knowledge, skill building, and resource development. More specifically, it collaborated with 14 CDMCs in Dodhara Chandani Municipality, aiding them in comprehending EWS and taking proactive measures against flood hazards.

They have committed to conduct regular meetings to discuss forecasting, EWS, and readiness for improved response strategies. Notably, cash transfers have emerged as a viable means of delivering efficient, cost-effective, and timely aid to vulnerable households within the critical timeframe for action under this anticipatory approach.

Photo: Nirmala Limbu

The project trained 32 youths on basic search and rescue, first aid, camp management, protection, and other cluster related activities. Further to the action, the municipality developed a policy guideline to mobilise volunteers for DRRM interventions. A 'Youth Resilience Network' has been institutionalised in the municipality through the guideline. Altogether 118 youth members from across the municipality were engaged in the Youth Resilience Network. Further, project partner NNSWA also helped the municipality develop a roster of DRRM volunteers in the municipality.

The project supported municipality and CDMCs) to strengthen disaster preparedness and response. The support involved training on EWS understanding, search & rescue, first aid, humanitarian principles as well as material and equipment such as a motorboat, an electric siren that can be operated remotely, and establishment of river level sensor at the bridge down the Sharada barrage.

The project also supported the municipality in developing SOP for FBAs. The Municipal Executive endorsed the SOP on 13th August 2023 which was published in the municipal gazette. The municipal DPRP has been updated by including FBAs. Community based mock-drills and table-top simulation exercises were organised, which strengthened coordinated actions between sectors and stakeholders. The mock-drill exercises provided the opportunity to test the plan as well as the SOP.

During the updating of the DPRP, the municipality and the communities have identified evacuation shelters, escape routes, and have discussed about the actions that would follow a forecast with different lead-time for readiness and action. The municipality had initiated a standing agreement with the food grain suppliers, had kept open spaces ready for temporary shelter and requested stakeholders to remain at ready position.

NNSWA has concluded MOU with the concerned CDMCs and School Management Committees (SMC) to transfer funds to the latter in the event of flood and for temporary evacuation. This commitment enabled the CDMCs and the schools to invest their funds and manage things in credit. The review of the documents and consultation with the stakeholders revealed that the municipality and the stakeholders have institutionalised the FBAs, however, the capacity is yet to test in real-time flood event.

Over the recent years, in humanitarian actions, cash is seen as the best option to deliver effective assistance both in terms of delivery and cost, within a short window of time available to the FBAs. Therefore, to smoothen the cash transfer during the emergency, the project has established a digital cash transfer mechanism at the Municipal level. Sunrise Bank Ltd. along with the municipal authorities have worked together to help members of the most vulnerable households of the flood-prone areas to open bank account. As of December 2023, 567 highly vulnerable households from Ward No. 10 have opened and maintained their bank accounts.

In 2023, amidst the looming threats of floods in Dodhara Chandani ward no. 10, the project implemented a Group Cash Transfer approach as a strategic measure to mitigate the potential impact of the flood. This approach involved the coordinated disbursement of cash assistance to community members enabling them to undertake flood prevention activities in anticipation of the forecasted heavy rainfall over three days. Recognising the imminent danger, the community mobilised the local resources and expertise, employing materials readily available in the area such as bamboo, sand, and sacks to fortify their defences against flooding. These materials were utilised in the construction of barriers, embankments, and other makeshift structures aimed at diverting or containing floodwaters thereby safeguarding lives, property, and livelihoods. The Group Cash Transfer mechanism facilitated swift and targeted assistance, empowering community

Photo: Suraj Gautam

members to take proactive measures tailored to their specific needs and circumstances. By providing financial resources directly to the affected population, the project fostered a sense of ownership and autonomy, allowing for the implementation of localised and culturally appropriate flood control strategies.

Learning from the project implementation, NNSWA has established contingency fund to promote anticipatory actions at organisational level. NNSWA has also established its own mechanism to mobilise money transfer services for effective and timely distribution of cash support for the households who do not have their bank accounts for various reasons.

Photo: Suraj Gautam

Locally-led planning by the governments and humanitarian organisations, access to finance and risk data, and the operational readiness of local actors are all essential prerequisites for ensuring the effective implementation of anticipatory action at the local level. Local actors play a crucial role in driving the transition towards anticipatory action. With their continuous presence on the ground, deep contextual understanding, and established relationships with local structures and communities, the local actors bring unique value to anticipatory action efforts. One of the key success factors of the project was the successful engagement with the local government, which was pivotal for strengthening the systems. Equally important was fortifying the linkages between the local, provincial, and federal governments to scale-up anticipatory action. The local actors, including the local governments, participated in numerous policy dialogues and knowledge-sharing workshops, facilitating the building of confident ownership, and evidence-based policy advocacy for anticipatory action.

The sharing of good practices in improving disaster preparedness and response have contributed to help develop positive attitudes among the government and the donor agencies towards FBAs. The project results have encouraged the municipality to institutionalise the piloted activities through the SOP and generate further evidence for improvement and upscaling. Other studies also suggest that there is a need of robust evidence base to improve future policy and programming on anticipatory action [4].

Section 4

CHALLENGES, BARRIERS, AND SOLUTIONS

> The warning and danger levels in the transboundary river were found to be determined from the historical experiences and scenarios, rather than utilizing high-resolution hydro-met datasets and cross-section surveys in the region. These limitations, combined and in isolation, restricted the identification of effective threshold and lead-time for the communities residing in the flood-prone areas.

One of the most important challenges in the Mahakali basin is to develop a robust flood-forecasting model. Mahakali River is a transboundary river and almost 65 percent of its total catchment falls in India. Assumingly so, Nepal has a very limited access to data of rainfall of the areas in India. Similarly, historical discharge data of Mahakali River were not available for this study. In Nepal, meteorological stations are scantly distributed at the higher altitude regions and have limited hydrological stations.

As a transboundary river, the measurement of discharge on a regular basis is extremely difficult as no time series data were available. Recently, the DHM has installed RLS station at Dattu of Darchula district and Parigaon of Dadeldhura District (i.e. 32.5 Kilometres up to the upstream of Sharada Barrage, 38 Kilometres up to the Four-Lane Bridge[4]). These stations are capable to detect the river water level but not the discharge.

Further, in the downstream there are two controlled structures across the river, i.e. Tanakpur Barrage and Sharada Barrage thereby obstructing free open channel river flow. Both barrages are operated by India, which raises uncertainties regarding the quantity and specific conditions during which the water is released down the river. Therefore, the study team found it difficult to develop a representative model for the flood hazard due to limitations in hydrometeorological data.

Similarly, it was found that the warning and danger level of the DHM reports are also derived based on the experience irrespective of high-resolution datasets and modelling in the region. These limitations, combined and in isolation, restricted in finding threshold and lead-time for the communities residing in the flood-prone areas.

Photo: Nirmala Limbu

4. The measurement was taken in Google Earth Pro following Mahakali River path.

Furthermore, Jogbudha river, which originates in the Indian Siwalik, is also a transboundary river and has no measured discharge data (Figure 1). Generally, during monsoon, water level in Jogbudha-Mahakali confluence rises if the water from the Sharada Canal is released into the river and this is very common irrespective of any rainfall in its catchments. In the past, there was an incident of Jogbudha river getting flooded in the month of December, even when there was no precipitation in the catchments. The flooding was due to the release of excessive amount of water from Sharada Canal. On the other hand, Jogbudha river faces back flow if the flood level is high in Mahakali. In the year 2021, the peak flow in Mahakali river blocked Jogbudha thereby causing a backflow overtopping the bank and inundating settlements and farmlands.

Through this study, the project decided to conduct a detailed cross-section survey of Mahakali River and establish a RLS with near real-time data sharing technology at the Four-Lane Bridge (shown in Figure 1). River water level monitoring at this point provides about 35minute lead-time to Kutiyakabar community at the confluence of Mahakali and Jogbudha rivers.

Figure 1. Mahakali and Jogbudha River in Dodhara Chandani

To cope with the challenges mentioned above, the study developed flood hazard model for a small reach of about 12 kms downstream from Sharada Barrage to Kutiyakabar. This was based on an assumption if excess water (beyond the design/operation capacity of the barrage) is released downstream. The model included the discharge of Jogbudha river and analysed peak flood for different return period considering the impact of climate change scenarios. This model identified opportunity time and safe places for evacuation of communities and their assets to safety before the flood would hit the area. The flood that hit on 21 October 2021 was taken as reference scenario for rainfall to run off model and inundation (Figure 2). The flood marks on the house walls, tree branches contributed to validate the model results.

As seen in the zoomed out figures of different inundation scenarios in Figure 2, the modelling showed that the local observation in the downstream of Sharada Barrage still has potential to save lives even during extreme flood events with about 35 minutes lead-time. The concerned authorities can alert communities through Audio Emergency Warning and Notification System (AEWNS), a remotely operational electric siren, which is installed over the top of a building in the project village with the support from the project. Other sources of communication are telephones, online messenger group(s) including WhatsApp, and Viber. Communities have initiated the local observations of the flood as well as receiving rainfall and flood forecasts.

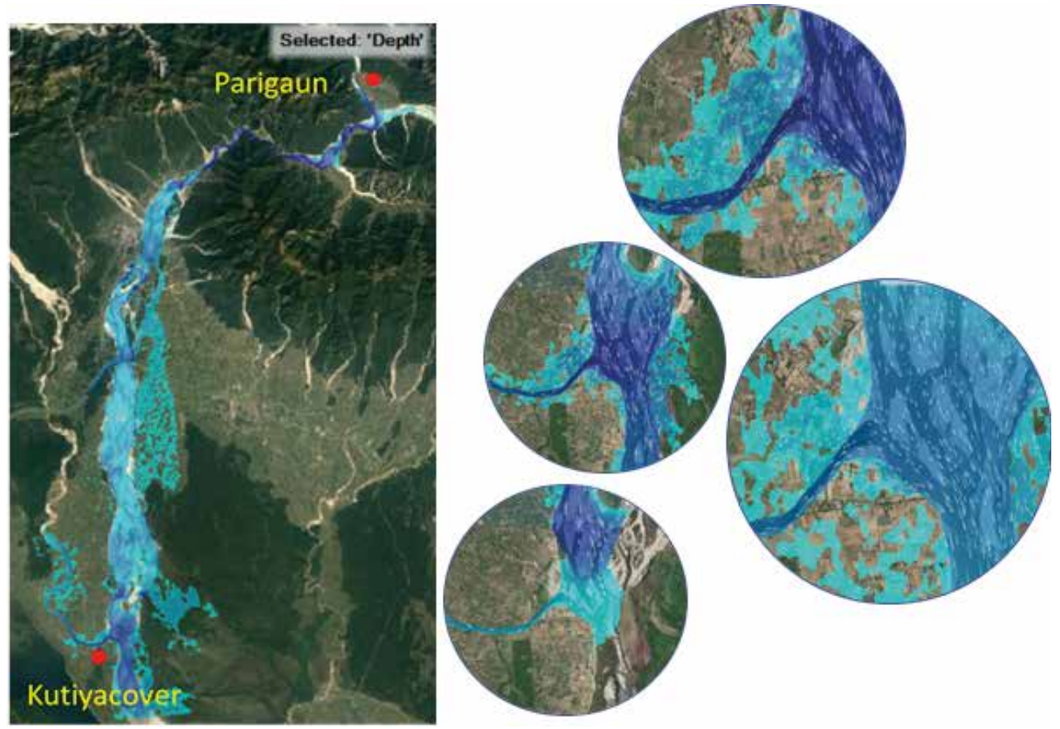


Figure 2. Inundation map generated from flood modelling

The flood model helped understand the limitations in existing warning and danger level as well as flood travel time set by the DHM in Parigaun. There was a lack of comprehensive rainfall data, and river discharge including its tributaries, which impacted the study.

Since both rivers are transboundary rivers, use of advance technologies such as drone to map the area was not possible. This limitation led to measure the cross-section of Mahakali River where both sides of the river fall in Nepal such as across the Four-Lane Bridge that connects Bhimadatta Municipality and Dodhara Chandani Municipality. It let the stakeholders realise the importance of coordination and collaboration with Indian authorities in strengthening reliability of flood EWS. Furthermore, a data sharing culture must be established for better formulation of AA in the region.

Flexibility in the project to implement new ideas and identified needs during the project implementation has helped overcome a few barriers, identify challenges, and carry out possible solutions. Each anticipatory action project should have flexibility to make instant decisions based on the available information at the time of action. Flexibility is a key success factor in managing uncertainties of weather-induced hazards. There can be various unprecedented situations arising between a forecast and disaster shock. Strategic and instant decisions are important to overcome such challenges arising out of uncertainties.

The project team have concluded that further efforts are necessary to improve flood forecasting through a robust rating curve development. This requires long-term time-series data. Also, as a prerequisite, reliability of weather forecasts is expected from the DHM while local observation and flood monitoring is important to verify the flood hazard model. All the efforts will collectively support in strengthening of AA and disaster response.

It was highlighted during the consultation with the local government authorities that institutional capacity is currently low, and its strengthening is essential for the local monitoring, analysis of rainfall and flood forecasts, developing advisories, efficient and effective communication, and anticipatory response. The SOP authorises a task group comprising of officials from different sectoral units in the municipality to analyse available forecasts and develop locally suitable advisories for forecast based anticipatory actions. The project also supported a simulation exercise to test the capacity based on the SOP. The learnings from the exercise revealed gap in the municipality's capacity vis-à-vis analysing forecasts and developing advisories and determining triggers including proper alert and warning in time.

Although the local observations, surveillance, and monitoring of flood have been set up in the vulnerable communities, lack of forecast analysis will limit the AA and timely response in the event of a disaster. Currently, the project is supporting the task group to analyse the weather forecasts and flood warnings that are available from the DHM and other public domain, and to develop advisories. This will require enhanced capacity of the both the municipality leadership and the project partners, in particular, training on analysing forecasts and developing appropriate advisories.

Since this chapter is also about offering solutions, a list of the same, based on the experiences of the implementers and observation/analysis of the study team is recommended. The solutions, however, need to be presented as a list of best practices, not recommendations.

Photo: Nirmala Limbu

Section 5

LESSONS LEARNED

The municipality faced various challenges while responding to 2021 October flood. According to municipal authorities, they faced challenges during data collection of loss and damage and affected families. It was also found that information and data were duplicated, and frequent false information were observed in the past that raised question on the authenticity of actual loss and damage data.

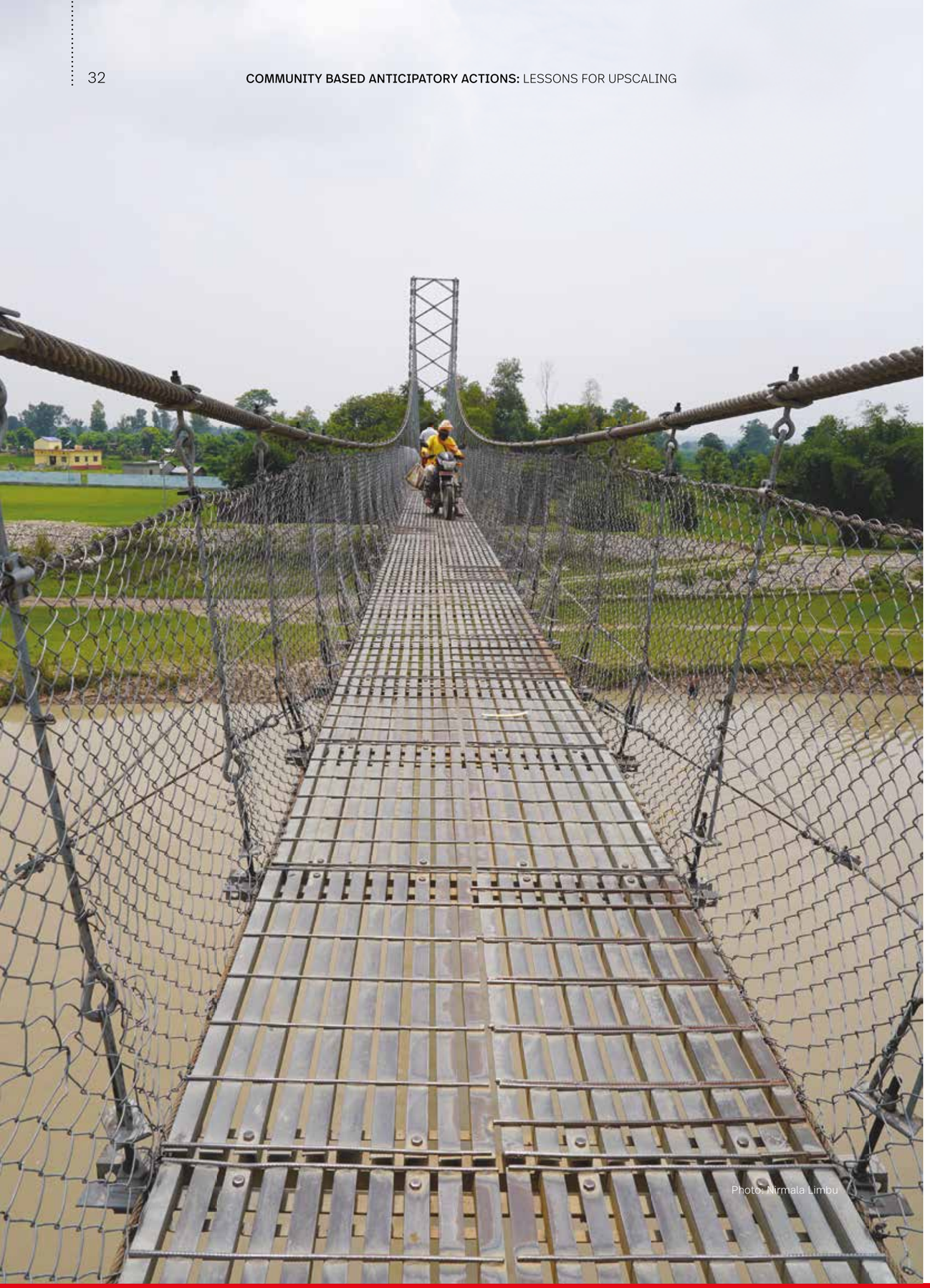


Photo: Nirmala Limbu

5.1 HH Vulnerability Assessment

"Indicator based household vulnerability assessment is comprehensive and transparent, but it is costly and time consuming specially to update annually. Efficient, rapid approach, and tools are essential to review and update household vulnerability", said DRR Focal Person of Dodhara Chandani Municipality.

Due to lack of spatially disaggregated household data, the municipality faced various challenges while responding to 2021 October flood. According to municipal authorities, they faced challenges during data collection of loss and damage and affected families. It was also found that information and data were duplicated, and frequent false information were observed in the past that raised question on the authenticity of actual loss and damage data.

The household characteristics and coping strategies in the communities have been further differentiated by the culture, values, norms, and beliefs. The communities are composed of families with different social, economic, and cultural backgrounds. Therefore, the response of each household or a group of households towards the crisis may differ. Thus, conducting HH level vulnerability and risk assessment are essential. The household vulnerability assessment used over 60 indicators to assess household vulnerability depicted to be reasonable for the better planning of AA. The indicators were analysed using the Multi-criteria based Decision Analysis (MCDA) adopting Analytical Hierarchy Processes (AHP) algorithm. An HH-level vulnerability model was developed indicating the high (red) medium (yellow) and low (green) vulnerable HH. Table 1 depicts dimensions and their components of vulnerability.

Index	Dimension	Component
Household Vulnerability Assessment (HVA)	Economical	Food consumption score
		Safety nets
		Assets possession and insurance
		Livelihood
	Attitudinal	Exposure
		Attribution to the guidelines and by-laws
		Household coping strategies
		Susceptibility to losses
	Physical / Infrastructural	Access to services
		Communication
		Building location
		Building details
	Social	Social interaction
		GEDSI
		Characteristics
		Proximity
	Institutional	Resource availability
		Skill support
		Institutional support
		Knowledge

Table 2. Household vulnerability criteria and indicators

The household vulnerability assessment considers five different dimensions of vulnerability indicators: physical, social, economic, institutional, and attitudinal dimensions. These dimensions and underlying indicators were discussed and agreed with the municipal authorities and community groups. Under each dimension, there are four components and each component further features three parameters. Each parameter is assigned a score ranging from 0 to 1. Table 2 provides synopsis of these dimensions of vulnerability, their factors and different parameters chosen to evaluate each component of the factors.

In the project area, the recurrence of flooding has considerable impacts on the elements-at-risk such as population, roads, etc. Generally, community who are exposed to frequent hazards should be better prepared compared to those who are less exposed. This is, however, not the case in the project area. Poverty, lack of access to services, and magnitude of hazard are aggravating vulnerability, and thus preparedness and Forecast-based anticipatory actions can help reduce the impacts of potential disaster by giving an ample amount of time to prepare and improve the situation.

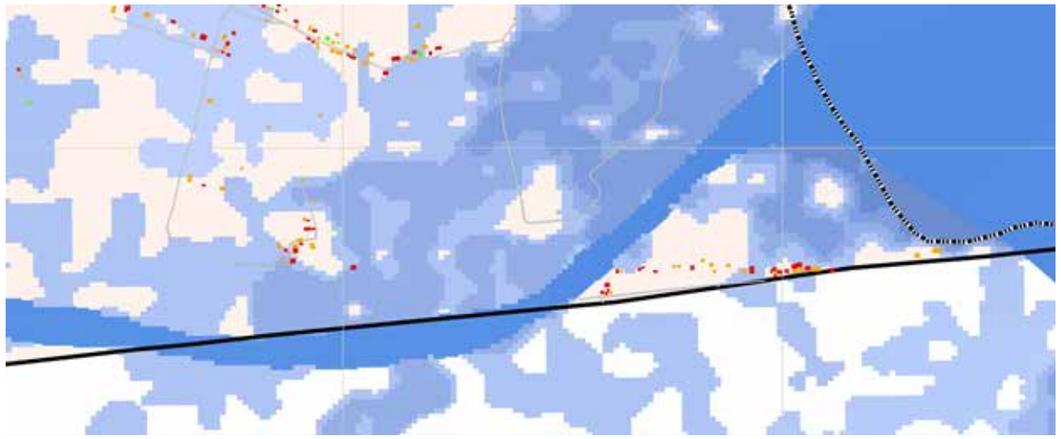


Figure 3. Inundation map of the communities at the confluence of Mahakali and Jogbudha River

Note: The dots in Figure 4 show location of households. The inundation was verified based on 2021 October flood.

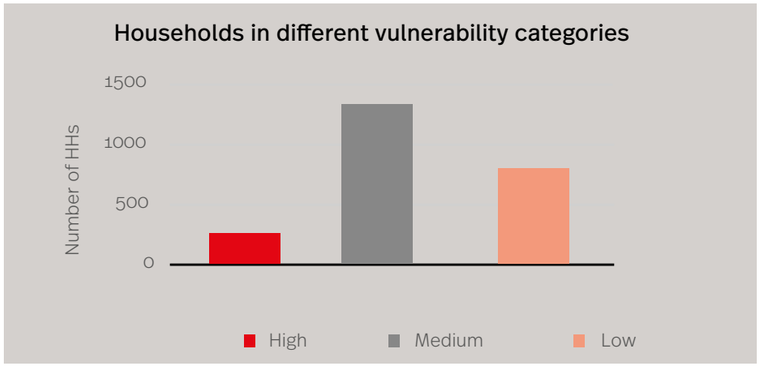


Figure 4. Households in different vulnerability category (Ward No 8, 9 and 10)

The learning from this analysis, therefore, suggests detailed indicator-based evidence to segregate a household into specific category of vulnerability which could help in setting prioritising to the access to support with much reduced contentions. The process, however, is protracted and may be cumbersome as well as expensive to update every year. The vulnerability depends on different changing factors and thus is dynamic. An efficient process needs to be employed to update the vulnerability of households while updating DPRP.

5.2 Flood Hazard Modelling

Transboundary river poses additional challenges in accessing data and setting up of early warning system. In such situation, the local observations are often only options as last mile solutions. The modelling provided opportunity to identify gaps in data and areas to improve flood forecasting in Mahakali River.

Improving flood forecasting was one of the priorities and important component of the project. Several efforts were put towards accessing data and develop a robust model. However, several factors that affected flood forecasting and inundation mapping. The flood hazard modelling was expected to include the following:

- Flood travel time: a matrix for different discharge at a hydrological (forecast) station such as Parigaun. This would also serve to specify trigger for different rainfall patterns– more specified to the basin from the general national thumb rule of accumulated rainfall.
- Inundation zoning: a map delineating the area that would be flooded by different levels of flood (i.e. discharge) at a hydrological station. High-resolution data is required for terrain analysis and running inundation model. While there is lack of accurate data, more error margin is suggested for inundation mapping. The uncertainty therein should be managed through real-time observation and precautionary actions in the vulnerable communities. In the context limited by the lack of comprehensive data, the project adopted the local observation through household level inundation marks to support last mile decision-making.
- Warning and danger level identification: rainfall, flood level and impact matrix would be helpful to decide on readiness triggers and action triggers. It needs comprehensive hydrometeorological data for many years to model the flood hazard and determine warning and danger level. It also warrants real-testing and intermittent verification of the model outputs. Furthermore, amount of discharge through structures like barrage should be readily available.

The inundation zoning and flood modelling for a transboundary river like Mahakali would require effective data-sharing and coordination mechanisms for accessing meteorological and hydrological data among countries sharing the river. This should be supported by appropriate actions from the authorities and stakeholders. Furthermore, strong upstream-downstream linkage is imperative among the authorities and the associated communities. Establishing a transboundary civil society network of organisations and individuals can be helpful in data sharing as well as alert and warning to downstream communities in both countries.

From the flood-modelling and inundation mapping, the project team, the municipality and the DHM officials realised that an automatic River Level Sensor (RLS) at the Four-Lane Bridge (shown in Figure 1) can be helpful to provide alert and warning to the vulnerable people in the downstream. Later through calculation, it was identified that there would be about 35 minutes lead-time for the communities from the Four-Lane Bridge to the confluence of Mahakali and Jogbudha rivers. Similarly, time-series data from the station can be used to develop a rating curve in the long-run, which can help improve efficiency of the EWS. Building on the above learning and potential of the RLS, the project supported the DHM to establish a RADAR technology based RLS at the Four-Lane Bridge, Mahakali river (Figure 6).

Photo: Nirmala Limbu

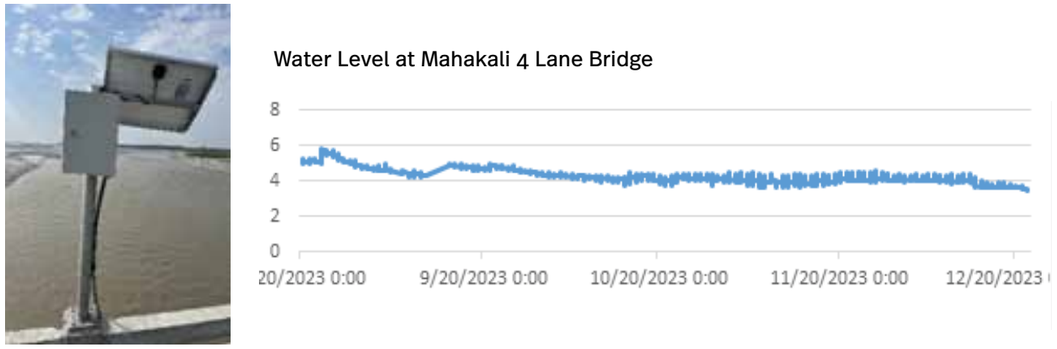


Figure 5. River Level Sensor and its reading record

The project also supported this station while coordinating with Dodhara Chandani Municipality and the downstream communities' CDMCs. The data from the RLS can be accessed from the DHM website. Despite having the controlled structure at Tanakpur and Sharada Barrages, the downstream community of Kutiyakabar can receive information about the water level at Four-Lane Bridge and take anticipatory actions. This was possible because of the close coordination of the project with the DHM in flood modelling and mapping. Also, this action became possible due to flexibility of the project to make instant decisions for innovative and needful investments.

These interventions and the ouptuts suggest that coordination with the concerned actors helps institutionalise system strengthening such as the EWS. Similarly, flexibility in terms of making needful adjustement in the plan, activities, and budget allows spaces for innovations. Such innovations might not be apparent at the outset of the project in all cases.

5.3 Early Warning Systems

Capacity of the municipality, particularly the LEOC and the CDMCs, needs to be improved significantly to access and analyse weather and flood forecasts, develop advisories and mobilise resources for anticipatory actions.

Reliable EWS is fundamental to disaster preparedness and anticipatory actions. It constitutes understanding of the associated risks, monitoring of hazards and their factors of progression, forecasting disaster risk, communication, and dissemination of forecasted risks, and finally taking risk prevention, reduction actions thereby protecting lives, assets, and livelihoods before the forecasted hazard hits the area. It entails the provision of institutional structures, plan and protocol, physical infrastructures like evacuation camps, materials and services, and financing. Therefore, important components to be considered in the EWS at the municipality level are:

- Institutional structures and coordination mechanism(s);
- Forecast analysis, warning, and advisory development;
- Anticipatory actions following a forecast or warning considering available lead time; and
- Communication efficiency and effectiveness.

Photo: Suraj Gautam

The study team found a set of institutional structure in the municipality including at the ward and the community level to receive and disseminate forecasts and warnings. The stakeholders we interacted with, however, also pointed out a need for analysing national or regional weather forecasts to assess localised impact and develop an advisory accordingly. Therefore, a multi-disciplinary team has been formed by the municipality to support LEOC in this regard.

The municipality has also prepared a communication mechanism for early warning and emergency management. A 'communication tree' connects the authorities, DRRM actors, and the vulnerable people through different media including telephone, SMS, social media, online messenger groups, megaphones announcements, and sirens.

There are, however, issues related to false alarms as well. A CDMC member, in this regard, shared, “Sometimes there are incomplete or false messages. Often these messages do not include potential impact; there are only instructions to remain alert. And it is based on only 35 percent catchment of the river”. Such issues should, therefore, be mitigated. The communities were found to have come up with their own approaches in mitigating such problems. The local observation, follow-up on the received messages, and becoming vigilant are often used as important strategies to cope up when the forecasts are not reliable. Therefore, enhancing reliability of forecasts is paramount, the role of LEOC to analyse forecasts and develop advisories should also be strengthened. The SOP for FBAs has provisions and chronologically defined activities mandated as the LEOC functions and duties it must carry out while seeking support, when necessary, from other units of the municipality and supporting agencies. Based on the SOP provisions and regular monitoring of forecasts and potential scenarios, the warning and advisories are developed thereby contributing to decision-making at the community and municipal level.

5.4 Anticipatory Actions

Flexibility to make instant decision and switching project resources to the needs of the time is of utmost importance in anticipatory action projects. Flexible budgets help to tap opportunities to take innovative and effective anticipatory action.

Together with strengthening of EWS, the project had planned early actions to implement following readiness triggers and warnings (action trigger). The DPRP of the municipality and the SOP of FBAs include these activities. As one of the DRRM actors in the municipality, the project has activities to contribute to the DPRP and test the SOP following a common goal and differentiated actions of the actors. Special attention was given to minimise confusion and distrust due to false alarms. The project has organised several meetings with the concerned communities, conducted training sessions, and simulation exercises to prevent misconception, and deepen understanding of the people about forecast-related uncertainties.

Although there have been several good practices and outputs of the project, evidence to support and prove cost-effectiveness, efficiency, and loss & damage reduction impact of the anticipatory actions is not strong. This is, however, not a shortcoming of the project design or implementation. Since the project inception, there hasn't been any extreme event. Although many preparedness activities like prepositioned resources for rescue and relief have not been brought to use, bank accounts of the vulnerable families have been useful for saving and receiving remittance for the beneficiaries. This suggests a lesson for the project implementing partners including the municipality:

An anticipated disaster situation may not occur but there is no harm to be ready and vigilant. Standing agreements with the suppliers, prepositioning of rescue gears, provision of cash and its transfer mechanism in place, and allocation of funding for early actions, among others, are set to be proved vital during occurrence of any disaster events in the future.

Investment in building resilience helps build ground for anticipatory actions, and success of anticipatory actions leads to resilience in many ways. Series of studies by Courtenay Cabot Venton [8], [9], [10] with the support from various experts identified that investing in longer-term interventions that support resilience should be prioritised, alongside ongoing early responses to humanitarian needs.

> The project has organised several meetings with the concerned communities, conducted training sessions, and simulation exercises to prevent misconception, and deepen understanding of the people about forecast-related uncertainties.

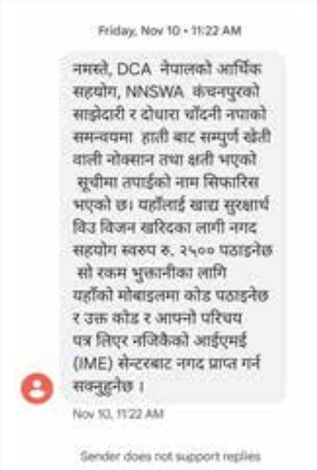


Figure 6. SMS to a cash recipient

Photo: Nirmala Limbu

Cash-Based Approaches

Cash-based approaches are relatively new, adopted by development and humanitarian agencies to development and disaster risk management projects [11]. Different studies have identified multipurpose cash supported recipient households in many ways to cope with shocks and disaster impacts.

The project adopted cash-based approach to support vulnerable households in taking anticipatory or early actions. The project supported to open the bank accounts of 567 highly vulnerable households in Dodhara Chandani -10. Agencies can use that information to transfer cash to the households following the cash transfer guideline of the municipality. NNSWA itself also has opened its own money transfer system on IME where bank accounts were not operated. Through IME, cash was supported to 84 families, whose crops were damaged by wild elephants. NPR 2500 was provided to each family to buy seeds and for food security (Figure 6). Recipients of the cash shared that the cash helped to buy seed, fertiliser and other essentials as per the need of the family. Reportedly, there was no case of the misuse of cash.

Although there remains risk of misuse of cash, proper social mobilisation has helped to minimise the risk [12]. The project works together with the municipality and

has strong social mobilisation component. In response to the question of how they would use cash if they got it after a 15- and 7-day forecast of heavy rain and flooding, the respondents in the flood-prone community indicated that they would use the money to move their movable assets to safety, such as hiring a vehicle and making arrangements for other necessary items for the family during flooding.

There has not been real-time experiment of cash support following a forecast, despite written commitments provided to CDMCs and School Management Committees. They were informed, however that NNSWA would provide cash for evacuation and camp management. Therefore, there is lack of empirical evidence and further research is needed to determine appropriate approach of cash transfer including amounts for anticipatory action to different vulnerable groups and households.

5.5 Institutional Base

Robust and efficient institutional structure extended to vulnerable communities is necessary to effective forecast based anticipatory actions. This entails to availability of trained human resources, machines and equipment, physical infrastructure and clear plan of actions tested through practical exercises.

Since the scope of DRRM falls on the authority of local level as well as concurrent authority of federal, provincial and local level, there are several policy documents at all three levels of governance. Moreover, District Disaster Management Committee periodically implements different policy decisions, related to disaster preparedness and response. There is a challenge to harmonise between these policies. However, there has been more or less uniformity and harmony in disaster preparedness and response planning, which is guided by federal guideline [8]. Local governments have also developed DRRM related act, rules, plans, SOPs and guidelines to institutionalise the DRRM at their constituencies. Dodhara Chandani Municipality has also developed different policies in this regard.[5]

Photo: Nirmala Limbu

5. DRRM related policies developed by the municipality are listed in annex 2. The project supported in developing some of the policies. It is worth noting that more than one organisation/project team may have supported in the process of policy and plan development while overall leadership is taken by the municipal units.

Municipal officials are proud of having policies, plans, and guidelines in place for disaster preparedness and response. They claimed, “We have the best DRR policies in the district. Our development partners contributed a lot to make it possible”. The project supported to prepare volunteer mobilisation guidelines and SOP for forecast-based actions as well as updating DPRP. Municipal authorities regarded this support as key milestone in institutional strengthening. The SOP will provide hands on guideline to do activities in sequence following forecasts and warnings with different lead-time. The Disaster Focal Person and the IT Officer of the municipality said that the SOP provides guidance to staffs and stakeholders with their role in different situations. They are confident that the SOP can be updated based on the learning from its implementation. The SOP is developed for multiple hazards (both slow onset and rapid onset) to which the municipality is exposed.

During the development of SOP, they realised that a multi-sector team is required to support LEOC to analyse forecast and its impact on different sectors, and develop advisory to different communities, actors and stakeholders. Therefore, there is a provision of a multi-disciplinary team to institutionalise forecast-based actions.

Along with household level vulnerability data, municipal officials are hopeful that they will be able to manage relief distribution and recovery support more accurately and fairly. Earlier, there was challenge to maintain uniformity, equity and justified distribution of relief.

The municipality has allocated a responsible official as focal officer to DRRM. Similarly, IT and Information Section looks after DRRM database and LEOC operations. Other sector section/official are also provided with appropriate roles and mandates in their respective sectors. At the municipality level, a Municipal Disaster Management Committee is functional in leadership of the Mayor. Ward Disaster Management Committees are functional at each ward and there are CDMCs in vulnerable communities.

Photo: Nirmala Limbu

These CDMCs have prepared their anticipatory action plans with the support from the project. The process helped them to know about the sources of weather forecast, early warning and devise strategies of anticipatory actions based on the forecasts and warnings with different lead-time. All CDMCs have trained task forces for early warning, first aid, search, and rescue. Moreover, the CDMCs has emergency fund, which they can utilise for emergency response.

Besides DMCs at municipality, ward and vulnerable communities, there is a Youth Resilient Network. The network is institutionalised by 'Dodhara Chandani Resilient Youth Network Formation and Mobilisation Procedure, 2079'. The network has currently 118 members from across the municipality. However, there is challenge to retain members in community as most of the youths migrate out in search of employment. The projects should consider enhancing youth capacity for entrepreneurships, self-employment. Most of the project support on livelihoods and income goes to vulnerable households.

It is an important lesson that projects on anticipatory action, despite their focused role to the activities between a forecast and event, shall reprioritise to support youth in the community such that anticipatory action is better institutionalised, the community have better preparedness and response capacity, and there is bigger impact in resilience building.

Contemporary projects often prioritise specifically vulnerable groups like persons with disability, old age people, children, pregnant and lactating mothers and socio-economically marginalised people.

Photo: Nirmala Limbu

5.6 Community Participation and Leadership

After LEOC, CDMCs are the key actors in the FBAs, and their leadership and proactive actions lead to success. The better community actions, the better success in utilising forecasts to save lives, assets and mitigate disaster impacts. Community priority and perspectives should be at the centre of every input.

The project considered community participation and their leadership as the centre of concern to prepare for and respond to impending disasters focusing on flood. The community consists of both local and migrated families from across the country, heterogeneous in terms of their social norms, and traditions. They are organised into CDMCs and are recognised by the local government, other DRR actors and the project. The CDMCs implement project activities and are consulted in activities like providing training, building safe evacuation platforms, shelters, identifying or categorising vulnerable households and specifically vulnerable persons as well as mobilising communities. The community regards I/NGO support as very important and crucial in coping with floods and other hazards and building resilience.

The project interventions and their implications have generated important learnings in community participation and leadership in anticipatory action. The Youth Group for Resilience shared a case that there were only three people trained for search and rescue, with two of them currently employed in India. In an incident during disaster response, they realised that the team was not able to perform task effectively. The task requires at least four people to rescue a casualty, such as to lift stretcher in balanced way. Normally, the action needs a leader, the fifth person, who would lead and command the crew. Likewise, individuals trained in first aid mentioned the importance of having a first aid toolkit so they can respond promptly when needed.

While the CDMCs have learned that a consideration of availability of trained persons in sufficient number is important, the youth group have learned that a comprehensive team should be prepared with required tools and equipment for the assigned tasks. These can be fulfilled by continuing training activities every year and organising mock-drill exercises regularly.

Lessons from the trainings are on the choice of venue including training cost and time utilisation, appropriate time to organise training, resource persons and sufficient number of trained persons in each sector as well as appropriate participant selection.

While doing mock-drill exercises, an end-to-end forecast, early warning and anticipatory actions could have been included, which can be done in future provided that there is resource available for the task.

Photo: Suraj Gautam

Section 6

CONCLUDING REMARKS

> The provincial and federal agencies are also interested on the anticipatory actions, but concrete normative institutionalisation is still lacking. The federal government officials, as of now, focus on utilising forecasts for preparedness and risk reduction; early humanitarian actions are seldom a priority. This is further intricated by interchangeable scope of and terminologies in forecast-based actions and real events.

Although the project initiatives and outputs are yet to be tested under complex and extreme scenarios, their potential impact has been assessed through logical analysis, stakeholder perspectives, and intuitive conclusion based on the experiences of the participants elsewhere. Good and innovative practices/approaches like cash transfer mechanism, household vulnerability analysis is worth continuing for further implementation and replication in different flood contexts.

The municipal authorities have, on several occasions, echoed about comprehensive guidance offered by the SOP. Therefore, this practice is replicable for other local governments as well. The document is already being referred by different organisations in a bid to support other local governments. The implementation of the SOP, however, requires enhanced capacity of the local governments and communities end to take early action by responding to the available forecast information. More experiences and evidence are expected after implementation of the SOP.

The provincial and federal agencies are also interested on the anticipatory actions, but concrete normative institutionalisation is still lacking. The federal government officials, as of now, focus on utilising forecasts for preparedness and risk reduction; early humanitarian actions are seldom a priority. This is further intricated by interchangeable scope of and terminologies in forecast-based actions and real events. Therefore, it calls for showcasing of successful examples and evidence-based advocacy to clarify and deepen understanding of forecast-based risk reduction and humanitarian actions in saving lives, assets and mitigating disaster impacts.

Based on the findings, it is, therefore, recommended to replicate and upscale the good practices, lessons, and policy measure on anticipatory actions.

Photo: Suraj Gautam

ANNEX

Annex 1. List of questions

The questions were used as reference to discuss with project team members, municipal authorities, concerned communities and other actors in the project area i.e. in Dodhara Chandani Municipality.

1. What is/was your role in the project?
2. In your experience or observation, what went well and was best in the project?
3. Which strategies and procedures contributed to success?
4. What didn't go well?
5. If done again, what would you do differently?
6. What should we start doing after the project completed?
7. What should we stop doing, which did not work or was a mistake?
8. What should we keep doing which needs to do more to achieve project goals?
9. What were challenges and barriers to implement project actions?
   - Policy, guidelines
   - Bureaucracy
   - Conflicting interests in community, project partners and other actors
   - Other problems -
10. What do we need to learn more about Anticipatory Action?
11. What problems did you encounter and how did you solve them in design, planning and implementation of AAs?
12. What caused project inputs (activities, interventions) to succeed or fail (cause-effect relationships)?
13. What are your insights to improve actions and processes in FBAs?
14. What are your specific learnings from following:
    - Household Vulnerability Assessment
    - Flood Hazard Modelling
    - Early warning system
    - Anticipatory actions
    - Institutional strengthening (Policies, guidelines, CDMC, LDMC, LEOC, other)
    - Community participation, mobilization and leadership

Each project activity

What was done?
How it was done? tools, technology, human resources, approach
What was achieved?
What did not go well?
If done again, what would you do differently?
What could be next step from this task you completed?
What were challenges and barriers in this activity?
If there were challenges and barriers, how did you solve/overcome them?
Is there any suggestion for future similar activities?

Annex 2. List of policy documents reviewed during the study

1. Disaster Preparedness and Response Planning Guideline, 2067 (First Amendment, 2076), Ministry of Home Affairs, Kathmandu
2. Disaster Management Act, 2075, Dodhara Chandani Municipality, Dodhara
3. Forecast Based Disaster Preparedness and Early Response Procedures, 2080. Dodhara Chandani Municipality
4. Cash Support Operationalization Procedures, 2078. Dodhara Chandani Municipality
5. Disaster Management Fund Operationalization Procedures, 2077. Dodhara Chandani Municipality
6. Disaster Preparedness and Response Plan 2079-80. Dodhara Chandani Municipality
7. Community Disaster Management Committee and Climate Resilient Committee Formation and Mobilization Guidelines, 2079. Dodhara Chandani Municipality
8. Dodhara Chandani Municipality's Firefighting Engine Management and Operation Guidelines, 2078.
9. Dodhara Chandani Municipality Local Emergency Operation Centre Operationalization Guidelines, 2078
10. Dodhara Chandani Resilient Youth Network Formation and Mobilization Procedures, 2079.
11. Tole Development Organisation (Formulation and Mobilization) Procedures, 2078. Dodhara Chandani Municipality
12. Province Disaster Risk Reduction and Management Act, 2075. Sudurpashchim Province
13. Provincial Disaster Management Plan, 2075. Sudurpashchim Province
14. Monsoon Preparedness and Response Plan, 2078. Sudurpashchim Province

Annex 3. List of people consulted

Where documented in this report, views of consulted people were their personal and did not represent official views of the organisation they are working in.

1. Laxmi Rana Chhetri, Dodhara Chandani Municipality
2. Nirmala Limbu, Dodhara Chandani Municipality
3. Sanjay Devkota, IHRR
4. Suraj Gautam, IHRR
5. Nirmala Sunar, NNSWA, project staff
6. Tek Bahadur Sunar, Kutiyakabhar, Dodhara Chandani
7. Dhansari Budha Matawala, Mahakali CDMC
8. Mohan Sunar, Mahakali CDMC
9. Suresh Singh Saud, IT and Information Officer, Dodhara Chandani Municipality
10. Prem Rokaya, Resilient Youth Network, Dodhara Chandani Municipality
11. Mamata Magar, CDMC member, ward no 8, Dodhara Chandani Municipality
12. Laxmi Bhatta, Resilient Youth Network, Dodhara Chandani Municipality
13. Om Prakash Rokaya, Ward Chairperson Ward 8, Dodhara Chandani Municipality
14. Kishor Kumar Limbu, Mayor, Dodhara Chandani Municipality
15. Ganga Devi Joshi, Deputy Mayor, Dodhara Chandani Municipality
16. Prakash Khadka, People In Need, Kathmandu, Pratibaddha II project
17. Hari Karki, UNFPA
18. Bhesh Parajuli, IFRC

Participants of learning review and synthesis meeting

1. Ganesh Singh Thagunna, NNSWA, project staff
2. Rajkumar Sunar, NNSWA, project staff
3. Prabhu Nidhi Panta, NNSWA, project staff
4. Dinesh Gurung, DCA, project staff
5. Dinanath Bhandari, IHRR, consultant

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2 *IFRC (2009). Early Warning early action: evaluation of IFRC West and Central Africa zone flood preparedness and response, 2008, International Federation of Red Cross and Red Crescent Societies, Geneva*

3 *Coughlan de Perez, E., van den Hurk, B.J.J.M., Van Aalst, M.K., Jongman, B., Klose, T. and Suarez, P. (2015). Forecast-based financing: an approach for catalyzing humanitarian action based on extreme weather and climate forecasts, Natural Hazards and Earth System Sciences, 15(4), pp.895-904*

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