SAVING
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Forecast-based Financing in Nepal

A Return on Investment Study

WFP
World Food Programme

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Cover Photo: Villagers from Halkarapurwa watch the Daduwa river receed from their flooded village. Heavy monsoon rains can wash away homes and food stocks, leaving families nothing to fall back on.

Context

Floods and landslides are among the most destructive types of climate-related hazards present in Nepal. They are occurring with increased frequency, intensity and scope, particularly during the monsoon season within the densely populated southern Terai plains. Each year, tens of thousands of households are affected, justifying the pressing need to strengthen disaster risk reduction activities.

Growing evidence suggests that robust early warning systems based on credible scientific weather forecasts, together with preparedness and anticipatory action protocols, can add significant value in increasing community resilience and reducing the need for humanitarian assistance. The problem, however, has often been that although forecasts are available, the humanitarian community has not been able to use them effectively to take action prior to a climate-related shock turning into a disaster.

In Nepal, the government Department of Hydrology and Meteorology (DHM) possesses mechanisms to issue flood forecasts, but without sufficient lead times or timely communication mechanisms to allow for anticipatory actions in potentially affected communities. In addition, there is a gap between early warnings and anticipatory actions, preventing mitigation measures from taking place and thus suffering immense flood-related damages.

To address those challenges, the World Food Programme (WFP) and the Government of Nepal are implementing a Forecast-based Financing project (FbF) aimed at bridging the gap between early warnings and anticipatory actions for floods in the 14 most disaster-prone districts of the Terai region. As part of the effort to build evidence and analyse the benefits of investing in forecast-based anticipatory action in Nepal and other disaster-prone countries, a return on investment analysis was commissioned. This report presents the main results of that study.

The Humanitarian Return on Investment (H-ROI) Methodology

The return on investment methodology is widely used in finance for comparing the gains obtained from an investment (returns) with the costs of the investment over the course of its lifespan.

In the present study, the investment consists of inputs provided by donors, governments and humanitarian actors for emergency preparedness and anticipatory action initiatives. Returns are the quantitative savings and qualitative improvements in subsequent emergency responses that result from this investment.

Since 2014, in collaboration with other United Nations agencies, WFP has been developing a methodology for determining the quantitative savings and qualitative improvements obtained during an emergency response when prior investments in emergency preparedness and anticipatory action have been made.

The methodology is based on analysis of the eight evaluation criteria of the Development Assistance Committee of the Organisation for Economic Co-operation and Development (OECD-DAC).[1] These criteria provide a widely agreed framework of performance standards for humanitarian action. An investment in preparedness or anticipatory action is analysed according to each criterion by comparing the improvements in an emergency response when the investment is in place with the situation without the investment. The methodology includes standard indicators for some criteria; for example, financial savings is an indicator for the efficiency criteria. These standard indicators are complemented by other indicators that are developed on a case-by-case basis. The analysis is based on available historical data, informed assumptions and a risk scenario for the setting being analysed, including the type of emergency, the populations affected and the probability of the hazard taking place.

The methodology allows analysis of a wide range of investments from the pre-positioning of food assistance and infrastructure to the provision of training and data systems. The results of the analysis support WFP and partners in better planning emergency preparedness activities and anticipatory actions, demonstrating evidence of their benefits and mobilizing resources efficiently.

[1] Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). 2013. Evaluation of Humanitarian Action: Pilot guide, https://www.alnap.org/help-library/evaluation-of-humanitarian-action-pilot-guide. In 1991, OECD-DAC set out broad principles for guiding the evaluation process for DAC members. The criteria were adapted for the evaluation of complex emergencies (OECD-DAC, 1999). http://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm. The DAC criteria are intended to be a comprehensive and complementary set of measures.

Data Sources

The risk profile forms the basis of the analysis, developed using data from historical records (MoHA) and expert consultations with key informants from district chapters of the Nepal Red Cross Sosciety (NRCS). It provides an insight into the risk situation, including the frequency of risk and the population groups affected. Nepal experiences monsoon floods every year and the average affected population requiring assistance typically reaches 175,000 out[2] of an area with a population of 290,000.

Most of the data collected for the calculation of the qualitative and quantitative benefits for emergency responses that result from investments come from previous flood disaster impact and response data and experts' assumptions.

The Investment

Forecast-based Financing (FbF)

Forecast-based Financing is an innovative mechanism whereby anticipatory actions at community and government levels are predefined, triggered and implemented before a climate shock occurs. The key principle is that humanitarian responders, disaster management authorities and communities agree on a set of anticipatory actions that are implemented to mitigate, to the extent possible, the impact of a shock once a forecast predicts a certain threshold of risk probability will be exceeded. For instance, when a 10 day rainfall forecast indicates a high-risk level for flooding, early warning information is circulated between organizations and communities on the potential flood event, relief and rescue materials are readied for deployment, farmers are instructed to delay planting or harvest early depending on the time of the growing season or to protect their livestock and fishponds. These actions limit the losses and damages caused by climate hazards, reduce suffering and the overall need for humanitarian assistance in their aftermath. Each anticipatory action has an associated budget and is implemented according to pre-agreed Standard Operating Procedures (SOPs) and pre-defined thresholds.

An intergrated approach, based upon forecasting technologies coupled with community practices, is required. Activities are closely aligned with national priorities, leverage local field expertise and build on existing coordination mechanisms.

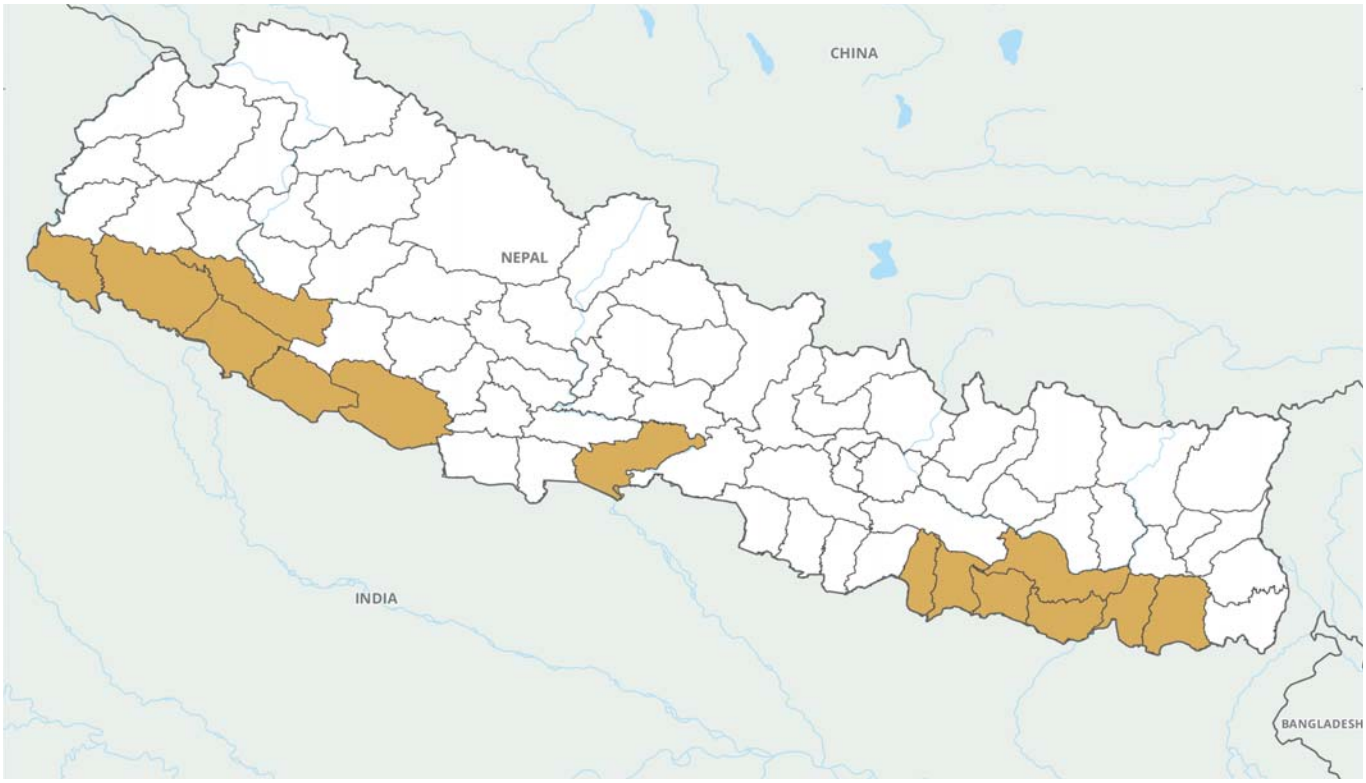
FbF implementation in Nepal

In Nepal, a baseline assessment of the early warning system was completed at the district level in 14 of the most flood-prone districts of the Terai region (recurrent flooded area). Following that, the project improved the lead times of DHM warnings from hours to days, assessed community flood risk, identified flood risk thresholds for low, medium and high-impact events, developed forecast triggers, and facilitated the development of anticipatory actions in each district together with all stakeholders involved in emergency response (local/national government authorities and humanitarian actors). Once these processes were captured and integrated into SOPs, a table-top simulation was undertaken to validate the SOPs and further adjustments were made. The SOPs became part of the DDRC (District Disaster Response Committee) disaster preparedness and response plan and a budget was allocated to implement the SOPs in case of an early warning trigger. Post and pre-monsoon reviews of the SOPs are undertaken to further refine the triggers, thresholds and anticipatory actions. General preparedness actions are undertaken on an annual basis, ahead of the monsoon season at the district level. To ensure national ownership and continuity, the FbF modality is included in the Nepal Strategic Action Plan for Disaster Risk Reduction and Management 2018-2030.

Regarding the early warning system, the investment does not directly intervene on the technical improvement of the forecasts but ensures that the DHM has access to new types of data and improved forecasting models. However, the project aims to improve early warning communication between the different stakeholders to ensure everyone receives the right information at the right time, with an emphasis on the "last mile" of flood warning communication to potentially affected communities.

[2] (MoHA 1971-2017, Multi Agency Flood Impact Assessment Report 2007, 08 & 17, Monsoon Preparedness Assessment Report, Shelter Cluster Nepal 2016 and key informants from district chapters of NRCS)

Figure 1: FbF Target Districts in Nepal



14 Flood-prone districts implementing Forecast-based Financing

A first phase of the project was implemented in six flood-prone districts[3] from 2015-2017. Building on the lessons learned from the first phase, a second phase started in 2017, which, at the time of this report, added another eight flood-prone districts[4] (14 in total) and consolidated the outputs of the first phase.

Risks

Having in place an improved early warning and communication system as well as an anticipatory action plan does not necessarily ensure effective use of the system by the authorities and communities. Moreover, Nepal is notably going through a transitional phase from centralized governance to a federal system, with operational laws, human resources and financial arrangements yet to be materialized at provincial and local government levels. For the system to run smoothly, advocacy and periodic exercises to sensitize new government actors are planned to mitigate those risks. To accurately reflect these risks, a learning curve of 10 years has been taken into account in the analysis of this project's return on investment.

Table 1: Total cost of FbF investment

TOTAL INVESTMENT COST OVER 6 YEARS (14 DISTRICTS)	YEARLY RUNNING COST	TOTAL ACTUALIZED COSTS OVER 20 YEARS
US$1.8 million	US$146,000	US$1.9 million

[3] Districts names: Dang, Banke, Bardiya, Surkhet, Kailali and Kanchanpur

[4] Districts names: Jhapa, Sunsari, Saptari, Dhanusa, Mahottari, Udayapur, Chitwan and Nawalparasi

In August of 2017, WFP began food distributions to 180,000 people in Nepal in response to floods. The damage caused by the floods to homes near the river bank is clearly visible.

Table 2: With or Without Forecast-based Financing

Response Scenarios Analysed	RESPONSE SCENARIO 1: WITH FORECAST-BASED FINANCING	RESPONSE SCENARIO 2: WITHOUT FORECAST-BASED FINANCING (Traditional humanitarian response)
EARLY WARNING SYSTEM	The early warning system is able to provide indications on flooding up to 15 days before the disaster and provide an alert to the population 72 hours before the flood.	Even if an early warning system is in place, it only provides an alert 4-5 hours before the disaster. Given the additional communication challenges between the district authorities and the communities and the lack of procedures, the national disaster preparedness and response frameworks heavily focus on post-disaster rescue and life-saving measures.
ANTICIPATORY ACTION	Following an early warning, the authorities and communities in the 14 target districts undertake preparedness and anticipatory actions in accordance with the SOPs to protect people and assets. These actions are implemented at ten, three and one day(s) ahead of the flood before transitioning to emergency response: • Inform farmers to delay planting or harvest crops depending on seasonal calendar; • Prepare Non-food Items (NFIs) and inform farmers to protect fish and poultry farms; • Formation of Emergency Team, Information and Communication Team, Medical Team, Relief Distribution Team; • Emergency stockpiling of shelter materials, NFIs, food, water and medicines in a strategic location for distribution in minimal time; • Prepare and distribute Go-Bags, water-proof document pouches and medical and hygiene kits • Evacuate the infirm and disabled, and ensure shelter protection arrangements for women and children.	No significant anticipatory actions are taken to protect people and assets.
RESPONSE	Once the flood occurs, damages to infrastruc-ture, people and livelihoods assets are limited. The time, and above all, the quality of the re-sponse is improved since the government and other humanitarian actors have more time to get ready to respond. The cost of the response and the recovery is thus also reduced.	Once the flood hits, people usually try to evacuate, leaving their livelihoods behind. Often the population does not want to leave their home without their belongings, putting their own life at risk. The affected population usually receives some support from the government, but this is not systematized. The number of affected people is high, as are the response, recovery time and costs.

OECD-DAC Criteria* Results: Comparative Benefits of Response Scenario 1 Over Response Scenario 2

Efficiency

- The average cost for one emergency of an average size (175,000 affected people) is approximately US$10.1 million in the WITH scenario and US$31.5 million in the WITHOUT scenario. Thus, the cost savings per response are US$21.4 million.
- For each dollar invested, US$34,39 is saved (after deduction of the investment costs, over 20 years).

Apropriateness / relevance

- The SOPs for anticipatory actions are tailored to the district level taking into account local communities' needs. Thanks to an improved early warning system (increased lead time), the response can be better prepared, linked with anticipatory actions and aligned with local needs.
- The investment increases the level of ownership of emergency preparedness and response at the district level and strengthens the overall capacity of the government in the area of planning, early warning, communication, preparedness and anticipatory actions. FbF has been included in the Nepal Strategic Action Plan for Disaster Risk Reduction and Management 2018-2030 and the SOPs have become part of the DDRC disaster preparedness and response plan. By 2030, it is expected that the Nepal Government will be able to lead the planning and implementation process of emergency preparedness and anticipatory action formulated in the FbF project.

Effectiveness

- While the 0.5 days of time saved is not substantial, the investment's aim is to reduce the number of people and assets affected rather than the amount of time saved to provide a response. However, in the WITH scenario, given that the alert is provided much earlier, the authorities can better plan for the response, while in the WITHOUT scenario, the response is not systematized and could be poorly planned.
- Based on experts' judgment and experience, on average the investment is expected to significantly reduce the quantity of damaged assets, for example if 100 livelihood assets are damaged in the WITHOUT scenario, only 50 are damaged in the WITH scenario.

Connectedness

- The total carbon savings reach 42 kg CO2e per dollar invested.[5] This is due to the reduced transport of relief items given the lower number of people affected when anticipatory actions have been implemented.
- By protecting the livelihoods of the population, future negative impacts on food security can be avoided (protecting seeds, cattle, tools and etc. for the next planting season)

Coverage

- The investment allows implementation of preparedness and anticipatory actions in case of a forecast for floods in the 14 flood-prone districts of the Terai region.
- It provides more time and specific instructions on how to support vulnerable groups (pregnant and lactating women, disabled, elderly and children) which constitute about 23 percent of the population of the 14 concerned districts.

Coherence

- FbF directly contributes to proactive disaster management as specified in the SENDAI framework.

Coordination

- The formulation and implementation of SOPs bring humanitarian actors (on average, 35 actors per district) together and specific actions are jointly defined for each actor in the case of a forecast for floods.
- The investment also improves the collaboration between government institutions (Department of Hydrology and Meteorology and the Ministry of Home Affairs) for early warning and preparedness.

Table 3: Damage Reduction by Category

Source: Historical Records (MoHA) and Expert Consultation

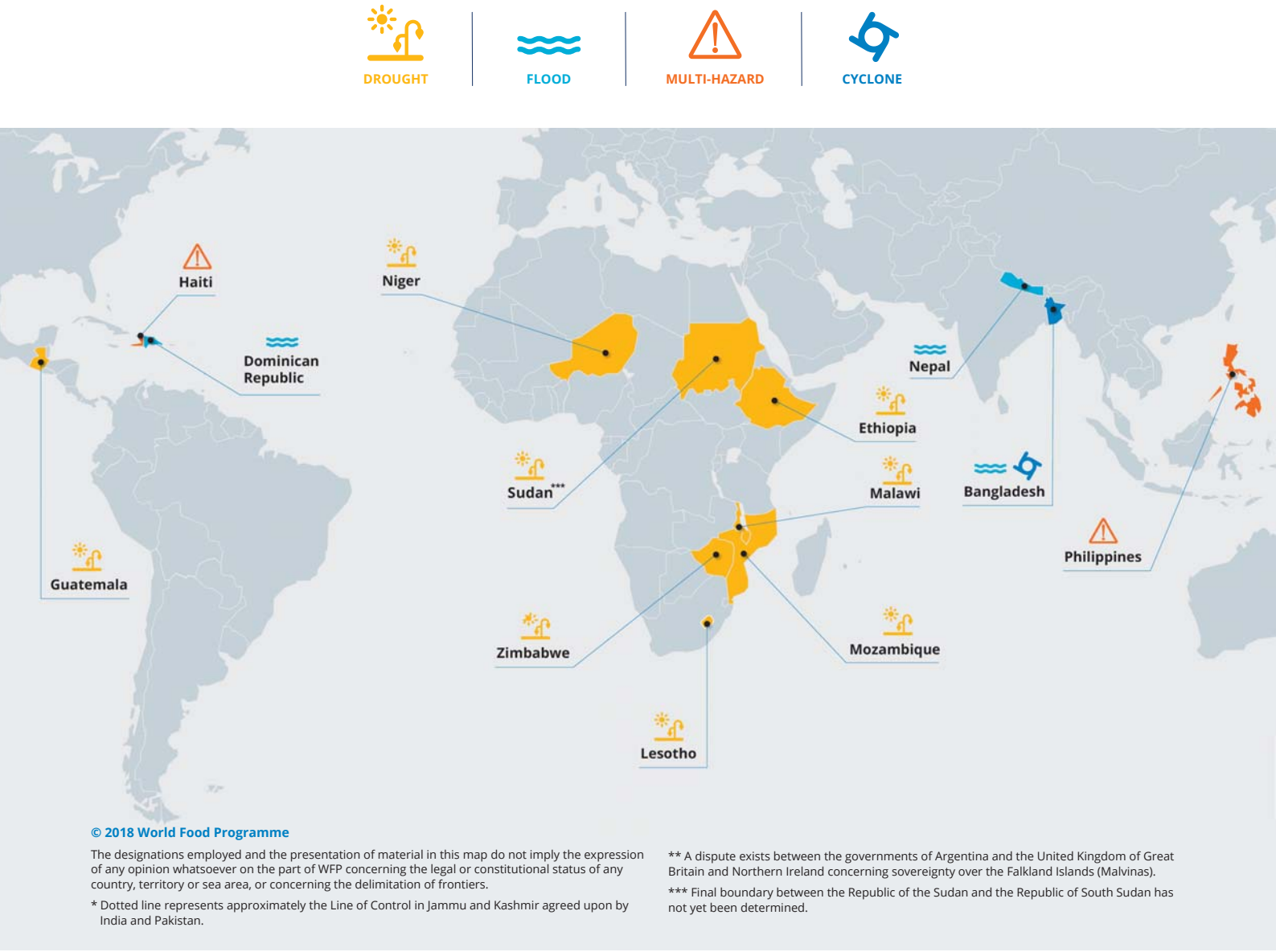
CATEGORY	Overall Population	Vulnerable People	Cattle	Food stock (MT)	Seeds (MT)	Public Buildings	Private Buildings	Roads (KM)	Water Infrastructure	Crops Hectare
DAMAGE REDUCTION[6]	58%	75%	50%	75%	75%	25%	33%	33%	25%	50%

* See Annex for detailed description

[5] The CO2e is calculated for both scenario using the following formula: MT*KM*GHC coefficient. The two scenarios are then compared and related to the cost of the investment.

[6] (assets damaged WITHOUT - assets damaged WITH)/ (assets damaged WITHOUT)

Global Map of WFP FbF Countries and Hazards



The designations employed and the presentation of material in this map do not imply the expression of any opinion whatsoever on the part of WFP concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of frontiers.

* Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan.

** A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

*** Final boundary between the Republic of the Sudan and the Republic of South Sudan has not yet been determined.

Conclusion

The results of the humanitarian return on investment analysis confirm the existing evidence on the benefits of early warning and anticipatory action systems. Not only does the FbF modality offer a process to limit damages caused by a natural hazard on vulnerable people (75 percent damage reduction) and assets (50 percent of damage reduction on crops and cattle) and thus save a significant amount of money in the immediate response (US$34 per dollar invested) but it also further decreases long-term recovery needs and costs. The capacity development aspect of the FbF project is not negligible and has the potential to reduce the national dependency on external support when a disaster occurs.

Finally, the project helps better coordinate preparedness and response by convening various government institutions, communities and humanitarian actors. Given the increasing unpredictability and magnitude of climate-related disasters, FbF is becoming increasingly relevant for disaster-prone countries. The study shows the pertinence of investing additional resources in replicating similar anticipatory action projects in analogous contexts. Additional H-ROI studies would help corroborate the results in other contexts. It would also be useful to undertake ex-post analysis to validate the anticipated FbF benefits assessed by the H-ROI model used in the present study.

Annex

1. Key assumptions of the analysis

- Time horizon over which the results are evaluated: 20 years.
- Learning curve starting at 25% with a yearly increase of 7.5% for 10 years.
- With the investment in place (WITH scenario), when an alarm is given, anticipatory actions established in the SOP are implemented with a cost of approximately US$110,000 per 10,000 affected people. When the flood hits, the response cost reaches about US$6,000 per 10,000 affected people.
- If the investment is not done (WITHOUT scenario), no preparatory action is taken and the response cost reaches US$1,087,000 million per 10,000 affected people.
- For every 100 floods, the probability that the alarm is given reaches 80%. In the remaining 20% of cases, the flood is not detected and no preparation is done.
- For every 100 alarms, 30 are false and unnecessary preparation is done (US$110,000 per 10,000 people).
- Without the investment, 60% of the population is affected and need support for three months. Thanks to the investment, 25% of the people are affected and thus need emergency support for three days as emergency kits will already have been distributed as part of the preparation activities defined in the SOP.

2. Cost-savings calculation model

For the cost of response WITH SOP Scenario,[7] using the average cost for one event (from the far right column in table below) that on average impacts 175,000 people out of a population of 290,000 is calculated: US$347,665*(290,000/10,000) = US$10.1 million.

In the WITHOUT a SOP Scenario,[8] the average cost of one event is far higher (from the table below), on average impacting 175,000 people out of a population of 290,000, calculated as follows: US$1,086,636*(290,000/10,000) = US$31.5 million.

Therefore, the saving per event equals 31.5-10.1= US$21.4 million from the end of the learning period (from year 11 after the end of the investment period).

Starting from this value, the total saving over 20 years (including the investment period) is calculated, taking into account the following factors:

- Period needed to fully implement the investment: 6 years, savings for all 14 districts start from year 6.
- Enabling running costs: after the investment implementation period, running costs must be sustained on a yearly basis to maintain the capability of implementing the SOPs in case of emergency (simulations, SOPs review, general preparedness), estimated at US$146,000 per year.
- Learning curve: savings per event are assumed to be only 25% of the maximum value (21.4 million US$) in the first year after the end of the investment period and grow up linearly to 100% in the eleventh year.
- Average affected population: each year, within the 14 districts, flooding affects 175,000 people in an area with about 290,000 resident people.
- Yearly discount rate: a 10% discount rate applies to all cost elements (savings in case of an emergency event, investment cost, enabling running costs).

Over 20 years, the resulting total discounted savings reach US$64.9 million with the discounted investment (initial investment + enabling running costs) equaling US$1.9 million, therefore, 64.9/1.9= US$34.39 are saved per US dollar invested.

Table 4: Cost-Savings per Scenario

Cost-Savings Calculation Model			N. of times the alarm is given or not given, out of 100 emergency events **N**	Cost sustained each time, referring to one event involving 10,000 resident people (US$)				Cost **C**	N*C	Total cost for 100 events	Average cost for 1 event
				Cost of preparation WITH SOP	Cost of response, WITH SOP	Cost of response WITHOUT SOP	Cost of response if alarm is not given				
				109,993	5,777	1,086,636	1,086,636				
WITH	Event happens	Alarm is given	80	109,993	5,777			115,770	9,261,577	34,765,485	347,655
WITH	Event happens	Alarm is NOT given	20				1,086,636	1,086,636	21,732,713		
WITH	Event does NOT happen	Alarm is given	34	109,993				109,993	3,771,195		
WITHOUT	Event happens					1,086,636					1,086,636

[7,8] After the 10 years of learning period

3. OECD-DAC criteria

DAC CRITERION	DEFINITION
Appropriateness and relevance	Relevance is concerned with assessing whether the project is in line with local needs and priorities (and donors' policy). Appropriateness is the tailoring of humanitarian activities to local needs, increasing ownership, accountability and cost-effectiveness accordingly.
Effectiveness	Effectiveness measures the extent to which an activity achieves its objectives, or whether they can be expected to be achieved on the basis of the outputs. Implicit to effectiveness is timeliness.
Efficiency	Efficiency measures the outputs – qualitative and quantitative – achieved as a result of the inputs. Calculation of efficiency generally requires comparisons of different approaches to achieving an output in order to assess whether the most efficient approach has been used. Implicit to the criterion of efficiency is financial saving.
Impact	Impacts are the wider effects – social, economic, technical and environmental – of a project on individuals, gender and age groups, communities and institutions. Impacts can be intended or unintended, positive or negative, macro-level (sectors) or micro-level (households). The overall impact of a project refers mainly to short-term impacts that can also have long-term impacts.
Connectedness	Connectedness refers to the need to ensure that activities for a short-term emergency response are carried out in a way that take into account longer-term, interconnected problems (medium- and long-term effects, sustainability).
Coverage	The need to reach all major population groups facing life-threatening suffering wherever they are.
Coherence	The need to assess security, development, trade and military as humanitarian policies in order to ensure that they are consistent and, particularly, that they all take into account humanitarian and human rights considerations.
Coordination	The systematic use of policy instruments in order to deliver humanitarian assistance in a cohesive and effective manner. Such instruments include strategic planning, gathering of data and management of information, mobilization of resources and ensuring accountability, a functional division of labour, negotiation and maintenance of a serviceable framework with host political authorities and provision of leadership.

Acronyms

DDRC	District Disaster Response Committee
DHM	Department of Hydrology and Meteorology
DRR	Disaster Risk Reduction
FbF	Forecast-based Financing
H-ROI	Humanitarian Return on Investment
MoHA	Ministry of Home Affairs
NFI	Non-food Item
NRCS	Nepal Red Cross Society
OECD-DAC	Development Assistance Committee of the Organisation for Economic Co-operation and Development
ROI	Return on Investment
SOPs	Standard Operating Procedures
WFP	World Food Programme

Photo Credit

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