Case study

Measuring cost benefits of community disaster risk reduction in Ilam, Nepal

River bank strenghtening to reduce erosion in Ilam, Nepal.

Overview

Cost benefit analysis (CBA) can provide information on the economic rationale for implementing disaster risk reduction (DRR) initiatives. The use of CBA for DRR is gaining prominence and becoming an essential tool in not only purveying the economic return of DRR but also, and perhaps more critically, strengthening the economic argument for greater global advocacy and investment in mainstreaming a 'culture of preparedness.' The inherent limitations of CBA, including the limited ability to quantify social impacts (e.g., empowerment of women) and heavy reliance on the quality of data available, requires that CBA sits within a complimentary analysis of qualitative impacts.

The following case study provides an overview of a CBA that was conducted for DRR activities which were implemented by the Nepal Red Cross Society (NRCS), with the support of the British Red Cross and the International Federation of Red Cross and Red Crescent Societies (International Federation), from 2001 to 2008 in southeast Nepal.

The two main objectives of the study were:

1. to produce analytical evidence of the micro-level benefits (versus the costs) of community-based DRR; and
2. for the NRCS, British Red Cross and the International Federation to learn more about and to develop skills around the CBA methodology.

A key aim of the project was to investigate the viability of CBA as a tool that can be used by National Societies to make investment decisions and produce evidence of the benefits generated by their projects. Clearly, the outcome of the analysis is important. Equally, the process used to reach that outcome is highly valuable, as it focuses discussion on specific outcomes of the programme, and helps staff to consider the economic implications of their work. To this end, all efforts have been made to ensure that the process for undertaking the CBA is accessible and transparent. Further, it is intended that the analysis is robust, but not overly complex.

This study illustrates that CBA can be utilized as a decision-making tool in the allocation of investment in community-based DRR projects and provides the necessary evidence of the impact derived from such projects. Furthermore, and perhaps more importantly, the process of undertaking this study brought many benefits to the project team as well as local communities, helping to highlight the trade-offs between various project investments, and guiding thinking towards outcomes rather than outputs.

General context

The CBA was conducted in Nepal's Ilam district, situated approximately 600 kilometres east of Katmandu, which in 2001 had a population of 283,000.

The community-based DRR programme was spearheaded by the NRCS to reach approximately 9,000 people in 15 vulnerable communities, which were selected as a result of a baseline survey in the disaster-prone districts of Saptari, Panchthar and Ilam. This baseline survey provided analysis of the socio-economic conditions influencing communities' vulnerabilities and capacities in relation to locally experienced hazards.

Specifically, this study was undertaken in five communities in Ilam district where the NRCS had been working. The National Society worked with communities targeted by the programme in Ilam to facilitate DRR activities, including **structural** (mitigation works such as building gabion boxes, construction of flood containing walls and evacuation shelters), **non-structural** (such as revolving emergency funds, first aid training, drafting of disaster preparedness plans, public awareness campaigns), and livelihood (income generation) activities.

Methodology

Fieldwork was conducted over the span of ten days in June 2008 whereby the project team set about collecting data in the five communities (Altabare, Bukuwa, Hatileda, Kamal and Peltimari). The data was collected through:

- **meetings with the NRCS staff:** the meetings served to collect existing baseline data on the affected communities, the characteristics of the hazards in the community area and the impacts of these hazards and the DRR programme, respectively.
- **meetings with stakeholders:** including local government representatives, the police, health posts, teachers, chair of the agricultural cooperative and the International Union for the Conservation of Nature.
- **field visits:** to the five communities as well as to Chulachuli Ward, where the NRCS is not operating. The Chulachuli Ward was used a control community in order to gather further data on the impacts of hazards without any external initiated/funded disaster risk interventions. The field visits including community meetings to discuss the types of hazards affecting the community, and the impacts of these hazards. The field visits also included transect walks to gain a better understanding of the nature and magnitude of hazards. Focus groups, established on the basis of gender parity and diversity, were established and questions based on the Sustainable Livelihoods Framework were used to address all five areas of impact: human, social, financial, physical and natural.

The objective of the fieldwork was to gather data on the risks faced by communities, the impacts of natural hazards on the communities, and the impact of the NRCS's DRR programme in reducing the impact of these risks. In-line with common CBA methodology, the fieldwork aimed to compare the scenario **without** the DRR programme, and the scenario **wi**th the DRR programme.

Analysis

The data collected was used to build a model to analyse the costs and benefits over the lifetime of the project for the five study villages.

The characteristics of hazards and their impacts on the community (the "without" scenario) were compared against the changes in impacts (or benefits) that the community had experienced as a result of the NRCS DRR programme. All changes which noted either additional benefits or adverse impacts of the programme were included. There was also special attention not to double count the positive impacts from other non-governmental and/or governmental activities.

A quantitative analysis of costs and benefits was undertaken for those impacts that could be quantified. For each quantifiable benefit, the change in impact was calculated, using the best data available. It is important to note that data is based on local evidence, gathered through communities and local staff. The benefits were set against the costs of the NRCS programme (both one-off capital costs (fixed), and those that occur on a yearly or regular basis (variable) were included). Costs and benefits were then modeled over the lifetime of the project. The project lifetime should reflect how long the benefits are expected to accrue to the communities. While the NRCS programme technically only ran for

three years, the skills and assets provided should provide benefits for much longer. Costs and benefits are discounted by a certain percentage each year to reflect the changing value of money over time (the discount rate).

Results

A wide range of hazards affecting the communities were raised and discussed by community members, including repeated flash floods, epidemics (in particular diarrhea associated with flooding) and snakebites. Each community considered flash floods to be the most significant risk they face.

The analysis focused on the impacts of the flooding, and the associated epidemics (diarrhoea) and snakebites that come during the flooding season. Other hazards occur less frequently, and do not consistently impact the communities. Although the floods occur annually, communities tend to differentiate the flooding into years of high magnitude floods and years of average magnitude floods. Triangulation of community experience with NRCS data suggests that the large flash floods come every five to ten years, dependent on the level of rainfall (monsoon rains).

The impacts of the DRR programme have reduced vulnerability and risk in the communities, ranging from social benefits through increased empowerment of women, to direct reduction in losses from physical structures such as the building of check dams. Some of these impacts cannot be quantified, such as social impacts, and therefore cannot be included in the cost-benefit model. The quantifiable benefits from the DRR programme that were included in the model included reduced visits to doctors (as a result of improved water supply and first aid training), reduction in interest paid through income generation loans, and reduced land and crop losses as a result of the gabion boxes.

The findings from the cost benefit analysis demonstrated that the programme generates a benefit to cost ratio of over 15. While the results must only be thought of in terms of order of magnitude (not exact numbers), a benefit-to-cost ratio greater than 1 is considered economically "worth it." Sensitivity analysis was used to determine whether the programme would still be worth it if more pessimistic assumptions were used. Even with "worst case" assumptions, the benefit-to-cost ratio was estimated at just under 15.

When the mitigation works, which deliver the highest financial benefits, were removed from the analysis, the benefit-to-cost ratio reduced to about 2. For flood risk reduction it is often the case that structural measures deliver high benefit-to-cost ratios, but this assumes that they always function perfectly. This is not always the case, especially when considering changing flood patterns due to climate change, and sometimes mitigation works just shift flood impacts up- or downstream. More decentralized approaches like protecting water wells, providing income generating loans and first aid training are not only "worth it," but are also more robust in that they provide benefits no matter what the flood pattern and even during non-flood times.

Lessons learned

CBA is only as robust as the data available, and hence the findings must be taken within the context of qualitative impacts, as well as alongside other evaluation tools. However, the process of generating the analysis and testing its assumptions can be very useful for thinking through programming options.

The process undertaken for this CBA added significant value through the following:

- CBA requires specific and concrete data around the impacts of DRR programmes, and therefore discussion in focus groups and meetings was very focused and targeted. Such discussions are needed to make transparent and well-informed analysis assumptions.
- The CBA process helped local and national staff to consider the economic implications of their work, to think about impacts in terms of outcomes (e.g., number of injuries reduced) rather than outputs (e.g., number of community members trained in first aid).
- The CBA tool provides a mechanism whereby assumptions and programming options can be altered and offset against costs to help decide on the most economical programme of work, within the context of a wider qualitative discussion.
- Given the existing information gap with regard to systematic or verified collection of data on hazard impacts or vulnerability, triangulation of data between communities, Red Cross staff and other organizations/officials is key to ensure quality of data.
- The CBA process is very much in line with existing NRCS processes, such as vulnerability and capacity assessment, and monitoring and evaluation. As such, it would be relatively straightforward to integrate the CBA methodology into existing processes.
- The CBA process may be more difficult when it comes to the actual analysis, as this can be quite technical and requires a sound understanding of the economic principles behind CBA (e.g., how to

choose an appropriate discount rate, running calculations, issues over double counting, etc.).

A process of training trainers, or CBA mentors, may be necessary to ensure that any analysis is robust.

Intervention	Flood impacts "without"	Flood impacts "with"	Utilized values	Assumptions	Annual benefits (NPR)
Mitigation works	Large flood: Houses/land swept away. Average flood: Land eroded	Large flood: Same: mitigation works overwhelmed Average flood: No loss of land	1 ha land = NPR 600,000	Large flood: Occurs every 5-10 years. Average flood: Occurs almost every year, leading to 10 ha of land lost per village.	32.7 million
Income generation loans	Loans at 3-5% interest	Loans at 2% interest	NPR 100,000 loaned		1,000
Water source protection	Wells contaminated during floods leading to diarrhoea.	No contamination - so no diarrhoea.	2,445 people use water wells and the cost per doctor visit for diarrhoea treatment = NPR 370.	80% of population get diarrhoea from drinking contaminated water, 80-90% of these cases go to the doctor, and each person can get diarrhoea only once per flood.	579,050
First Aid training	All injuries and diarrhoea cases must be treated by doctor.	Injuries: 20% of smaller injuries can be treated by villagers, remainder go to doctor. Diarrhoea: Villagers can treat more mild cases so only half of cases go to doctor.	250 visits per year per community to the doctor for small injuries, with cost per doctor visit (injuries and diarrhoea) = NPR 370	Large flood: 25% of population gets diarrhoea, 80-90% of these cases go to doctor. Average flood: 10-20% of population gets diarrhoea, 80-90% of these cases go to doctor.	279,350

1 Some villages report that loss of land is still occurring, though at a much slower rate, others report that land is actually being recreated, so have assumed no loss of land (but equally no gain) as an average impact.

2 In some cases the interest rate on loans is only 1.5 per cent but the norm is 2 per cent.

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