COST BENEFIT ANALYSIS FOR COMMUNITY BASED CLIMATE AND DISASTER RISK MANAGEMENT: SYNTHESIS REPORT

August 2010

Developed and Commissioned by:
Oenone Chadburn, Tearfund
Jacobo Ocharan and Karey Kenst, Oxfam America

Courtenay Cabot Venton, Author, Freelance Consultant

This paper has been developed with the very helpful participation of a range of key experts. We would like to acknowledge and thank the following people for their contributions: Robert Roots, British Red Cross (BRC); Daniel Kull, International Federation of Red Cross and Red Crescent Societies (IFRC); Andrew Mitchell, Accion Contre el Faim (ACF); Karl Deering, CARE International; Jo Khinmaung and Jessica Faleiro, Tearfund; Marcus Moench, ISET; Nana Kuenkel, GTZ; Susan Romanski, Jose Fernandez and Teron Moore, Mercy Corps; and Paula Holland, SOPAC. We would also like to thank Bina Desai at the International Strategy for Disaster Reduction (ISDR), who was instrumental in the initial discussions that brought about this report.

1. Introduction

1.1 Background

Cost Benefit Analysis (CBA) is increasingly being used to inform and evaluate a range of interventions that can address climate and disaster risk. The findings from these analyses are being used for multiple purposes – first and foremost, CBA can be used as a decision support tool, to help decide between a range of possible interventions that reduce risk and to maximise benefit for every dollar of investment spent. Furthermore, CBA can be used to make an economic argument for investment in risk reduction (rather than responding to the impacts of a future disaster event). While CBA has historically been used to assess larger scale infrastructure projects and public investment projects, its use at a local or community level is becoming more widespread.

A variety of case studies looking at the impacts, costs and benefits of Community Based Disaster Risk Management (CBDRM) and Climate Change Adaptation (CCA) have been undertaken over recent years. Further, Non-Governmental Organisations (NGOs) and others are beginning to look more closely at the applicability of CBA as a tool to sit alongside existing processes, such as Vulnerability and Capacity Assessment (VCA) and Monitoring and Evaluation Frameworks (M&E), to help project partners examine in greater detail the quantifiable, as well as the more qualitative impacts of their programming.

At the same time, in the context of a changing climate, a variety of initiatives are attempting to shed more light on the costs and benefits of various disaster risk and climate adaptation options at a macro level, to help prioritise and inform decision making and public policy going forward. These studies are part of a critical path to move the adaptation agenda from a pilot/localised level, to a more scaled up and global approach to tackling adaptation. The challenge lies in identifying a range of potential interventions that are suited to different situations, identifying basic principles that are universally applicable, and finally developing the analytical tools that enable measures to be tailored to local contexts. However, there will never be a “one size fits all” approach to risk reduction, and to this end, the development of strategies at a global level need to be interlinked and take account of evidence from household, community and regional levels.

It is recognised that a stock-taking of research on CBA of CBDRM/CCA to date is needed, with recommendations for how, and in what context, this tool may be useful and applicable going forward, as well as the implications of findings for wider initiatives to promote adaptation and reduce risk.

Box 1: What is CBA, and why is it useful for DRR/CCA?

CBA is an economic tool used to compare the benefits against the costs of a given project or activity. CBA can be a particularly useful tool in a disaster/climate risk context. Firstly, CBA can help communities and local partners, as well as government, NGOs and donors, decide on program options, by entering into a more robust process of weighing up costs and benefits of different interventions, both qualitative and quantitative. Secondly, risk reduction requires significant resources to be spent before a disaster, and the benefits are not always overtly obvious. CBA can provide a powerful tool for demonstrating the value of pre-emptive action and investment in risk reduction.

In order to be effective, CBA must be linked with other techniques – such as community engagement – and it needs to be conducted in a transparent and accessible manner.

1.2 Aim of this Report

The aim of this report is to present a brief synthesis that takes stock of the significant efforts on Cost Benefit Analysis of CBDRM/CCA to date, reflecting not only on findings, methodological approaches and lessons learned, but also addressing the implications for where and when CBA may be usefully applied at a community level, and pointing to gaps and methodological constraints that could usefully be addressed going forward.

1.3 Scope of Research and Approach

Scope: It is important to note that this synthesis is very much focused on the application of CBA to *community-based initiatives* for *disaster and climate risk management.* Initiatives may be structural or non-structural, hard or soft, but are part of a community driven process for DRM and are very much bottom-up.

This report is intended as a first step towards a broader and more in-depth discussion around the cost effectiveness of various resilience and adaptation strategies, and the applicability and usefulness of CBA at a community level to help inform decision-making by NGOs, government and donors alike. It is intended as a high level review of recent work – it is not within the scope to conduct a detailed review or in-depth analysis. However, it is hoped that this report will act as a stepping stone for further development and discussion.

Research Approach: The research was conducted by undertaking a literature review for relevant recent studies in the area of CBDRM/ CCA and CBA. Further to this, a number of key contacts working in this area were approached to identify additional reports/research and/or other contact points (see Annex A). The findings from the

studies identified were condensed into a brief synopsis (see Annex B) and summarized here. A draft synthesis was submitted for review to the list of key contacts, and a consultation/brainstorming meeting was held in London on June 29, 2010 to discuss the draft findings, refine the discussion, and identify ways to move the discussion forward. This report summarizes not only the literature to date, but also incorporates the comments and issues that were raised during the consultation exercise (Annex C contains a very brief list of the key points raised at the consultation).

1.4 Structure of this Report

This report is structured as follows:

- *Section 2* looks backs at recent work on CBA applied at a community level. In particular, it highlights key elements of the approaches used, some of the methodological issues faced in applying CBA at a community level, and some of the key lessons learned in relation to both the process as well as the cost effectiveness of various interventions.
- *Section 3* looks ahead, presenting initial thoughts on the usefulness and applicability of CBA at a community level, and is intended to stimulate discussion for moving forward.

- *Annex A* contains a listing of the key participants contacted for the research, with an indication of those that attended the workshop.
- *Annex B* provides a brief synopsis of each of the studies included in the synthesis.
- *Annex C* highlights the key points coming out of the June 29 consultation exercise.
- *Annex D* contains a bibliography of sources reviewed.

2. Looking Backward: A Synthesis of Studies Identified on CBA for CBDRM/CCA

2.1 Introduction

This section looks back at the work conducted to date – it provides a synthesis of the key findings from the studies identified on CBA for CBDRM/CCA:

- First, the key elements of the methodological approaches used and study findings are summarized.
- This is followed by a discussion of some of the methodological issues faced in conducting CBA at a community level.
- Finally, this section looks at some of the key lessons learned, both in relation to applying CBA at a community level, as well as the types of activities that are cost effective (and not) for addressing disaster and climate risk.

This section is used to support the discussion in Section 3, which is intended to stimulate discussion and debate on the usefulness and applicability of CBA at a community level going forward.

Box 2: De-mystifying CBA – is it accessible?

CBA is an economic approach that is frequently associated with the assessment of large infrastructure projects. As such, it is often perceived as a tool that is resource intensive, and that requires specialised technical skills.

However, the principles of CBA are applied to every day decisions – people and organizations regularly weigh up the costs and the benefits of most every activity – whether it's deciding which crop to plant, which materials to use to build a house, or whether to hire more staff. As such, the principles that underpin a CBA process are highly intuitive, though rarely applied in a systematic manner.

Where CBA is used as part of a participatory process with communities, it can be extremely valuable, by helping communities and programme staff to think through the costs and benefits of different programme options, and targeting resources towards achieving "outcomes", rather than "outputs". Data gathering for a CBA does not necessarily require a great deal of extra resource or technical capacity (depending on the availability of data, and the level of analysis undertaken), but rather in many cases relies on additional lines of questioning around the quantitative impacts of program interventions, and is often very similar to existing baseline data collection and VCA processes.

Where data is limited, a quantitative CBA may not be appropriate, and could present misleading results. However, the CBA *process* can nonetheless generate a great deal of added value to decision making, especially in the context of an uncertain future.

2.2 Key Elements of the Studies Reviewed

In total, 13 studies were reviewed for this report (a further four case studies are due to be published over the next few months and will be incorporated as they become available). Table 2.1 below highlights some of the key elements of each of the studies, such as where they were conducted, the type of hazard addressed, and some of their main findings. This table is supported by a more detailed Annex B, which contains a brief synopsis on each of the studies.

Box 3: The Oxfam America CBA Toolkit

Oxfam America (OA) is in the process of developing a Toolkit that will facilitate regional offices and partners to undertake Cost Benefit Analysis as a routine part of the project cycle. OA wants to progressively introduce CBA in its DRR programs to appraise and present the cost and benefits of their interventions and inherent tradeoffs in their investment in risk reduction. In 2009 OA's headquarters-based DRR staff developed a user-friendly CBA methodology, designed to enable effective decision-making in OA's DRR projects in every region.

The Toolkit is designed to sit alongside existing VCA processes, and is composed of three modules, with a range of associated templates and tools:

- Module 9a: Introduction to Community Based CBA for DRR
- Module 9b: Methodology for Community Based CBA for DRR
- Module 9c: Valuation Worksheets

OA is in the process of field testing the methodology in two countries, El Salvador and the Gambia.

Box 4: Glossary of CBA Terminology

Benefit to Cost Ratio (BCR): The BCR indicates the level of benefit that will be accrued for every $1 of cost. A ratio greater than 1 therefore indicates that the project is worth investing in from a *financial* perspective, whereas anything less than one indicates a negative return.

Net Present Value (NPV): The NPV takes the net benefit (benefit minus costs) each year and discounts these to their present day value. If the result is greater than zero, this indicates that the benefits outweigh the costs. The higher the value, the greater the financial argument for initiating the project.

The **Discount Rate** is used to discount costs and benefits occurring in the future, as people place a higher value on assets provided in the present and a lower value on benefits that may accrue further into the future. The discount rate is normally equivalent to the average return one might expect if the same money was invested in an alternative project.

Table 2.1: Summary of CBAs of Community Based Disaster and/or Climate Risk Management

Organization	Date	Country	Hazard	Key Elements	Key Findings
Tearfund	2004	India	Flood; Drought	• Backward looking • Interventions include construction of an escape road, provision of boats for evacuation, raised hand pumps • Data collected through transect walks, focus groups • Qualitative and quantitative	Bihar BCR = 3.76; AP BCR = 13.38
World Bank	2007	Kenya	Flood	• Forward looking • Community Driven Development, including woodlots, medicinal plants, indigenous vegetables, beekeeping. • Data collected primarily from research institutions with pilot projects on related activities.	See case study summary – a wide variety of initiatives and scenarios are estimated, some not viable, some viable.
ISET	2008	Nepal	Flood	• Backward looking • Purely qualitative, uses "Shared Learning Dialogue" • Addressed distributional issues • Hard and soft resilience measures • Addresses climate change - qualitative	Structural measures cannot be an effective primary strategy for responding to the increased flood risk anticipated as a consequence of climate change
ISET	2008	India	Flood	• Backward and forward looking • Addresses climate change • Embankments compared with a more people-centred basket of interventions (raised house plinth, raised fodder storage, early warning, flood shelters, community seed banks, self help groups, etc) • Data collected through a household survey	Embankments have not been economically beneficial. The analysis generates a BCR of 1 and it is predicted that this would decrease with climate impacts. BCRs for people centred approaches range from 2 to 2.5 under current and future climate scenarios.

Organization	Date	Country	Hazard	Key Elements	Key Findings
ISET	2008	India	Drought	• Insurance mechanisms for addressing drought risk, groundwater irrigation • Forward looking • Risk based modelling framework used to generate probabilistic drought shocks to farmers. • Incorporates climate change • Resource and time intensive due to complex modelling needs	All interventions seem economical, with the integrated package of both interventions delivering similar benefits at lower cost.
ISET	2008	Pakistan	Flood	• Four measures addressed: warning system, concrete lining of the channel, construction of a dam in the upper reaches of the stream, and relocation of the most exposed population to higher ground. • Backward-looking • A simplified downscaling technique and rainfall runoff model were used to investigate potential climate change impacts • Used data from 2001 floods	The over- designed early warning system in place is the only one with a benefit cost ratio of less than one.
British Red Cross/Nepal Red Cross Society	2008	Nepal	Flood	• Qualitative and quantitative approach • Quantifiable measures include mitigation works (flood defence), income generation loans, protection of water sources, and first aid training. • Backward looking	Full suite of quantifiable measures: BCR = 18.6 Without flood mitigation (only loans, water sources, training): BCR = 2
SOPAC	2008	Samoa	Flood	• Interventions assessed include: floodwalls, a diversion channel, an improved flood forecasting system, and development control through the construction of homes with elevated floor heights.	Non-structural measures were found to be the most economically viable. Improved forecasting system: BCRs range from 1.92 to 1.72. Homes with raised floors: BCRs range from 2 to 44, dependent on the type

Organization	Date	Country	Hazard	Key Elements	Key Findings
				• Flood hazard maps created using impacts of previous floods from public records, household and business surveys. • Direct and indirect monetary losses estimated. • Distribution of impacts is accounted for across sectors.	of structure, floor height, and discount rate used in the analysis. Structural measures were found to be not economically viable, and it is not believed that other non-quantifiable benefits would be enough to raise ratios above one.
SOPAC	2008	Fiji	Flood	• Survey used to assess impacts to a range of sectors including household, business, government and donors. • Intervention assessed is an effective flood warning system. • Assessed distributional issues.	Overall: BCR of 3.7 to 7.3 Navua community: BCR is infinite (no costs borne) Govt of Fiji: BCR = 1.1 to 2.2
Oxfam America	2009	El Salvador – ex post	Flood	• Field testing of a CBA tool with local partners • Qualitative and quantitative • Participatory approaches with communities used to gather primary data. • Backward looking CBA of a DRR program to improve evacuation and shelters.	The program yields a BCR of 0.97 using conservative assumptions. Sensitivity testing yields BCRs of 1.05 to 1.60.
IFRC	2009	Philippines	Flood	• Qualitative and quantitative • Participatory approaches with communities used to gather primary data. • Conducted as part of a wider evaluation. • CBA of three specific interventions: a hanging footbridge for evacuation, a sea wall and a dyke • Backward looking	Two of three interventions are cost effective: Hanging footbridge: BCR = 24 Sea wall: BCR = 4.9 Dyke: BCR = 0.67
IFRC	2010	Sudan	Drought	• Qualitative and quantitative • Participatory approaches with communities used to gather primary data. • Conducted as part of a wider evaluation.	Earthdams/embankments and water interventions were all found to be economically efficient. However, some of the most important impacts were

Organization	Date	Country	Hazard	Key Elements	Key Findings
				• CBA of individual activities.	qualitative, namely educational benefits and women's groups.
Oxfam America	2010	El Salvador – ex ante	Drought, Pests, Livestock disease	• Field testing of a CBA tool with local partners • Qualitative and quantitative • Participatory approaches with communities used to gather primary data. • Forward looking CBA to assess a range of possible project interventions for investment.	A wide range of interventions were assessed, including silos, alternative food sources for cattle, vaccination, alternative seeds, vegetable gardens, and community organizing. The BCRs range from 0.42 to 86.70. Silos yield a negative BCR – for cultural reasons they need to be provided on a household basis at high cost. Community organizing for collective bargaining on agricultural inputs yields the highest BCR.
Oxfam America	2010	Gambia – ex ante	*In Process*		
Oxfam America	2010	Gambia – ex post	*In Process*		
Tearfund	2010	Malawi	*In Process*		
Mercy Corps	2010	Nepal	*In Process*		

Broadly speaking, the studies reviewed are built on a common methodological approach in as much as they all incorporate the following (though to varying degrees of complexity and detail):

- A **hazard assessment** that investigates the hazards affecting the population in question, their magnitude and frequency.
- An **impact assessment** that investigates the impacts of hazards on the community, specifically in relation to the population's vulnerabilities, capacities, and exposure to hazards, "without" CBDRM.
- An **analysis of risk reduction**: what interventions have been/can be introduced to reduce risk and how have the impacts of hazards changed as a result? What are the costs of these interventions? This assessment investigates the impacts of hazards "with" CBDRM. The difference in impact "without" and "with" CBDRM represents the avoided cost, or benefit, for undertaking CBDRM.

There are also a number of notable differences in the studies/approaches reviewed:

Qualitative versus quantitative*.* Studies range from purely qualitative, as in the example of ISET Nepal where Shared Learning Dialogues were used to understand the costs and benefits of risk reduction from a purely qualitative perspective through discussion; to a mixture of qualitative and quantitative assessments, where the full range of impacts are assessed, but a subset of those that can be quantified are investigated in further detail. Of note, CBA studies that investigate more structural measures on a larger scale (for instance, some of the World Bank studies for development projects) typically focus almost entirely on the quantitative aspects, whereas the application of community level CBA has the opportunity to take a more holistic approach by elaborating on both qualitative and quantitative aspects.

Ex-post versus ex-ante*:* CBA at a community level has been used to assess projects or programmes that have already occurred – referred to as "backward looking" or "ex-post". It can also be used to decide between a suite of interventions, to identify those that are most cost effective going forward – referred to as "forward looking" or "ex-ante". Some assessments could have elements of both – for example, the 2009 Oxfam America study in El Salvador was backward looking, but found that several interventions were too recent to have taken hold, and hence a forward looking assessment, using anticipated impacts and sensitivity testing, was used for those elements.

Data sources: The data used for quantitative assessments comes from a mixture of primary and secondary sources depending on the study and the availability of data in the country. Examples of secondary data collection include: datasets on hazards and

their impacts from government records; data on hazards, their impacts, and the viability of alternative approaches to activities such as agriculture from research institutions; projected impacts of climate change from meteorological institutions and research bodies; GIS maps from relevant authorities and research organizations; and data on community level impacts from existing NGO baseline studies. Examples of primary data collection include: participatory processes such as transect walks and focus groups to gather data on hazards and their impacts; surveys of affected populations to gather data on hazards and their impacts as well as demographic data and indicators of vulnerability; and semi-structured interviews with local officials, CBOs, and other relevant stakeholders.

Data on hazard impacts: Data on hazard impacts can take a number of forms:

- Direct/indirect – in most cases, only direct impacts are included in the analysis (e.g. loss of assets, damage to houses, etc). In some cases, efforts are made to identify indirect impacts as well – for example, floods may result in business interruption for several months after the fact.
- Monetary/non-monetary – many impacts are non-monetary. In other words, they cannot be numerically measured. Or they may be too complex to measure. Or, in the case of placing a value on loss of life, some studies choose not to place a monetary value on this loss from an ethical standpoint.
- Financial/economic – in theory, CBA is used to account for economic impacts – all those impacts that affect the wellbeing of a population. However, in practice most CBAs at the community level are financial in nature, with a focus on those impacts that can be easily monetized. Economic benefits, such as protection of natural resources, can be valued but usually require time intensive studies to do so. Nonetheless, most of the studies incorporate economic benefits at least from a qualitative perspective.

Types of risk reduction measures assessed: The risk reduction measures included in the CBA can vary, and very much depend on what has been/is being considered under the project or programme. Furthermore, the CBA may either take an approach that evaluates individual activities under a program (as in the IFRC Philippines study) or the programme as a whole (as in the BRC Nepal study). Measures can be broadly categorized as prevention versus preparedness (e.g. a dam to "prevent" the flood versus grain stores to ensure food is available during flood times); and structural versus non-structural (e.g. water pumps, dams, and embankments, versus training, advocacy and awareness raising measures). By their very nature, community level interventions tend to encompass a range of types of activities, and hence the different studies cover a variety of types of risk reduction measures. Furthermore, the impacts of softer measures can often be hard to quantify, and hence the range of measures included in a

programme requires an approach that includes both qualitative and quantitative techniques.

2.3 Methodological Issues

The methodological approach for applying CBA at a community level can clearly take a number of forms, as highlighted above. There are aspects of the approach that are intuitive and work well, and other aspects that are harder to apply at a community level. This section highlights some of the key methodological issues faced in the studies reviewed.

The valuation of non-monetary benefits is a significant constraint in applying CBA. Community work brings a whole host of benefits that cannot be quantified – but which are often central to the work being undertaken – for example social and environmental benefits. Decision-making must take account of the full range of impacts, and the danger with CBA is that a project with a high level of monetary benefits will be selected over a project that may be equally beneficial but not so easily quantified. This issue becomes particularly critical in areas such as slow onset disasters, where it can be very difficult to identify both monetary and non-monetary benefits of breaking cycles of poverty brought on by successive droughts, or in the case of ecosystem based approaches, where environmental benefits are a key priority.

A clear understanding of risk is inherent to conducting CBA, and yet the probability of hazard occurrence, and associated impacts, can be very difficult to estimate, particularly when the analysis is taking place at a community level. Ideally, a CBA is built upon probabilistic risk modelling, where the probability of a hazard occurring is estimated for a range of hazard magnitudes. The impacts (and associated reduction in impacts that come about with risk reduction) are then weighted by the probability of an event happening. These points create a loss-frequency curve. In practice, however, data is often very limited, particularly at a local level, and it is only possible to map two or three hazard/impact probabilities.

Climate change adds another level of complexity to probabilistic risk modelling. The probability of hazards is changing under climate change, and hence loss-frequency curves will also shift, changing the outcomes of any cost benefit analysis. While significant efforts are being made to downscale projections on climate change impacts from more global models to country, region, and locale-specific models, this requires significant amounts of data, and even then, results are highly uncertain. In addition to a certain degree of unpredictability of future human behaviour and natural variations, the down-scaling of global projections itself is an imprecise science. Hence it becomes very

difficult at a community level to estimate whether a 1-in-10 year flood is likely to become a 1-in-8 year flood, or a 1-in-5 year flood, and indeed, how quickly these changes will take place. The ISET India study used a risk-analytic modeling approach, and found that ultimately this was a very resource and time intensive approach, which generated findings that were highly uncertain in any case. The study authors suggest that sensitivity testing for a range of probable climate scenarios could have generated equally reliable findings but more efficiently.

The distribution of benefits from risk reduction is very important from a development perspective, with many projects focusing on the most vulnerable, including women, children, the elderly and disabled. CBA does not traditionally account for distributional impacts. First of all, the work done to date on CBA at a community level has consistently emphasized the need to ensure that the quantitative analysis sits within a wider qualitative framework. As such, distributional aspects can be discussed and included in a more qualitative fashion. The SOPAC Navua study used a methodology that explicitly demonstrated distributional impacts between households, businesses and government. The study used a survey to investigate impacts of hazards, and reduction in impacts associated with risk reduction measures, to each of these groups. The study also allocated costs of risk reduction measures according to who would pay for them. The study goes on to estimate CBA figures specific to each of these groups – according to who pays, and who receives the benefit, and as such presents a very interesting case for addressing distributional aspects across a society as a whole.

For backward looking CBAs, the timing of the study with respect to implementation of project interventions can significantly impact on methodology and results. When assessing impacts, if the project interventions took place too far in the past, community members can find it difficult to reconstruct the "without" scenario. For example, in the IFRC Philippines study, the project had been implemented 10 years previously and thus there was a large degree of variation in recounting of impacts. In Samoa, the household survey was conducted 6 years after the event and resulted in values that were so unreliable they had to be replaced with other estimates. On the other hand, if interventions have occurred too recently, it may not yet be possible to observe the impacts of the intervention (as was found in the 2009 Oxfam America study in El Salvador). This is particularly true for activities such as changes in cropping patterns or introduction of new seeds, which require a longer time frame to take hold, and for which impacts are not always easily attributable (a new crop could reduce impacts of drought, but it can be hard to quantify this in the immediate term because so many exogenous factors impact on crop yields).

2.4 Lessons Learned

A number of lessons learned can be highlighted from across the studies reviewed.

There is broad consensus that the CBA process can be useful at a community level…

- CBA at a community level yields findings that are helpful for both evaluation purposes as well as making forward looking planning decisions, and these findings have been used effectively for advocacy and demonstrating the value of CBDRM to donors and government.
- The process of conducting a CBA is fairly intuitive, especially with regards to the field work.
- The process introduces another layer of evaluation, encouraging a more robust analysis of benefits, as well as fostering a greater focus on outcomes as opposed to outputs. Furthermore, CBA encourages an open discussion that fosters consensus building, innovative thinking and transparency, and can help to bridge discussions between government and Community Based Organizations (CBOs). In fact, a key finding is that the process is often more beneficial than the "product" (the final analytical result), because it forces organizations to clarify and test the assumptions they make between an intervention and the desired outcome, as well as opening up a transparent dialogue.
- The studies reviewed have not only confirmed some anticipated outcomes, but have also generated some surprises, and hence added value to the overall decision making process. For example, the CBA study undertaken by Oxfam in El Salvador in 2010 (as yet unpublished) demonstrated that the use of silos and storage practices to protect crops were actually not cost effective, in large part because of cultural barriers to collective storage that dictated the need (and expense) of household silos, and hence a suite of other options are being investigated and prioritised that can reap greater gains for beneficiaries.

There is also no doubt that it has its limitations…

- CBA, at its core, is about risk assessment, and hence uncertainty is inherent in the process, especially at a community level and in the face of climate change.
- Data limitations can pose a substantial challenge, especially where there is not the capacity/resource to conduct primary data collection. And even where data can be collected, there are often significant levels of uncertainty over the data gathered (e.g. bias in responses, long recollection times, conflicting/inconsistent information among those surveyed).
- Further, while CBA is underpinned by some common principles, due to data constraints and other limiting factors, it is not applied systematically at a community

level, making it difficult to compare across studies and draw broader lessons around successful interventions.

- A focus on quantitative aspects of programme design sits more comfortably with large infrastructure projects. By contrast, CBDRM, by its very nature, is typically focused on a mix of hard and soft resilience measures, largely implemented by NGOs/CBOs, and hence the focus on quantitative is not as natural, and the benefits are often inherently difficult to measure and quantify.
- There are differing perceptions on how valid the CBA process is at a community level, given these data limitations.

There are some interesting and unexpected lessons learned with respect to those interventions that are most cost effective, with direct relevance to NGOs, governments and donors alike…

… a focus on interventions that bring wider development gains are generally going to be more cost effective. This is particularly emphasized in the face of uncertainty. In areas where the frequency and magnitude of hazard occurrence is less known, activities that focus only on CBDRM are more likely to have a negative return. By contrast, if these activities also bring wider development gains, they are more likely to be cost effective. For example, in the Tearfund study in India, boats were provided for evacuation purposes, but were also rented out by villages to neighbouring communities for fishing outside of flood times, generating an important source of income for the community that was then used for community development projects. Indeed many of the interventions assessed for CBA deliver both disaster and development benefits – evacuation shelters are used at other times for community meetings, provision of raised water wells are not only beneficial in floods, but provide sufficient clean water year-round, and training and community organizing for evacuation often results in community groups that advocate for themselves on a whole range of issues. This finding strongly supports the current discussions around “no-regrets” development approaches and integrating/mainstreaming DRR/CCA within wider development plans.

… soft resilience measures are often more cost effective and more robust in relation to uncertainties than hard resilience measures. Firstly, soft resilience measures generally cost less (less capital intensive) but can be highly effective. For instance, in El Salvador, Oxfam found that training on evacuation was highly effective and resulted in significant savings as families evacuated livestock in good time. Second, even where the ratio of benefits to costs is similar across soft and hard measures, the absolute cost for softer measures tends to be much smaller. For example, the Maldives study highlighted in Box 6 below found that soft resilience measures yielded similar ratios to hard resilience measures, but the total spend was far less. Further, hard resiliency measures tend to be

"threshold dependent" – designed to withstand a specific magnitude of hazard. As a result, returns from soft measures may be more robust in the context of uncertainty over changing conditions. The Samoa case study also came to a similar conclusion, finding that softer measures such as improved flood forecasting were more cost effective than more structural measures such as floodwalls.

Box 5: Hard Resilience versus Soft Resilience

Most activities undertaken in the name of disaster risk reduction fall into two broad categories: (1) "Hard Resilience" measures: the strengthening of physical systems to directly withstand or respond to the specific stresses imposed by earthquakes, storms, floods or other extreme events; and (2) "Soft Resilience" measures: a wide variety of "softer" and indirect measures intended to reduce the impact of events on people and assets, improve relief capacities when events occur, and aid recovery.
Source: Moench, M. (2008)

… the design of both soft and hard measures for risk reduction should be fit-for-purpose to ensure returns. The ISET Pakistan study found that, contrary to intuition and previous experience, the Early Warning System (EWS) was not cost effective, because it had been over-designed for its purpose. This finding also accentuates that there is no one-size-fits-all approach; even an EWS can be cost-ineffective if it is not tailored to local circumstances.

… CBDRM programming needs to take a holistic view, even if activities are only undertaken in a subset of communities. Benefits accrued from activities are not valid if risk is simply displaced. For instance, in Nepal, BRC/NRC found that mitigation works in the river were having significant benefits for the communities in that section of the river, protecting crops and houses from annual floods. However, there was concern that the displacement of the water from one set of villages could possibly be increasing the flow of water in other villages, and hence simply displacing the impacts of flooding. While NRC could not operate across the whole river basin, the study findings highlighted the need to take a more holistic approach under consideration. This is a key weakness in many community-based approaches - they generally miss system level vulnerabilities and/or benefits.

… longer term support can reap significant benefits. In several of the case studies, CBAs were assessed for both the short term and the longer term. Whereas much NGO and donor programming in communities typically runs for one to three years, CBA demonstrates that returns can often be doubled if a small amount of support, for instance refresher training, or maintenance on physical works, is provided over the longer term. For example, the BRC study in Nepal found that benefits could be doubled

for a minimal amount of support for maintenance of first aid kits, water wells, and check dams over 10 years as opposed to the standard project lifetime of 3 years.

Box 6: Building Resilience in the Maldives

A CBA of three islands in the Maldives was conducted in 2009 to determine the effectiveness of creating "safer islands", using mostly hard resilience measures to protect selected islands from the risk of sea level rise, flooding and tsunami. Two of the islands were under consideration for development as safer islands, whereas one of the islands had already been significantly modified following near complete destruction from the 2004 tsunami. A number of scenarios were considered, including a full suite of safe island measures (for instance construction of safe harbors, building of sea walls), a selected suite of measures, and a limited protection scenario.

The findings from the CBA were mixed, with a range of positive and negative findings. Furthermore, the findings are very specific to island characteristics. In particular, the analysis for Thinadhoo Island is more positive because 1) Thinadhoo has a predicted lower intensity for a tsunami and therefore a standard suite of risk management measures affords more protection, and 2) much of Thinadhoo's infrastructure is located away from high intensity zones and therefore easier and less costly to protect.

Furthermore, the study found that soft resilience measures may, in fact, be a more successful and sustainable option for the Maldives. The greatest threat to the Maldives is sea level rise, which is slow onset (unlike other hazards such as flash flooding), and can be monitored (unlike earthquakes). Hence the Maldives can use time to its advantage to look into alternative protection options, allow for development of new technology, and lower cost innovation, while also allowing the natural adaptation processes of the islands to work to their full advantage. Man-made interventions may only hinder the ability of islands to respond naturally, and thus while providing some protection in the short term, may contribute to a lack of longer-term resilience. In addition, many of the more frequent hazard events, such as rainfall flooding, are not reported in the past – they have largely come about as a result of poor development practices on the islands, and hence could be rectified through lower cost measures such as revising and enforcing land use planning.

Source: Cabot Venton et al, 2010.

3. Looking Forward: The Context for Using CBA at a Community Level

3.1 Introduction

As summarized above, a variety of studies have been undertaken using CBA at a community level to evaluate and inform disaster and climate risk reduction programmes. The synthesis of findings has clearly highlighted that CBA at this level can be very useful, especially where it is part of a wider qualitative evaluation process, but that it also has a number of significant limitations, particularly in data and resource constrained contexts.

It is clear that CBA cannot and should not be used across the board. Hence the question arises: **In what context can CBA be useful for application at a community level?**

3.2 Approaches to Applying CBA at a Community Level

The research to date suggests that there are three possible approaches to a CBA at a community level, requiring progressively increasing amounts of data and resources. These three approaches are by no means absolute - they are categories along a continuum and therefore studies may combine elements from different approaches. Nonetheless, the three approaches help to provide a framework for discussing the application of CBA at a community level.

These approaches are applicable to any organization implementing CBDRM and/or CCA programmes, including NGOs, government, and donors.

Approach 1: Qualitative Assessment
As with the ISET study in Nepal, the principles of CBA can be used to engage in a more quantitative line of questioning with communities through focus groups and other participatory tools, but without actually quantifying benefits in full for a detailed CBA. This approach can be very beneficial as it encourages a greater discussion around outcomes (as opposed to outputs). This approach can be used in scenarios where capacity and/or resources are significantly constrained, or proposed interventions are too small to justify a more in-depth analysis. Focus is on the process rather than the product.

Approach 2: Basic CBA

A basic CBA should be used where quantitative analysis/findings are desired, but where there is not enough resource or capacity to do a thorough statistical sampling of the population. It can be run alongside existing VCA/M&E processes, and hence does not need to be time intensive. Fieldwork can be undertaken by project partners/staff/local counterparts. Some specialist assistance may be required for modelling the findings.

Approach 3: Full Scale CBA

A full scale CBA should be used where a significant investment is being made, or where a detailed analysis can help inform wider discussions on scaling up of particular DRR/CCA interventions. For example, where governments are interested in prioritizing certain initiatives in national level policy and planning, CBA at a community level may be appropriate to ensure that implementation of these policies will be effective and takes account of local conditions. Primary data is gathered through surveys, specifically on hazard characteristics and their impacts on lives and livelihoods, as well as the potential reduction in impacts through DRR/CCA. GIS maps can be used to visually represent impacts. This type of study may be particularly relevant in larger/consolidated populations (e.g. urban), where costs of risk management interventions could be high.

3.3 Which Approach?

Organizations will need to decide where and when to use CBA, if at all. Clearly, CBA is not applicable, nor beneficial, across all programmes within an organization. Rather, it should be used strategically within an organization to make programming decisions in areas that are of key importance or focus, where significant sums of money are designated and/or plans include scaling up of activities.

There is no right answer as to which approach to use – it depends very much on the mission and strategic focus of the organization, levels of resourcing, and levels of capacity (see Box 7). It also depends on the type of organization wishing to undertake the assessment, and their motivation. CBA can be used for a range of purposes – to demonstrate cost effectiveness of a specific intervention, to identify cost effective measures across a broad geographical region, to generate ownership and facilitate decision making as part of participatory processes with communities, to advocate for specific measures, etc – and these will vary depending on whether government is trying to inform policy making, or whether an NGO is deciding how to work with a particular community, or whether a donor is making strategic decisions for investment.

Nonetheless, the flow chart on the following page suggests a number of steps/questions that can help to guide the decision making process as to when and how to implement a CBA.

Box 7: What Skills are Required for CBA?

The implementation of a CBA at a local level, by practitioners who are not experienced in the tool, has had mixed results – some are surprised by how intuitive they find the process, whereas others find it challenging.

Clearly CBA involves technical analysis, and requires a sound understanding of the economic principles on which it is built. It also requires certain mathematical and computing skills. It cannot be implemented as an off-the-shelf product, but rather requires some level of training in its use.

Equally, many aspects of the CBA are intuitive, and tie in neatly with existing processes such as VCA participatory approaches and data collection for monitoring and evaluation. This would suggest that, where local partners have good capacity in the skill sets required for VCA/M&E, that the data collection phase of CBA may be fairly easy to implement with a small amount of support. More technical support will likely be required for the data analysis phase.

Flow Chart for Applying CBA to Organizational Activities

Step 1: Identify areas of strategic focus (either historic or planned), where more in-depth analysis of costs and benefits of risk reduction programming could be beneficial, both to demonstrate value for money, as well as to decide on a suite of programming options that are most cost effective.

- ***What are the strategic areas of focus for the organization?*** (e.g. training, advocacy, specific types of interventions such as alternative seeds, irrigation or water infrastructure, and/or specific countries/regions).

Step 2: Determine a subset of programmes to analyze. Once the organization has decided on two or three strategic areas of focus, evaluate those partner organizations/local government offices that could carry out a CBA, by asking the following questions:

- Is partner capacity on VCA/M&E strong?
- Has M&E baseline data already been collected in beneficiary communities?
- Will project activities affect a large population/be scaled up in the future?
- What level of funding can be committed to undertaking CBA studies (which in turn will dictate how many studies are planned)?

Step 3: Decide on the CBA approach for each programme to be assessed. Where capacity is relatively weak, and/or data is limited, but a CBA analysis is desired for strategic (or other) reasons, a qualitative approach may be most appropriate. At the opposite end of the spectrum, if funds and capacity are available, and a specific set of activities are deemed to be very strategic to the organization or a significant component of government plans, it may be appropriate to invest in a full scale CBA, and use the findings to determine how best to scale up activities, as well as to solicit further support/funding for scaling up.

4. Key Messages and Recommendations

The application of CBA at a community level is clearly adding value to efforts to reduce climate and disaster risk. As the findings above indicate, the case study material conducted to date has added a new dimension to our understanding of the types of interventions that are cost effective, in some instances confirming suppositions, and in others presenting unexpected findings. The *process* is also proving valuable in helping partners to think through interventions in terms of outcomes, rather than outputs.

However, the application of CBA at a community level also has a number of significant limitations – methodological gaps and capacity constraints need to be addressed, and where and when to apply CBA at a community level needs to be elaborated.

This section highlights some of the key recommendations, from the report and from the consultation exercise, for developing this area of work.

4.1 Key Messages

First, CBA at the community level has demonstrated that **the success of risk reduction and adaptation measures is context specific – a common suite of measures applied in similar hazard contexts can in fact have very different outcomes based on cultural characteristics, for example**. Certain groups of measures are likely to have a lower cost relative to their benefits. This is true of many softer resilience measures. However, as highlighted by the example of over-designed EWS in Pakistan, and silos for crop storage in El Salvador, measures cannot be divorced from their context. On the one hand, scaling up of adaptation and risk reduction will require some broader lessons and "rules of thumb" for measures that are most likely to be cost effective. But these discussions must include mechanisms for recognizing **the need for risk reduction to be embedded in a participatory process that takes account of local conditions.**

Second, while CBA can help to demonstrate the value for money of community development projects, community based risk reduction and adaptation result in a wide range of benefits that cannot be monetised but which are central to good practice development – gender issues, capacity building, advocacy and governance, and environmental benefits, are all examples of key pillars of development that are often (though not always) difficult to quantify. Any assessment of the value of a programme has to include both qualitative and quantitative aspects, otherwise it could lead to development losses and poor policy choices. **Any assessment of the value of a project or programme of work needs to encompass both qualitative and quantitative aspects, particularly when applied to community based development work.**

4.2 Specific Recommendations

A number of specific recommendations were elaborated in the CBA studies, and as part of the consultation meeting in London, to build on the work done to date. Many of these are applicable to the full range of stakeholders implementing and financing community based work, including NGOs/CBOs, government and donors.

- The **development of a consistent CBA methodology and procedure for data collection** will help to ensure that findings from a range of studies across agencies and regions are comparable, creating a body of evidence which can help to inform policy choices at national and international levels. A potential starting point is the **integration of CBA into M&E and VCA procedures**. This will help to **institutionalise CBA** and ensure that it is implemented in the context of a strong M&E/VCA platform. Strong M&E/CBA will only **improve the transparency and accountability of activities**, and the integration of CBA into M&E systems can help to drive more **quantitative and efficiency driven monitoring**.

- **Further research is required to address non-monetary benefits –** given that many of the qualitative impacts addressed by DRR/CCA are central to good development, further work is required to **1) identify ways that these non-monetary benefits can be quantified** (drawing from literature in other areas of practice, such as environmental protection, for example, where some of these issues have been quantified using more complex techniques) and **2) develop procedures for assessing and ranking both qualitative and quantitative impacts for decision-making** (such as risk assessment matrices) to ensure that non-monetary benefits are explicitly included in the process. This recommendation is particularly relevant in the context of an increased focus on **Ecosystem-based Approaches (EbA),** where soft resilience measures and environmental approaches play a central role.

- To date, most of the case study work has occurred in rapid onset disasters. It is recommended that **a body of evidence is developed in areas where CBA is more complex**, such as conflict, slow onset disasters and cyclical/cumulative impacts, DRR in recovery operations, and multi-hazard contexts.

- **Investigate the use of CBA in other areas of development practice**, for example the **health/HIV communities** where demonstrated cost effectiveness has been used to great effect to advocate for further investment. Document lessons and/or methodological approaches that can be transferred across. As an example, the use of “Knowledge, Attitude, Practice and Behaviour” Surveys (KAPB) in the health sector could provide some useful lessons and methodologies for collecting data.

- **Develop guidance for when, how and why different actors should implement CBA,** building on the discussion laid out in Section 3 of this report. Clearly, CBA has a role, but it can also be a distraction that uses up valuable resources. **Conduct further consultation to elaborate on when and where CBA can be most usefully applied, how the outcomes of CBA have been applied by NGOs** (e.g. how it has influenced programming, advocacy), and **donor and government views on CBA for DRR/CCA** (do they find it useful, how can they apply it to their work and policy development), to help inform this discussion**.**

- **Establish a CBA website/blog** where practitioners can upload case studies, document methodological approaches, and raise technical questions to a community of CBA practitioners. This could also facilitate greater **exchange of practice** amongst the NGO, government and donor communities, identifying ways to work together, thematically and geographically. **Linkages should be created between CBA and other relevant bodies of work**, for example, "Views from the Frontline," spearheaded by the Global Network of CSOs for DRR, and the ongoing work on the "Characteristics of a Disaster-resilient Community".

- **Develop seed funding for conducting CBA.** Where CBA is used to inform programming/policy decisions, it needs to be undertaken *before* the proposal stage – in other words, CBA should be used as part of a first step to deciding project activities with a community as part of a participatory process, and these findings are then used to influence the proposal/planning stage. In particular, donors should consider establishing Technical Assistance funding to allow these studies to be undertaken, and governments will need to allocate budgets for these studies as part of the national policy development stage.

Annex A: Consultation with Key Experts

The following were consulted as a part of this process. Those with a (*) next to their name participated in the June 29 consultation exercise.

Name	**Organisation**
Oenone Chadburn*	Tearfund
Jacobo Ocharan*	Oxfam America
Karey Kenst	Oxfam America
Jo Khinmaung*	Tearfund
Jessica Faleiro*	Tearfund
Robert Roots*	British Red Cross (BRC)
Daniel Kull*	International Federation of Red Cross and Red Crescent Societies (IFRC)
Andrew Mitchell*	Accion Contre Faim (ACF)
Karl Deering*, Clare Sayce	Care International
Marcus Moench	ISET
Muyeye Chambwera	International Institute for Environment and Development (IIED)
Susan Romanski	Mercy Corps
Jose Fernandez and Teron Moore	Consultants to Mercy Corps
Paula Holland	SOPAC
Nana Kunkel	GTZ
Reinhard Mechler	International Institute for Applied Systems Analysis (IIASA)
Soraya Smaoun, Johara Bellali	United Nations Environment Programme (UNEP)
Margaret Arnold	World Bank
Charlie Benson	Independent
Moortaza Jiwanji	United Nations Development Programme (UNDP) Fiji
Emily McKenzie	World Wildlife Federation (WWF)
Tim Waites, Jane Clark	UK Department for International Development (DFID)
Tom Tanner, Maggie Ibrahim, Katie Harris	Institute for Development Studies (IDS)
Ryo Hamaguchi, Mohammed Inaz	UNDP Maldives
Simon Maxwell	Overseas Development Institute (ODI)
Daniel Maxwell	Tufts, Feinstein International Center

Annex B: Cost Benefit Analysis of Community Based Disaster/Climate Risk Management: Case Studies

Name of Study: Disaster Preparedness Programmes in India: A cost benefit analysis

- ***Organisation:*** Tearfund
- ***Date***: 2004
- ***Region***: Asia
- ***Hazard Type(s):*** Flood/drought
- ***Weblink:*** http://tilz.tearfund.org/Topics/Disasters/Case+studies/DRR+Case+studies.htm

Project Summary: This study presents a cost benefit analysis of two disaster mitigation and preparedness (DMP) interventions in India. The objective is to analyse the net benefits resulting from DMP to assess the cost-effectiveness of the interventions. Tearfund, a UK-based NGO, commissioned the study in response to a call from the international community for greater evidence of the impacts and effectiveness of DMP.

This study is intended to inform the growing discussion on risk reduction in a number of ways. First, it aims to provide evidence-based research to confirm that investment in DMP initiatives is money well spent from an economic point of view. Second, it intends to show how cost benefit analysis can be used as an analytical tool to choose between different types of DMP intervention. Third, it aims to provide evidence of the potential for using DMP as a significant element in both humanitarian relief and development programming. Such evidence can also be used to advocate for increasing the resources allocated to specific DMP interventions.

Summary of Methodology: The study involved the following steps: 1) selection of study areas; 2) definition of the project scenario; 3) identifying project impacts; 4) data collection; and 5) cost benefit analysis. Data was collected in five villages using transect walks and focus groups to discuss hazards and their impacts both “with” and “without” DMP.

Both assessments were backward looking. In Bihar, an assessment was made of community based DMP interventions in response to yearly floods, with measures including the construction of an escape road, provision of boats for evacuation, installation of raised hand pumps, establishment of village development committees and village development funds. A wide range of qualitative and quantitative impacts were identified and the cost benefit analysis was conducted for a subset of impacts including reduced costs associated with raised hand pumps, and reduction in loss of lives and assets. In Andhra Pradesh (AP), a range of interventions addressing both flood and drought had been introduced. The CBA assessment specifically focused on the impact of raised hand pumps installed in seven villages, which have ensured access to clean water and resulted in a reduction in illness.

Key Findings:

Bihar: The study found that the quantifiable impacts produce a benefit to cost ratio of 3.76 (ranging from 3.17 to 4.58 in sensitivity analyses).

AP: The study found that the quantifiable impacts produce a benefit to cost ratio of 13.38 (ranging from 3.70 to 20.05 in sensitivity analyses).

Name of Study: Western Kenya Community Driven Development and Flood Mitigation Project

- ***Organisation:*** World Bank
- ***Date***: 2007
- ***Region***: Africa
- ***Hazard Type(s):*** Flood
- ***Weblink:*** http://www.proventionconsortium.org/?pageid=26

Project Summary: The objective of the proposed project is to empower local communities of men and women to engage in sustainable and wealth creating livelihood activities and reduce their vulnerability to flooding. The project has three major components as follows: (a) Community Driven Development (CDD); (b) Flood Mitigation; and (c) Implementation Support. The CDD component will support community-prioritized investment projects to improve livelihoods and build demand and capacity for local level development at community and district level.

Summary of Methodology: The Project Document contains a CBA of the following CDD interventions: (a) woodlots; (b) medicinal plants (including processing); (c) indigenous vegetables; (d) Sustainable Land Management (SLM) practices (though these don't seem to be discussed in detail); and (e) beekeeping. The methodology is not discussed in detail, and varies between each of the interventions, but broadly speaking seems to rely on data from already existing pilot projects underway through research institutions. The methodology looks at returns both from the perspective of the participating communities (i.e. when costs for non-production purposes and overheads are not included) labeled as the "private" IRR, as well as for the project as a whole, labeled the "social" IRR.

Key Findings: The following scenarios were assessed. The key findings are included in the table below.

- *Woodlots*: Two scenarios were considered: the first one would include the benefit from fuelwood collection, and the second would not include other benefits than timber.
- *Medicinal plants:* Intercropping of Ocimum (medicinal plant), with Mundia (medicinal plant) and agroforestry (Sasbania).
- *Vegetables:* The CBA is based on crop budgets collected from the World Vegetable Center. The vegetables evaluated include: amaranthus, cowpea, and nightshade. If maize production is taken as the without project scenario, amaranthus and nightshade can be expected to be highly profitable. The CBA analysis for cowpea revealed that maize production could be more profitable in the project area and therefore the respective micro-project would not be financially and economically viable.
- *Beehives:* The figures illustrate that establishment of woodlots with low

beekeeping intensity is unlikely to be economically viable. However, the profitability can be realistically improved through more intensive beekeeping, i.e. through increasing the number of beehives per ha.

	Financial IRR (NPV- USD)	**Economic IRR (NPV-USD)**
Woodlots with fuelwood	19.4% ($818/ha)	19.2% ($793/ha)
Woodlots w/o fuelwood	10.1% ($13/ha)	10% ($13/ha)
Ocimum - mono	Not viable	Not viable
Ocimum-Mundia-Agroforestry (Sasbania) intercropping	101% ($3,104/ha)	37% ($2,391/ha)
Ocimum processing – with construction of new buildings	Not viable	Not viable
Ocimum processing – w/o construction of new buildings	63%	51%
Indigenous Vegetables - Amaranthus	151% ($66)	24% ($26)
Indigenous Vegetables - Nightshade	106% ($781)	13% ($91)
Indigenous Vegetables - Cowpea	Not viable	Not viable
Beekeeping – 6/ha	9% ($103/ha)	4% ($579/ha)
Beekeeping – 10/ha	34% ($1,764/ha)	14% ($476/ha)

Lessons Learned:

- Woodlots on private, community, or public land are one potential type of micro-projects with attractive IRR.
- Production and processing of medicinal plants would constitute another economically viable option for communities.
- Indigenous vegetables would be another potential micro-project as part of the WKCDD/FM Project.
- The financial viability of beekeeping on forest land or woodlots is significantly determined by the number of beehives per ha.

Name of Study: Costs and Benefits of Flood Mitigation in the Lower Bagmati Basin: Case of Nepal Tarai and North Bihar

- ***Organisation:*** ISET
- ***Date***: 2008
- ***Region***: Asia
- ***Hazard Type(s):*** Flood
- ***Weblink:*** http://www.i-s-e-t.org/index.php?option=com_content&view=section&layout=blog&id=5&Itemid=9

Project Summary: The study presents the results of a systematic qualitative analysis of the costs and benefits of constructing embankments in the lower Bagmati River basin, which stretches across the Nepal Tarai and into northern Bihar. The methodology employed provides insight into the trade-offs among strategies that are similar to, but more transparent than, those used in a full cost-benefit analysis. In particular this methodology also reveals the differences in costs and benefits for different sections of the population, information not generated by conventional approaches to quantitative cost-benefit analysis which focus primarily on the aggregate benefits and costs to society as a whole.

Summary of Methodology: The methodology used a "Shared Learning Dialogue". It was comprised of the following steps:

- *Step 1: Scoping and initial engagement*: review of relevant information (maps, background documents, etc.) already available as well as a series of visits to the region.
- *Step 2: Intensive shared learning dialogues to identify key risks and potential response strategies:* The next step was to hold a series of focused group and one-to-one discussions in local communities to outline flood hazards and responses.
- *Step 3: Intervention-specific evaluations to identify the benefits and costs associated with each response strategy*. Measures consisted of (a) structural interventions, specifically the network of flood control embankments that has been constructed over recent decades; and (b) an array of alternative measures, undertaken by individuals, communities and NGOs to minimize the risks they face.
- *Step 4: Ranking and related techniques to assign relative weights to perceived benefits and costs*: In consultation with local communities, the relative costs and benefits of each response measure were ranked.
- *Step 5: Shared learning dialogues to identify directions of change in perceived benefits and costs as climate and other processes of change proceed:* In this final step discussions were held with communities to consider the implications of climate change on the direct and indirect benefits and costs currently associated with each of the main response strategies. The focus was on whether or not the strategies would remain effective in the projected climate change scenarios.

Key Findings: Where climate change impacts are concerned, the effectiveness of the approaches to flood risk management will change significantly. Increases in flow peaks and sediment loads appear almost certain to undermine the efficacy of existing embankments, spurs and other structural interventions. In particular, the associated water logging and embankment breaches are likely to increase. As a result, structural measures cannot be an effective primary strategy for responding to the increased flood risk anticipated as a consequence of climate change. In contrast, the benefits of people-centered interventions appear relatively resilient to the impacts of climate change.

Lessons learned: The information generated by this qualitative benefit-cost assessment can serve as a foundation for many of the similar insights that would be generated by a quantitative approach. In many ways, this qualitative analysis lays the groundwork for a quantitative evaluation without replacing it. If a full cost-benefit analysis is needed to assess structural options, this methodology would strongly complement it because it identifies and includes many costs and benefits that are often excluded as externalities in standard economic evaluations.

Name of Study: Evaluating Costs and Benefits of Flood Reduction under Changing Climatic Conditions: Case of the Rohini River Basin, India

- ***Organisation:*** ISET
- ***Date***: 2008
- ***Region***: Asia
- ***Hazard Type(s):*** Flood
- ***Weblink:*** http://www.i-s-e-t.org/index.php?option=com_content&view=section&layout=blog&id=5&Itemid=9

Project Summary: In this case study, the costs and benefits under potential climate change of different flood risk reduction approaches in northern India were analyzed and compared. In addition, the utility, applicability and limitations of cost-benefit analysis for supporting disaster risk reduction decision-making under a changing climate were investigated.

Summary of Methodology: Beginning with a risk analysis, past flood impacts were adapted to current conditions and then projected for future changes in risk due to climate and population changes. Flood risk reduction strategies were selected based on both real and potential interventions (hence the study was both backward and forward looking). Field experience and estimations were used to quantify and monetize costs, benefits and disbenefits (potential negative consequences of interventions), which were subsequently compared under a probabilistic cost-benefit framework. Finally the methodology, experiences and results of the analysis process were reviewed for robustness and utility within the policy context.

Downscaled climate change projections to the year 2050 indicate monsoon rainfall will increase. Translated into potential changes in flooding, the frequency of smaller, less-intense events will increase greatly, for example with a current 10-year flood becoming a 5-year flood, while rarer but more intense floods will remain relatively constant. This will result in a twofold increase in future average annual economic loss due to floods.

The economic performance of embankments, reflecting a historically dominant centralized flood risk reduction approach, was analyzed in comparison to a more egalitarian "people-centered" basket of interventions, including a range of measures such as raised house plinth, raised fodder storage, early warning, flood shelters, community seed banks, self help groups, etc. People-centered interventions were assumed to be implemented at the individual, community and societal levels with the goal of reducing vulnerability within the relatively poor population in the basin by increasing general socio-economic resilience to floods. Embankments, on the other hand, are threshold-driven, meaning that they are designed for a certain flood magnitude, beyond which they fail to provide protection.

Focusing on evaluating flood risk reduction strategies, 18 villages were selected for a survey, with 10% of households in each village surveyed, resulting in a total of 208 households surveyed. Households were selected to capture diversity across landholding size, wealth, caste, women-headed households and engagement in different risk reduction activities. The survey questionnaire was designed to collect specific disaster-related loss, coping, exposure, vulnerability, preference and cost/benefit data, and yielded direct loss information for housing, assets, crops, livestock, wages and health/medical expenditures.

As cost-benefit analysis must be performed under present conditions, losses from past floods were adapted to present conditions. Observed regional population dynamics were used to account for changes in exposure. Due primarily to a trend of switching from mud to brick construction, housing vulnerability has decreased by about 40% over the past 10 years. Enhanced rural communication (particularly the advent and rapid expansion of mobile telephones) has also led to better early warning, allowing for increased response time.

Key Findings: Detailed analysis undertaken through the project demonstrates that embankments cannot be concluded to have been economically beneficial. When analyzed from a social welfare perspective in which all costs and benefits are considered, the benefit/cost ratio from past investments is about 1; that is the costs have equaled the benefits. Projected impacts from climate change would reduce returns further probably driving the benefit/cost ratio for new embankment construction in the future below 1. Given that investments in existing embankments represent sunk costs, investments in proper maintenance of those embankments would, however, generate high economic returns (benefit/cost ratios in the range of 2) under both current and future climate change scenarios.

In contrast, scenarios based on a more "people-centered" resilience-driven flood risk reduction approach perform economically efficiently. Benefit/cost ratios for such strategies range from 2 to 2.5 under both current and future climate change scenarios. Furthermore, since such strategies have low initial investment costs in relation to annual operation and maintenance, these returns are not sensitive to discount rates or assumptions regarding future climate conditions.

Lessons Learned: If undertaken in an inclusive stakeholder-based manner, the process of undertaking a cost-benefit analysis forces participants to systematically evaluate the details of risk management strategies and the assumptions underpinning them. This analytical process can ensure that the strategies ultimately selected are socially and technically viable, broadly owned and likely to generate solid economic returns. It can also ensure that the distributional consequences of strategies - who benefits and who pays - are addressed; a factor not incorporated in conventional cost-benefit analysis. Without inclusiveness, debate and iterative learning among stakeholders, cost-benefit analysis can easily be manipulated and thus misused.

Name of Study: Uttar Pradesh Drought Cost-Benefit Analysis, India

- ***Organisation:*** ISET
- ***Date***: 2008
- ***Region***: Asia
- ***Hazard Type(s):*** Drought
- ***Weblink:*** http://www.i-s-e-t.org/index.php?option=com_content&view=section&layout=blog&id=5&Itemid=9

Project Summary: The case study presented here analyzes the costs and benefits of alternative strategies for mitigating the impact of drought on rural livelihoods in Uttar Pradesh, India. Costs and benefits were assessed for donor Disaster Risk Management (DRM) support for helping farmers better deal with drought risk to rice and wheat crops and subsequent income effects. DRM interventions considered were (i) irrigation via the implementation of a borehole for groundwater pumping, with pumping costs paid for by the affected household, (ii) subsidized micro crop insurance, and (iii) an integrated package.

Summary of Methodology: The study uses a forward-looking methodology assessing risk explicitly in a risk-based modeling framework. In order to systematically assess the costs and benefits of risk management, a risk-analytic modeling approach was developed. The model is stochastic in nature making use of Monte-Carlo simulation to generate probabilistic drought shocks to farmers.

Key Findings: All interventions seem economically efficient:

- Irrigation benefits increase with climate change as rainfall means increased.
- Insurance benefits decline as volatility becomes less important with climate change.
- An integrated package delivers similar benefits at lower costs.
- For harnessing the benefits of integrated packages, cross-sectoral cooperation between different public and private actors is essential.

Specifically, the study suggests that the benefits of insurance are likely to decline in relation to the costs if climatic variability increases substantially as a consequence of climate change. In addition, the study suggests that approaches to drought mitigation that are based on integrated combinations of strategies rather than a single set of techniques or mechanisms may perform better.

Lessons Learned: When implementing this data and model intensive framework, a host of methodological hurdles were encountered, introducing considerable uncertainty into the assessment process. One of the biggest challenges was to incorporate the different types of information and estimation methods within one modeling approach. For example, rainfall variation pattern analyses require statistical methods, while the

generation of future scenarios has to be dealt within a simulation programming approach. Furthermore, outputs should be based on risk measures involving some mathematical complexity. Hence, not everything that is desirable to incorporate into such a framework can and should be incorporated. For example, the crop yield model is based on rainfall only, and detailed crop simulation modeling (accounting for soil conditions, cropping patterns etc.) could not be made use of in this analysis due to significant data and resource limitations as well as unsatisfactory calibration results.

The resource and time commitment for the analysis was large due to the need for conducting statistical analysis, stochastic modeling, and economic modeling of the household income generation process.

Name of Study: Evaluating the Costs and Benefits of Disaster Risk Reduction under Changing Climatic Conditions: A Pakistan Case Study

- ***Organisation:*** ISET
- ***Date***: 2008
- ***Region***: Asia
- ***Hazard Type(s):*** Flood
- ***Weblink:*** http://www.i-s-e-t.org/index.php?option=com_content&view=section&layout=blog&id=5&Itemid=9

Project Summary: This case study is designed to use both social and natural science tools to answer a set of basic questions on proactive risk reduction. The primary question is to determine whether and/or in what cases is proactive disaster risk reduction cost effective. Second, how can we compare the cost effectiveness of various proposed strategies to assist policy makers in making decisions? Finally, what are the limitations and risks in use of CBA for decision-making?

Summary of Methodology: The study examined four scenarios to address flood risk, namely, warning system, concrete lining of the channel, construction of a dam in the upper reaches of the stream, and relocation of the most exposed population to higher ground. A simplified downscaling technique and rainfall runoff model were used to investigate potential climate change impacts on the Lai. The JICA study on comprehensive flood mitigation conducted after the 2001 floods proved to be a wealth of information. The basic vulnerability analysis was conducted using assets at risk and damage data from the flood of 2001.

Key Findings: Contrary to the general perception of effectiveness of soft measures, the over- designed early warning system in place is the only one with a benefit cost ratio of less than one. This indicates that without careful consideration to various aspects (including economic) there is not a foolproof way of devising effective risk reduction strategies. The warning time is not enough to allow removal of household contents and commercial stock and a simpler system based on lesser dedicated infrastructure and more on already operational cell phone/sms could have been just as effective in saving lives at a much lower cost.

Lessons Learned: The CBA tool is extremely useful in comparing two similar technology based strategies where the concrete paving of the channel in the midsection is far less economically beneficial than channel improvement in the lower reaches. Due to the short length of the Lai and over design of the project in terms of costly equipment, the early warning system does not have a favorable benefit cost ratio. In terms of cost per life saved, it would not compare with improvement of basic services like health, water and sanitation. Using newer technologies for outreach such as Short Messaging Services on cell phones and fewer telemetry stations a very cost effective system could have been developed. Despite the lack of cost effectiveness the lower scale of investment

made it the most viable project in terms that it was implemented. The CBA tool was extremely useful in highlighting this short-coming of the designed project, whereas, generally most early warning systems are considered to be worthwhile investments.

The CBA process has made it possible to compare similar approaches for cost effectiveness and lent a sense of proportion to softer approaches in risk reduction that tend to focus more on people rather than the hazard. The process has also highlighted the shortcomings of the tool in assessing people-centered resilience building. Due to lack of distributional aspects in the analysis, it is extremely important to use more qualitative tools that focus on the differential effects of various approaches on the poor and the vulnerable.

Name of Study: Cost Benefit Analysis of a Nepal Red Cross Society Disaster Risk Reduction Programme
• ***Organisation:*** British Red Cross (BRC), Nepal Red Cross Society (NRC) • ***Date***: 2008 • ***Region***: Asia • ***Hazard Type(s):*** Flood

Project Summary: The purpose of this study is to conduct a Cost Benefit Analysis of the BRC-supported DRR programme in Nepal. The findings are intended to inform ongoing and future DRR programming in Nepal, to build on existing baselines and indicators, and to contribute to monitoring and evaluation systems and tools. The two main objectives of this CBA are:

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

A key aim of the project is 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.

Summary of Methodology: The methodology focuses on a community based approach, working with those affected to understand hazards and their impacts, and the resulting benefits of any DRR activities. It aims to identify both qualitative and quantitative impacts. The methodology is designed to help communities and staff engage in a process and dialogue that facilitates effective decision-making, and hence much of the value lies in actually discussing and analysing the data.

Broadly speaking, the methodology consisted of an initial preparation phase that included review of key documents and preparation of a field plan, followed by field work and data collection using focus groups and transect walks to investigate hazard characteristics and impacts, and changes as a result of the DRR program, comparing the "without" DRR to the "with" DRR scenarios. Finally, the data collected was used to build a cost benefit model to analyse the costs and benefits over the lifetime of the project, and conduct sensitivity analyses for a range of scenarios.

Key Findings: The quantifiable impacts of the project include mitigation works (flood defence), income generation loans, protection of water sources, and first aid training. The findings from the cost benefit analysis demonstrate that the programme generates a benefit to cost ratio of 18.6. This indicates that the programme generates over 18 NPR

of benefit for every 1 NPR spent.

The analysis was also conducted for a scenario in which the flood mitigation works are not included – observations in the field suggested that the avoided loss from these works may actually simply be offset to villages further downstream as floodwaters were simply displaced. Nonetheless, the program without the benefits of the flood mitigation is still positive, with a BCR of 2 and an IRR of 14%.

Lessons Learned: The process of undertaking the CBA at a community level demonstrated that the approach itself can generate a range of benefits. In particular, the analysis is only as robust as the data available, and hence, as emphasised above, 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.
- The CBA process helped local and national staff to consider the economic implications of their work.
- The process further helped staff 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.
- Long-term vision and support is vital. If the CBA is run for 3 years, the lifetime of full scale NRC involvement, the benefit cost ratio drops to 9.2. Hence, benefits can be doubled for a minimal amount of support for maintenance of first aid kits, water wells, and check dams over the course of 10 or 15 years.

Name of Study: Economic Analysis of Flood Risk Reduction Measures for the Lower Vaisigano Catchment Area (Samoa)
• ***Organisation:*** SOPAC • ***Date***: 2008 • ***Region***: South east Asia • ***Hazard Type(s):*** Flood • ***Weblink:*** http://www.sopac.org/tiki-index.php?page=SOPAC+Economics+Publications

Project Summary: The aim of this study is to assess and compare the economic feasibility of alternative structural and non-structural flood management options for the lower Vaisigano catchment area in Samoa. The options were originally identified under the Action Plan as potential measures to minimise the cost of floods and include: floodwalls, a diversion channel, an improved flood forecasting system and development control, through the construction of homes with elevated floor heights.

Summary of Methodology: The methodology included the following steps:

1) The benefits of each option were identified and then measured as avoided damages (tangible/intangible and direct/indirect);
2) The costs of each option were considered – market as well as non market costs (e.g. impacts on biodiversity);
3) Costs and benefits were compared to identify the 'best' option;
4) Sensitivity analysis was conducted; and
5) Policy issues affecting feasibility were identified.

More specifically, assessments of alternative measures were based on estimates of the cost of the last major flood event in the area, using:

- Government losses described in public records;
- Business losses based on a dedicated economic survey; and
- Household losses based on a combination of a dedicated survey, together with GIS data and information from flood maps produced for various flood events and formulae from the US Corps of Army Engineers. In the latter case, US Corps of Army Engineers 'stage damage curves' display the relationship between flood height and the average proportion of a house flooded. Using this information – and referring to flood inundation maps for the area that identify the extent of building flooding under floods of different severity, the average degree of damage to buildings across the area was predicted.
- Benefits associated with alternative flood mitigation measures were determined using evidence from various flood studies, lead time-damage functions and flood maps/ US Core of Army Engineers stage damage curves (elevated flood heights). Data on the costs of measures was obtained from consultations with relevant

stakeholder groups including construction and technical agencies.

Key Findings: For structural measures including floodwalls and diversion channels, a project life of 50 years is assumed. For non-structural measures, based on the life of a rainfall gauge, a project life of 30 years is assumed, and for raising floor heights, a life of 30 years is also assumed. The study finds that flooding in the study area imposes large costs on all sectors, including households, businesses, schools, churches and infrastructure. Using information on the estimated damages associated with 1 in 5, 1 in 20, 1 in 50 and 1 in 100 flood events and their associated probability of occurrence, annual average damages from flooding for all sectors are estimated to be WST$618,529. Non-structural measures, including an improved flood forecasting system, which would require the purchase of additional rainfall gauges and flood modeling software; and development control, which would require new homes constructed in the floodplain to be constructed with elevated floor heights, were found to be the most economically viable flood management options. In the case of an improved forecasting system, the ratio of benefits to costs was estimated to range from 1.92 to 1.72, depending on the choice of discount rate used to carry out the analysis. The most significant economic pay-off from investing in flood management options is found to be from constructing homes with raised floors. For new homes, the benefit cost ratio is found to range from 4 to 44 for wooden homes, and from 2 to 28 for cement block homes.[1]

Structural measures, on the other hand, were found not to be economically viable. In the case of floodwalls, the benefit-cost ratios ranged from 0.11 to 0.64 depending on the choice of floodwall design and discount rate used in the analysis. For the construction of a diversion channel, the benefit-cost ratios ranged from 0.01 to 0.09. Although, it is likely that many of the indirect or non- monetary benefits not captured in the analysis such as avoided health costs or trauma suffered by residents during flooding, or reduced flood damages to households and businesses in nearby districts, would raise the benefit-cost ratios, it is unlikely that they would be significant enough to raise benefit-cost ratios above one.

Lessons Learned: It is recommended that the Government consider investing in an improved forecasting system in conjunction with public awareness campaigns which educate the local population on the risks associated with flooding, and with the development of an effective flood advisory system. In addition, policies should be put into place in order to encourage residents living in the floodplain to construct new homes with elevated floor heights. This can be achieved either through development of zoning regulations which require that new homes constructed in floodplains have floor heights which exceed 1-in-100-year flood levels or the use of grants, tax rebates or low-interest loans to make flood-proofing of new homes more affordable to residents.

[1] The type of structure, height of the raised floor, and discount rate contribute to the wide range of possible outcomes.

Name of Study: An Economic Analysis of Flood Warning in Navua, Fiji

- ***Organisation:*** SOPAC
- ***Date***: 2008
- ***Region***: South east Asia
- ***Hazard Type(s):*** Flood
- ***Weblink:*** http://www.sopac.org/tiki-index.php?page=SOPAC+Economics+Publications

Project Summary: This study is an economic analysis of the expected net benefits of the planned Navua flood warning system. It is intended to:

- generate information on the economic return on investing in flood warning systems using the Navua system as a case study.
- Identify issues that affect the likelihood of benefits being fulfilled.

Summary of Methodology: A survey was used to assess the impacts of the 2004 flood on households and businesses (estimated as a 1-in-7 year event), while information from public records was used to assess the costs of the floods to other stakeholders (government, humanitarian agencies etc.). On the basis of group and one-on-one discussions, the value of these losses was then adjusted to describe the proportion of losses that would likely be avoided with an effective flood warning system. Clearly, some losses will be unavoidable, whereas others can be avoided in full.

The benefits estimated were then calculated for their benefit to cost ratios:

1) assuming a major flood happens only once every 20 years or as much as once every 10 years; and
2) using discount rates of 3, 7 and 10 per cent; and
3) under worst case, most likely case and best case scenarios.

Key Findings: It was estimated that a successfully implemented warning system would be most likely to save Fiji (its government, Navua families and the Navua business community) and the international community organisations a combined total of at least FJ$2.1- 4.2 million over 20 years. The range of values reflects that the major floods of the 2004 scale are likely to happen somewhere between once or twice during the life time of the system. It needs to be recognised that this estimate of savings from using the warning system is likely to be a significant underestimate since several smaller and larger floods are additionally likely to occur during the life time of the system and so cost savings would arise from these as well.
Furthermore, the estimates presented do not include the value of benefits arising from savings to education, reduced need to bring in volunteer labour such as the military, reduced trauma, potential use of the warning system for other local warnings and/or the value of lessons to any other warning systems in Fiji and across the Pacific (current or future).

The costs of establishing and operating the system were estimated to sum less than FJ$0.6 million over the 20-year lifespan of the warning system. Given the expected benefits of the system, overall investment returns from the warning system would then most likely be a minimum of between 3.7 to 1 to as high as 7.3 to 1 (table). In other words, every dollar spent on the warning system would be most likely to save FJ$3.7 - 7.3 in return.

Not surprisingly, the biggest beneficiaries of the warning system are expected to be the Navua community who would benefit from the warning system by protecting possessions and their health. Navua families were estimated to most likely save between FJ$ 1.7 and FJ$2.4 million over the 20-year life of the warning system.

The Government of Fiji would also benefit substantially from the system, by having the hospital, infrastructure and schools better protected and because it would need to provide less emergency aid (food etc.) if people were better prepared. Government savings would most likely be between $0.4 and $0.8 million over 20 years. These are minimum estimates. To achieve these savings, the Government of Fiji would need to cover the costs of awareness raising and maintenance of the system over its life. Together with its in-kind contributions to establish the system, the Government would be expected to pay a total of just under FJ$0.4 million over the life of the warning system. Given the benefits to the Government of the system, the Government of Fiji would most likely gain an investment return of $1-2 per dollar invested in the system.

Stakeholder	**Net present value over 20 years (FJ$)**	**Benefit:Cost ratio over 20 years**
Navua community	1.6-3.3 million	Infinite (no costs borne)
Government of Fiji	0.03-0.4 million	1.1-2.2
International Stakeholders	1.5-3.6 million	3.7-7.3

Lessons Learned: The returns estimated highlight the value to the national economy of investing in disaster mitigation measures. Investments in this area are likely to generate significant economic benefits over the life of the system.

While the Navua warning system offers substantial benefits to the local and national community, its benefits are not guaranteed. Whether the benefits of the scheme eventuate hinges substantially on getting the warnings to people and ensuring that they respond appropriately. This report identifies a number of issues that should be considered in designing a flood response plan for the community of Navua including the type of information that people need to know and options to disseminate warnings.

Name of Study: Cost Benefit Analysis of Oxfam America Disaster Preparedness Programs in El Salvador – ex-post

- ***Organisation:*** Oxfam America
- ***Date***: 2009
- ***Region***: Central America
- ***Hazard Type(s):*** Flood

Project Summary: Oxfam America (OA) has developed a CBA toolkit for implementing CBA for DRR at a community level. This case study was one of four testing this field tool. The primary objective was to better understand how the CBA tool is applied ex-post to an OA project, and to test whether it is effective for use at a program level. The second objective of the testing was to develop a CBA of the target program, to be used alongside the CBA Toolkit as a case study example, as well as to lend OA a stronger voice in communicating both internally and externally about the value of its DRR work and possible applications of the CBA Toolkit.

Summary of Methodology: The methodology used participatory approaches to document the impacts of hazards both without and with the OA DRR program. It was comprised of three phases (comprised of nine steps), namely preparation for field work, data collection, and data analysis. Both qualitative and quantitative impacts were documented.

Key Findings: The program activities have primarily focused on improving five evacuation shelters and associated supplies/facilities, and training for communities on improved preparedness and evacuation. These activities have clearly improved health conditions, particularly in the shelters where people can now sleep on mattresses (rather than on the floor), stay dry, and have access to adequate food and water and sanitation facilities. Furthermore, the training has enhanced awareness and organization, such that there was clear evidence that communities were now evacuating on time, in an orderly fashion, and hence able to save more animals and household goods by taking them to high ground. It is estimated that the interventions will benefit 18 communities, comprised of approximately 2,000 families.

Several of these benefits could be quantified, including a decrease in the loss of school days, reduction in diarrhea as a result of clean water, improved general health, and better evacuation of household goods and animals. The CBA for the program as a whole yielded a BCR of 0.97, suggesting that the program is more or less break even in terms of its financial impacts.

One of the most significant impacts of the program that was repeatedly mentioned in focus groups is the increased sense of security and confidence brought about through the trainings. Furthermore, it is clear that the provision of improved/more latrines will

have subsequent environmental impacts as a result of improved sanitation. However, while both of these factors would contribute to a positive BCR, neither can be quantified for inclusion in the analysis.

Sensitivity testing was used to test several of the key assumptions in the analysis, including the frequency of low magnitude events, the discount rate, and the attribution of benefits to the OA program (several other NGOs were working in the area, so benefits were discounted to reflect the fact that they were not entirely attributable to OA activities). The resulting BCRs ranged from 1.05 to 1.60.

Lessons Learned: The study reflected a number of lessons learned related to both the program as well as the process of conducting a CBA at a community level.

- Based solely on the interventions that can be quantified, the program is break-even using conservative estimates and assumptions, and becomes positive if some of the key assumptions are varied slightly. Due to data constraints, the findings need to be taken as indicative at best.
- The greatest quantifiable benefits arise from the training activities, and the impact that these have had on effective and timely evacuation.
- Follow through is essential to realize benefits from project activities – many families were not aware of the project improvements (only recently implemented).
- To date the program has very much focused on preparedness activities and could further benefit from wider risk reduction activities, to have a greater impact on underlying causes of vulnerability.
- There is no "one size fits all" approach to risk reduction in the area – each of the communities was very different in terms of sources of vulnerability, and possible measures that could be taken to improve resilience.
- The CBA process is fairly intuitive in terms of data gathering, but requires greater integration into already existing PCVA processes, and requires more technical/specialist assistance for data analysis. A good local translator and partner are critical to this process.
- CBA should not be used as a stand-alone tool. The qualitative impacts of a program can far outweigh the quantitative, and data on quantitative impacts, particularly at a community level, can have high levels of variability.
- Nonetheless, the CBA process is very useful for adding more rigor to the decision-making process, and helping to think of program activities in terms of outcomes rather than outputs. Specific to this exercise, the CBA was shown to be very useful for measuring the impacts of evacuation training (despite concerns before the fieldwork that this could be hard to measure using quantitative data).

Name of Study: Assessing Quality and Cost Benefit: A Philippines Case Study

- ***Organisation:*** International Federation of Red Cross and Red Crescent Societies, The Philippines National Red Cross
- ***Date***: 2009
- ***Region***: Asia
- ***Hazard Type(s):*** Flood

Project Summary: The project undertook a Quality Impact Assessment and Cost Benefit Analysis, jointly, to understand the impacts of disaster risk reduction work being carried out in the Philippines by the Red Cross.

Summary of Methodology: The CBA was conducted as part of a wider evaluation of the programme. Hence the activities required to undertake the CBA were integrated within the context of the wider evaluation. Specific activities included a preparation phase including review of key documentation, field work where transect walks and focus group discussions, as well as other participatory approaches were used to assess both the full range of impacts of the programme as well as the more specific quantifiable aspects of the programme for inclusion in the CBA. Data for the CBA was very limited and therefore it was only possible to undertake CBAs of three specific interventions.

Key Findings: Two of the three analyzed interventions appear to have produced significant positive returns. A hanging footbridge that was built in Pis-anan/Indig-an to help link the two communities during normal and flood times has proven its effectiveness by ensuring continued access to health services, education and markets during floods. It was estimated to have produced a return of 24 Philippine Pesos for each Peso invested.

In Poblacion 1 and 2, where a sea wall of over 200 metres in length was built to protect houses and associated crops near the sea front, significant losses have been avoided despite the continuing regular occurrence of flooding due to storm surges. Assuming that the sea wall has a 20-year lifespan, the CBA yielded a BCR of 4.9.

The CBA identified that the building of a dyke at Barangay Roxas actually produced what appears to be a negative return on investment. Assuming that the dyke has a 15-year lifespan, the project yielded a BCR of 0.67, therefore returning less than 1 Philippine Peso for every Peso invested. The analysis was however challenged by a lack of data on certain benefits, which is often the case for community-level interventions. At the same time, the community still highly values the dyke, committing regular maintenance funds to look after it. This highlights the importance of placing the findings of CBA within a wider context, as unquantifiable benefits such as a sense of safety from the presence of a dyke may be substantial.

Lessons Learned: As an early pilot in the Red Cross Red Crescent, the CBA process

offered a number of lessons that will strengthen the application of the methodology in the future, helping to improve data collection methods to measure the progress and value of disaster preparedness activities. The process of gathering baseline and monitoring and evaluation data for a CBA should be integrated into existing needs assessment processes and tools, such as Vulnerability and Capacity Assessment and monitoring and evaluation systems.

Name of Study: Impact and Cost Benefit Analysis is the Red Sea State Sudan

- ***Organisation:*** International Federation of Red Cross and Red Crescent Societies, The Sudanese Red Crescent Society (SRCS)
- ***Date***: 2010
- ***Region***: Africa
- ***Hazard Type(s):*** Drought

Project Summary: Red Sea State in Sudan suffers regular droughts, which have resulted in increased vulnerability of the indigenous nomadic Beja pastoralist community. The Sudanese Red Crescent Society has been undertaking activities to reduce risk and improve livelihoods and food security, including construction of terraces and earthdams, water interventions, educational inputs and the creation of women's centers.

Summary of Methodology: The CBA was conducted as part of a wider evaluation of the programme. Data was gathered through key stakeholder interviews and focus group discussions with affected communities. CBAs were conducted for individual activities, rather than the programme as a whole, to isolate the varying impacts of a range of interventions

Key Findings: It was evident from discussions with communities and local Government that the programmes implemented had considerable impacts on the targeted population. Examples such as the terraces and earthdams/embankments enabled households to undertake successful agricultural activities, providing food for consumption and the possibility to diversify diets, as well as the possibility to sell produce and earn income. Cost benefit analysis indicated that these projects were economically efficient with a benefit to cost ratio greater than 2:1.

Water interventions such as the construction of hafirs (retention ponds) have also impacted positively on pastoral communities, reducing the loss of livestock, reducing the amount of time they travel for water, decreasing human disease, and reducing tension over water sources. Cost benefit analysis also indicated that the project was economically efficient with a benefit to cost ratio exceeding 2:1.

Three key interventions supported by the SRCS were the support to education, health services and women's centers, which could only be assessed qualitatively and were therefore not the subject of a CBA. These interventions appear to have the potential to have "generational" and societal impact, for example demonstrated by increased girls attendance at school and an increase in those attending university. Equally women attending the women centers are gaining new skills and knowledge including literacy, health and nutrition awareness, which is being translated into practice. These interventions have started to influence the Beja traditions and societal norms, for the better, and will continue to do so in the future.

Lessons Learned: It was only possible to do a cost benefit analysis for four interventions during the study; however a number of learning points about undertaking a cost benefit analysis have been recorded:

- Where integrated multi-sectoral programming is undertaken it is difficult to compare cost efficiency between the different interventions, however it is possible to measure the cost efficiency of the whole programme.
- While doing CBA assumptions are regularly made and necessary to do the calculations. While these assumptions are noted as part of the description for the calculations undertaken it remains unclear at what stage the compound uncertainty of multiple assumptions and data issues faced render the confidence in the results too low for acceptance.
- Pastoralists rely heavily on social obligations/kinship for survival. Many respondents suggested that their ability to undertake social obligations was a key impact of the interventions. These are difficult to quantify particularly as they can often leave the direct target beneficiary community.
- Nomadic pastoralists are constantly on the move and this made verification of numbers difficult and sometimes meant that cost benefit analysis could not be performed.

Without a clearer link between undertaking cost benefit analysis and programming decisions it is unlikely that Red Cross Red Crescent National Societies would as a routine undertake such studies. In addition, to do so would require technical support from analysts with the requisite skills. Increasing investment in basic monitoring and evaluation skills may be a more worthwhile investment since it is unlikely (as evidenced from this study) that cost benefit analysis is accurate enough in an “ex post” or “looking back” scenario.

There is however potential to use cost benefit analysis for future programming:

- To help design economically efficient programmes and activities, i.e. the traditional “ex ante” usage of cost benefit analysis.
- By including the necessary indicators for measuring cost and benefits from the beginning of a programme/activity, integrated in any baseline analysis, to enable more quantitative and efficiency driven monitoring.

Name of Study: Cost Benefit Analysis for a Livelihoods Protection and Diversification and Disaster Risk Reduction Project in the Coastal Zone of El Salvador

- ***Organisation:*** Oxfam America
- ***Date***: 2010
- ***Region***: Central America
- ***Hazard Type(s):*** Drought, pests, livestock disease

Project Summary: Oxfam America (OA) has developed a CBA toolkit for implementing CBA for DRR at a community level. This case study was one of four testing this field tool. This study was a forward-looking analysis with local partners to help them evaluate a range of potential project interventions that address drought, pests and livestock disease.

Summary of Methodology: The methodology used participatory approaches to document the impacts of hazards on target communities, and to explore possible project interventions with the communities. It was comprised of three phases (comprised of nine steps), namely preparation for field work, data collection, and data analysis. Both qualitative and quantitative impacts were documented. The full list of project interventions, as identified with the communities, were prioritized into three categories: an A list of top priority interventions for which there was sufficient data to conduct a CBA; a B List of interventions that are highly feasible, but where there is some uncertainty around the data for the CBA; and a C list of interventions for which there simply is not enough information at this stage to do an evaluation.

Key Findings: The range of specific interventions analyzed included silos/storage practices/crop drying, education on alternative food sources for cattle, livestock vaccination/ shelters, native seeds, vegetable gardens, fruit trees, cleaning drains and river dredging, and community organizing on EWS and agricultural issues. The resulting BCRs ranged from 0.42 to 86.70. Most of the interventions yield a positive BCR. One of the few exceptions is the silos, which for cultural reasons need to be provided on a household basis, resulting in a very high cost as compared with quantifiable benefits. The vegetable gardens and fruit trees yield some of the highest BCRs – however they require a long term plan for sustainability due to their susceptibility to hazards in the first few years. The highest yield comes from community organizing around collective bargaining for agricultural inputs.

Lessons Learned:

- When considered for only one year, the majority of interventions are still positive. However, the benefits accrued are substantially lower than if the interventions are sustained over a longer time period. A longer-term view should be taken on program interventions as appropriate.
- The CBA process has added value to the evaluation and weighing up of possible

project interventions. The very fact that the findings have introduced some surprises and hence further discussion has added significant value to the process. For instance, the findings indicate that a one-size-fits-all approach does not work – the cultural barriers around collective working need to be addressed, and in fact play an important role in the viability of silos and crop drying as a possible intervention.

- Capacity on VCA provides an important backdrop for undertaking CBA at a community level – the two processes need to be integrated.
- The CBA process could benefit from a pre-assessment and data collection exercise to generate an initial profile before undertaking the field work for the CBA. Similarly, good monitoring and evaluation will be essential to verify benefits arising from the project.

Annex C: Key Points From Consultation Exercise, June 29, 2010

Key Issues (in no particular order):

- ***Institutionalisation of CBA:*** How can CBA be mainstreamed, given that many organizations struggle with implementing VCA in full at a local level?
- ***Accessibility for communities/partners:*** CBA is not always accessible for communities/local partners. Need to define the skill set required for local partners to carry out the CBA methodology.
- ***Who should be target beneficiaries:*** Viability of working with the most vulnerable, and how CBA can be used in this context.
- ***Valuation of longer-term issues, non-monetary issues***: For instance, a lot of the studies to date have been in rapid onset disasters, and have just included monetary benefits. How do we value things like slow onset disasters, chronic and cyclical stress, malnutrition prevention, ecosystem based approaches. Equally, how can CBA be applied to humanitarian response in the very short term? How do you apply it when you are dealing with displaced communities, where their ability to participate may be constrained?
- ***Parameters and thresholds*** – when do you use CBA? In what context? What are the thresholds for when CBA should/shouldn't be undertaken? What sort of enabling environment is required to undertake CBA?
- ***Issues of disaggregation*** – household versus community level activities – how can you account for these different levels of operation within a CBA?
- ***Software vs hardware approaches –*** How do we differentiate between these different approaches?
- ***Application of CBA findings –*** how have organizations/donors/governments used CBA findings to influence their decision making? Are there examples of the findings helping with advocacy?
- ***Donor/Government perspectives*** – it would be useful to have the views of donors and governments on how useful CBA at a community level is, and how they could also use the findings. The recent mandate by the UK DFID to demonstrate cost effectiveness of all funded projects suggests that this is increasing in importance.
- ***Climate change*** needs to be more integrated into the process (though this is constrained by a lack of downscaled data). Further, climate change isn't the only factor that can shift the analysis – changes in demographic trends, environmental degradation, etc, are all factors that can shift outcomes.
- ***Linkages with Knowledge, Attitude, Practice and Behaviour*** (KAPB) methodology uses a survey approach at a household level that can be linked with CBA.
- ***Accountability –*** Good M&E/CBA improves the transparency of what we are doing, and this will only benefit activities and accountability.
- ***Program vs Individual activities*** – do you conduct a CBA of a whole program of work, or disaggregate out individual activities. The latter is more useful for decision making, but it is not always possible to allocate/disaggregate costs and benefits on this basis.

Areas for further work:

- **Exchange of practice –** experiment and work together, thematically and geographically align organizations to do joint CBAs or develop new methodologies. Will also help to reduce transactional costs. CBA webpage/blogspot to support downloading of information, place to ask questions.
- **Build capacity –** for M&E, VCA as a platform for CBA. Simplicity and integration are key to ensure its ongoing engagement.
- **Scaling up –** CBA needs to play a part in the definition of how DRR/CCA are scaled up. Cost benefit thinking needs to be a part of all risk/resilience work.
- **Linkages –** find ways to link this in with "views from the front line" and characteristics of a disaster resilient community.
- **Apply CBA in unstable/other contexts -** DRR in recovery operations, conflict, cyclical trends, multiple hazards.
- **Need to highlight to donors that demonstrating cost effectiveness is not applicable in all areas.** And indeed a focus on costs and benefits can be ineffective because it does not account for all of the non-quantifiable benefits of programs.
- **Integrate CBA into existing tools** – eg M&E and VCA frameworks (across the board? Or only in some contexts?).
- **Seed money from donors to fund CBA –** need to demonstrate to donors the importance of providing seed money to fund CBA to demonstrate cost effectiveness and choose the best value for money, BEFORE the proposal stage, to inform what goes into the proposal. Similarly governments will need to allocate budgets to integrate CBA, as applicable, into policy and planning.
- **Learning from HIV/health community** (e.g. cost effectiveness of mosquito nets for malaria prevention). Look at the literature/studies of a similar nature in these communities, where the cost effectiveness of measures has been demonstrated and been very influential in scaling up the response.
- **Incorporation of non-monetary benefits –** greater research is required on how non-monetary benefits can be valued/included given that they are such an important component of community based work, and given the increased focus on ecosystem based approaches (which are characterized by environmental/intangible benefits).

Annex D: Bibliography

Cabot Venton, C., P. Venton, and A Shaig (2010). "Cost Benefit Study of Disaster Risk Mitigation Measures in Three Islands in the Maldives." UNDP Maldives, Government of Maldives, Male.

Cabot Venton, C., Sayce, C., Venton, P. (2008). "Cost Benefit Analysis of a Nepal Red Cross Society Disaster Risk Reduction Programme". British Red Cross, London.

Chambwera, M. and R. Berger (2010). "Beyond cost benefit: developing a complete toolkit for adaptation decisions." IIED Briefing Note.

Holland, P. (2008). "Fiji Technical Report – An Economic Analysis of Flood Warning in Navua, Fiji." EU EDF – SOPAC Project Report.

IFRC (2009). "Assessing Quality and Cost Benefit: A Philippines Case Study."

Jiwanji, M., Cabot Venton, C. and Samuel J. (2006). "Natural Disaster and Disaster Risk Reduction Measures: A Desk Review of Costs and Benefits." UK DFID.

UNFCCC (2010). "Synthesis Report on Efforts Undertaken to Assess the Costs and Benefits of Adaptation Options, and Views on Lessons Learned, Good Practices, Gaps and Needs." Bonn: Secretariat of the United Nations Framework Convention on Climate Change.

Venton and Venton (2004). "Disaster Preparedness in India: A cost benefit analysis". ODI, London.

Woodruff, A. (2008). "Samoa Technical Report – Economic Analysis of Flood Risk Reduction Measures for the Lower Vaisigano Catchment Area." EU EDF – SOPAC Project Report.

World Bank (2007). Project Appraisal Document. "Western Kenya Community Driven Development and Flood Mitigation Project".

<u>ISET Risk to Resilience Series:</u>

Mechler, R. and The Risk to Resilience Study Team, (2008): The Cost-Benefit Analysis Methodology, From Risk to Resilience Working Paper No. 1, eds. Moench, M., Caspari, E. & A. Pokhrel, ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.

Kull, D., Singh, P., Chopde, S., S. Wajih and The Risk to Resilience Study Team, (2008): Evaluating Costs and Benefits of Flood Reduction under Changing Climatic Conditions : Case of the Rohini River Basin, India, From Risk to Resilience Working Paper No. 4, eds. Moench, M., Caspari, E. & A. Pokhrel, ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.

Mechler, R., Hochrainer, S., Kull, D., Chopde, S., Singh, P., S. Wajih and The Risk to

Resilience Study Team, (2008): Uttar Pradesh Drought Cost-Benefit Analysis, From Risk to Resilience Working Paper No. 5., eds. Moench, M., Caspari, E. & A. Pokhrel ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.

Dixit, A., Pokhrel, A., M. Moench and The Risk to Resilience Study Team, (2008): Costs and Benefits of Flood Mitigation in the Lower Bagmati Basin: Case of Nepal Tarai and North Bihar, From Risk to Resilience Working Paper No. 5, eds. Moench, M., Caspari, E. & A. Pokhrel, ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.

Khan, F., Mustafa, D., D., Kull and The Risk to Resilience Study Team, (2008): Evaluating the Costs and Benefits of Disaster Risk Reduction under Changing Climatic Conditions: A Pakistan Case Study, From Risk to Resilience Working Paper No. 7, eds. Moench, M., Caspari, E. & A. Pokhrel, ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.

Moench, M., Ahmed, S., Mustafa, D., Khan, F., Mechler, R., Kull, D., Dixit, A., S. Opitz-Stapleton and The Risk to Resilience Study Team, (2008): Moving from Concepts to Practice: A Process and Methodology Summary for Identifying Effective Avenues for Risk Management Under Changing Climatic Conditions, From Risk to Resilience Working Paper No. 8, eds. Moench, M., Caspari, E. & A. Pokhrel, ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.

Moench, M. and The Risk to Resilience Study Team, (2008): Understanding the Costs and Benefits of Disaster Risk Reduction under Changing Climatic Conditions, From Risk to Resilience Working Paper No. 9, eds. Moench, M., Caspari, E. & A. Pokhrel, ISET, ISET-Nepal and ProVention, Kathmandu, Nepal.