

ANNEX A

Case studies: Cost benefit analysis of
community-based disaster/climate risk
management

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TEARFUND: INDIA (2004)

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

- **Organization:** Tearfund
- **Date:** 2004
- **Region:** Asia
- **Hazard type(s):** Flood/drought
- **Weblink:**
<http://tilz.tearfund.org/~media/Files/TILZ/Topics/Disaster%20preparedness%20in%20India%20a%20cost-benefit%20analysis.pdf>

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 were 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, 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).

Andhra Pradesh: 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).

WORLD BANK: KENYA (2007)

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

- **Organization:** World Bank
- **Date:** 2007
- **Region:** Africa
- **Hazard type(s):** Flood
- **Weblink:**

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 to reduce their vulnerability to flooding. The project has three major components as follows: 1) community-driven development (CDD); 2) flood mitigation; and 3) 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: 1) woodlots; 2) medicinal plants (including processing); 3) indigenous vegetables; 4) sustainable land management (SLM) practices (though these do not seem to be discussed in detail); and 5) 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) labelled as the 'private' internal rate of return (IRR), as well as for the project as a whole, labelled 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 fuel wood collection, and the second would not include benefits other 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 Centre. The vegetables evaluated include: amaranthus, cowpea and nightshade. If maize production is taken as the 'without' project scenario, amaranthus and nightshade can be ex-

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pected 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 hectare (ha).

	Financial IRR (NPV-USD)	Economic IRR (NPV-USD)
Woodlots with fuel wood	19.4% (\$818/ha)	19.2% (\$793/ha)
Woodlots w/o fuel wood	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-project 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 Western Kenya Community Driven Development and Flood Mitigation (WKCDD/FM) Project.
- The financial viability of beekeeping on forest land or woodlots is significantly determined by the number of beehives per hectare.

ISET: NEPAL (2008)

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

- **Organization:** ISET
- **Date:** 2008
- **Region:** Asia
- **Hazard type(s):** Flood
- **Weblink:** 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 – a 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 the strategies would remain effective in the projected climate change scenarios.

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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 that is anticipated as a consequence of climate change. In contrast, the benefits of people-centred 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.

ISET: INDIA (2008)

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

- **Organization:** ISET
- **Date:** 2008
- **Region:** Asia
- **Hazard type(s):** Flood
- **Weblink:** 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 amid potential climate change of different flood risk reduction approaches in northern India were analysed and compared. In addition, the utility, applicability and limitations of cost benefit analysis for supporting disaster risk reduction decision-making in a changing climate were investigated.

Summary of methodology

Starting 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 five-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 analysed in comparison to a more egalitarian 'people-centred' 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-centred 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.

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Focusing on evaluating flood risk reduction strategies, 18 villages were selected for a survey, with 10 per cent 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 per cent 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 analysed from a social welfare perspective in which all costs and benefits are considered, the benefit to cost ratio from past investments is about one; that is the costs have equalled the benefits. Projected impacts from climate change would reduce returns further probably driving the benefit to cost ratio for new embankment construction in the future below one. Given that investments in existing embankments represent sunk costs, investments in proper maintenance of those embankments would, however, generate high economic returns (benefit to cost ratios in the range of two) under both current and future climate change scenarios.

In contrast, scenarios based on a more 'people-centred' resilience-driven flood risk reduction approach perform economically efficiently. Benefit to 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 evaluate systematically 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 into conventional cost benefit analysis. Without inclusiveness, debate and iterative learning among stakeholders, cost benefit analysis can easily be manipulated and thus misused.

ISET: INDIA (2008)

Name of study: Uttar Pradesh Drought Cost Benefit Analysis, India

- **Organization:** ISET
- **Date:** 2008
- **Region:** Asia
- **Hazard type(s):** Drought
- **Weblink:** 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 analyses 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 to deal better with drought risk to rice and wheat crops and subsequent income effects. DRM interventions considered were: 1) irrigation via the implementation of a borehole for groundwater pumping, with pumping costs paid for by the affected household; 2) subsidized micro-crop insurance; and 3) an integrated package.

Summary of methodology

The study uses a forward-looking methodology assessing risk explicitly in a risk-based modelling framework. In order to systematically assess the costs and benefits of risk management, a risk-analytic modelling 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.

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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 modelling approach. For example, rainfall variation pattern analyses require statistical methods, while the generation of future scenarios has to be handled 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 modelling (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 modelling and economic modelling of the household income generation process.

ISET: PAKISTAN (2008)

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

- **Organization:** ISET
- **Date:** 2008
- **Region:** Asia
- **Hazard type(s):** Flood
- **Weblink:** 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 using CBA for decision-making?

Summary of methodology

The study examined four scenarios to address flood risk: 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 Japan International Cooperation Agency (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 of various aspects (including economic), there is not a fool-proof 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 mobile phone/short messaging services (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 the over-

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design of the project in terms of costly equipment, the early warning system does not have a favourable benefit to 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 SMS on mobile 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 the terms that it was implemented. The CBA tool was extremely useful in highlighting this shortcoming of the designed project. 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-centred resilience-building. Due to a 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.

BRITISH RED CROSS: NEPAL (2008)

Name of study: Cost Benefit Analysis of a Nepal Red Cross Society Disaster Risk Reduction Programme

- **Organization:** 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 disaster risk reduction 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 (IFRC) 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. This was followed by fieldwork and data collection using focus groups and transect walks to investigate hazard characteristics and impacts, and changes as a result of the DRR programme, 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 to conduct sensitivity analyses for a range of scenarios.

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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 more than 18 net present value of benefit for every one net present value 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 programme without the benefits of the flood mitigation is still positive, with a BCR of two and an IRR of 14 per cent.

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 three years (the lifetime of full-scale NRC involvement), the benefit to 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.

SOPAC: SAMOA (2008)

Name of study: Economic Analysis of Flood Risk Reduction Measures for the Lower Vaisigano Catchment Area (Samoa)

- **Organization:** SOPAC
- **Date:** 2008
- **Region:** South-East Asia
- **Hazard type(s):** Flood
- **Weblink:**
www.pacificwater.org/userfiles/file/IWRM/Toolboxes/financing%20IWRM/Samoa.pdf

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 minimize 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.

- The benefits of each option were identified and then measured as avoided damages (tangible/intangible and direct/indirect).
- The costs of each option were considered – market as well as non-market costs (e.g. impacts on biodiversity).
- Costs and benefits were compared to identify the 'best' option.
- Sensitivity analysis was conducted.
- 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. The average degree of damage to buildings across the area was predicted using this information and referring to flood inundation maps for the area that identify the extent of flooding in buildings under floods of different severity.
- Benefits associated with alternative flood mitigation measures were determined using evidence from various flood studies, lead time-damage functions and flood maps/US Corps of

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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 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 one in five, one in 20, one in 50 and one in 100 flood events and their associated probability of occurrence, annual average damage 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 modelling 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 to 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 to 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 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, (e.g. 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 to cost ratios, it is unlikely that they would be significant enough to raise these ratios above one.

Lessons learned

It is recommended that the government in Samoa considers investing in an improved forecasting system in conjunction with public awareness campaigns to educate the local population on the risks associated with flooding, alongside the development of an effective flood advisory system. In addition, policies should be put in place 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 new homes constructed in floodplains to have floor heights which exceed one-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 for residents.

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

SOPAC: FIJI (2008)

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

- **Organization:** SOPAC
- **Date:** 2008
- **Region:** South-East Asia
- **Hazard type(s):** Flood
- **Weblink:** <http://ict.sopac.org/VirLib/ER0122.pdf>

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 one-in-seven 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 fully avoided.

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;
- 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 organizations a combined total of at least FJ\$2.1m to FJ\$4.2m 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 lifetime of the system. It needs to be recognized 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 lifetime of the system, 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

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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 be less than FJ\$0.6m 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 (see table). In other words, every dollar spent on the warning system would be most likely to save between FJ\$3.7 and FJ\$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\$1.7m and FJ\$2.4m 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 \$0.4m and \$0.8m 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 throughout 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\$0.4m over the life of the warning system. Given the benefits, the government of Fiji would most likely gain a return of one to two dollars for every dollar invested in the system.

Stakeholder	Net present value over 20 years (FJ\$)	Benefit: Cost ratio over 20 years
Navua community	1.6-3.3m	Infinite (no costs borne)
Government of Fiji	0.03-0.4m	1.1-2.2
International stakeholders	1.5-3.6m	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.

OXFAM AMERICA: EL SALVADOR (2009)

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

- **Organization:** 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 undertaken to test this field tool. The primary objective was to understand better how the CBA tool is applied ex post to an OA project, and to test whether it is effective for use at a programme level. The second objective of the testing was to develop a CBA of the target programme, 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 programme. It was comprised of three phases (each of nine steps), namely preparation for fieldwork, data collection and data analysis. Both qualitative and quantitative impacts were documented.

Key findings

The programme 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, 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 diarrhoea as a result of clean water, improved general health, and better evacuation of household goods and animals. The CBA for the programme as a whole yielded a BCR of 0.97, suggesting that the programme is more or less break even in terms of its financial impacts.

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One of the most significant impacts of the programme that was repeatedly mentioned in focus groups is the increased sense of security and confidence brought about through the training. 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 programme (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 programme as well as the process of conducting a CBA at a community level.

- Based solely on the interventions that can be quantified, the programme 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 programme 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 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 programme 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 rigour to the decision-making process, and helping to think of programme 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).

IFRC: PHILIPPINES (2009)

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

- **Organization:** International Federation of Red Cross and Red Crescent Societies (IFRC), 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 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 with a review of key documentation and fieldwork 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 and 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 analysed 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 more than 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 one 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

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sense of safety from the presence of a dyke may be substantial.

Lessons learned

As an early pilot in the IRFC 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.

IFRC: SUDAN (2010)

Name of study: Impact and Cost Benefit Analysis in Red Sea State, Sudan

- **Organization:** International Federation of Red Cross and Red Crescent Societies (IFRC), 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 (SRCS) has been undertaking activities to reduce risk and improve livelihoods and food security, including construction of terraces and earth dams, water interventions, educational inputs and the creation of women's centres.

Summary of methodology

The CBA was conducted as part of a wider evaluation of the programme. Data were 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 earth dams/embankments enabled households to undertake successful agricultural activities, providing food for consumption with 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 centres, which could only be assessed qualitatively and were therefore not the subject of a CBA. These interventions appear to have the potential for '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's centres are gaining new skills and knowledge including literacy, health and nutrition awareness, which is being trans-

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lated 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 renders 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 the respondents 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.

OXFAM AMERICA: EL SALVADOR (2010)

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

- **Organization:** 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 undertaken to test 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 (each of nine steps), namely preparation for fieldwork, 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 analysed 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.

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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 programme 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 element of a vulnerability and capacity assessment 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 fieldwork for the actual CBA. Similarly, good monitoring and evaluation will be essential to verify benefits arising from the project.

MERCY CORPS: NEPAL (2010)

Name of study: Cost Benefit Analysis for Community-Based Disaster Risk Reduction in Kailali, Nepal

- **Organization:** Mercy Corps
- **Date:** 2010
- **Region:** Asia
- **Hazard type(s):** Flood
- **Weblink:** www.mercycorps.org/sites/default/files/mc-cba_report-final-2010-2.pdf

Project summary

The Kailali Disaster Risk Reduction Initiative (KDRRI) was implemented in six communities of the Far-Western Development Region of Nepal and later extended to an additional 10 communities. The main problems faced by these communities are flood inundation of settlement areas and erosion of riverbanks. The aim of the project was therefore to build safer communities through DRR initiatives including local capacity-building and training, early warning systems, small-scale mitigation (e.g. bio-engineering, evacuation routes, boats and embankments), education and the 'facilitation of coordination'. The initiative simultaneously focused heavily on capacity-building to drive community DRR, for example establishing disaster preparedness committees (DPC) and additional groups with responsibilities for early warning, first aid etc.

The CBA study had two primary goals: firstly to assess the cost-effectiveness of the KDRRI project; and secondly to create a quantitative methodology for determining the cost-effectiveness of community-based DRR projects that was generic (i.e. applicable to different DRR projects, and to cultural, economic and environmental contexts) and which can be quickly, cheaply and easily applied.

Summary of methodology

Of the six KDRRI communities, Bisanpur was selected for the risk-based CBA, which employed a backward-looking, hypothetical approach.

- **Primary data collection.** The assessment used structured surveys, field visits and interviews for data collection. Detailed surveying was carried out (i.e. 40 per cent of the community) because the initial qualitative assessment indicated that personal losses constituted a major portion of the disaster impact (and these capital losses were impossible to inventory without an extensive survey). Similarly, in-depth discussions with villagers, community leaders and local development workers highlighted the significant number of KDRRI project economic, social and environmental benefits that were unquantifiable. For example, increased social cohesion, education, empowerment, saved lives and indirect impacts on economic capital. These wider impacts were not included in determining the benefit/cost

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ratio.

- **Secondary data sources.** These were used to calculate the 'no DRR' impact. For example satellite photos were obtained to determine the number of houses that would have been flooded without mitigation measures.
- **Risk assessment.** This was carried out to assess the magnitude of floods in the data sets and the annual probabilities for flood years exceeding any particular magnitude.
- **Mapping quantified impacts to disaster magnitudes.** A mathematical model and computer programme Community-based Sigmoid Exponential Disaster Risk (CSEDR) was designed for carrying out the risk-based CBA analysis at the community level. This CBA represented the first field test of these methods. The quantitative CBA portion of the assessment did not include any impacts that occur more than a year after the flood. The results were analysed firstly without including any 'hard to quantify impacts' and then repeated but including health impacts from disasters.

Key findings

Overall, community members reported that flooding had become less of a problem through the implementation of DRR programming and they felt empowered to deal more effectively with floods. More specifically, using a rigorous and conservative estimate for flood damage, discount rate and project impact duration, the benefits of the KDRRI programming exceed its costs. The project yielded a BCR of 3.49. Had it been possible to quantify thoroughly the KDRRI benefits (e.g. savings made in terms of community empowerment, loss of life and livestock, future losses in crop production, loss of top soil and loss of educational resources such as books), the final ratio would have been significantly greater. It was concluded that a community investing in a similar type of DRR activity to the KDRRI project, in a similarly hazard-prone area to the Kailali region of Nepal, could expect to save at least 3.49 times their original investment.

Lessons learned

- A complete assessment of this DRR project would also consider its many significant qualitative benefits. Qualitative impacts of floods are those most significantly modified by the KDRRI programming and yet these were not included in the quantitative assessment; either because they were long term or difficult to quantify. These were highlighted as key benefits through the qualitative assessment and in-depth discussions. Inclusion of the full scope of benefits would have made the BCR significantly higher.

TEARFUND: MALAWI (2010)

Name of study: Investing in Communities: the Benefits and Costs of Building Resilience for Food Security in Malawi

- **Organization:** Tearfund
- **Date:** 2010
- **Region:** Africa
- **Hazard type(s):** Drought
- **Weblink:**
www.ealiance.ch/fileadmin/user_upload/docs/Publications/Food/2012/Investing_in_communities_web.pdf

Project summary

Tearfund conducted a community-based cost benefit analysis of a DRR and food security programme in a Malawian agricultural community with a history of major drought events and food insecurity. The overall programme covered 53 villages and targeted 5,000 farmers in Mzimba District and was funded by DFID and implemented by Tearfund's partner Church of Central Africa Presbyterian (CCAP). The CBA study was commissioned by Tearfund to address a gap in community-based CBAs for drought and food security; previous analysis had mainly focused on floods. The purpose of the study was to: 1) assess programme activities for cost-effectiveness thereby gathering evidence to inform future programming decisions; and 2) provide policy-relevant recommendations to convince governments, donors and UN agencies to act in a timely and appropriate way.

Summary of methodology

The study was retrospective or 'backward-looking' and involved the following:

- **Defining site parameters.** Three programme sites and one control site were selected by CCAP for analysis to ensure representation from all parts of the programme area. Only three of the 10 programme activities were selected for study and these were chosen through participatory consultation.
- **Data collection.** Fieldwork in the four sites involved focus group questions with community and neighbouring community members (i.e. representing nine of the 53 programme villages) to obtain quantitative and qualitative data.
- **Identifying the benefits.** The analysis focused on quantitative impacts for household income and assets, educational gains and impacts on health and mortality both 'with' and 'without' the project and across three differing rainfall scenarios (normal, erratic and drought). Following discussions with communities, the following specific benefits (clearly only a fraction of the full project benefits) were quantified for the analysis: 1) increased crop production; 2) increased livestock production; 3) loss of education avoided; and 4) loss of life avoided. The baseline CBA scenario weighed the total costs against quantifiable benefits over a 10-year timeframe and a discount rate of 10 per cent was used.
- **Calculating costs.** It was not possible to break down the budget by task, so the quanti-

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able programme benefits were offset against the costs of the full programme of work (clearly understating the BCR).

- **Sensitivity testing.** This was carried out to the baseline CBA for different assumptions (increased frequency of drought, increased uptake of project activities and increased crop yields).

Key findings

The affected communities highlighted three main impacts of drought: widespread crop failure, reduced water access and adverse impacts on livestock production. Focus group findings further revealed crop diversification, soil and water conservation and provision of drought-resilient livestock as the most important project activities for food security and for combating these. Qualitative benefits were also identified (e.g. confidence in withstanding future droughts without food insecurity) but were not incorporated into the CBA element. However, it is not known how the target communities would fare in a severe drought (since there has not been a severe drought in the five years since project implementation).

The CBA analysis found that the programme had a significant positive impact on target communities and specifically in terms of household income and assets, education, health and reduced mortality rates. The BCR is significant at 24.30 even though not all qualitative benefits were included.² This positive financial return provides a powerful argument for investing in preventative measures. Further, community-based CBA was shown to be a powerful tool for advocating for future DRR interventions.

Lessons learned

- CBA is a useful, evidence-based tool to analyse the benefits of resilience-building activities; contribute to the debate on integrating resilience-strengthening approaches into development and humanitarian programmes; inform choices between potential future activities; develop measures that have the greatest impact on the community; and demonstrate the cost-effectiveness of activities for donors and future proposals.
- A need to link CBA to the broader policy context. Effective and well-targeted local programmes can deliver significant benefits for a specific community; however, additional progress towards greater food security requires a supportive policy framework and coordination.
- The CBA process can have educational benefits for beneficiaries but a number of challenges emerged including the difficulty of beneficiaries commenting on all scenarios. The process can improve transparency and accountability and build a communities' capacity to recognize value for money when choosing between project options.
- Time is needed for projects to be realised. CBA works less well where activities require more time to deliver results and be fully appreciated (e.g. SWC practices).
- Quantitative findings must be set in their qualitative context, since some benefits and costs are difficult to quantify.

² The analysis focused only on activities identified by the beneficiaries and therefore was potentially biased towards the most successful ones.

OXFAM AMERICA: THE GAMBIA (2010)

Name of study: Responding to Food Insecurity in the Gambia: A Cost Benefit Analysis

- **Organization:** Oxfam America
- **Date:** 2010
- **Region:** Africa
- **Hazard type(s):** Drought

Project summary

Oxfam America (OA) partnered with the Agency for the Development of Women and Children (ADWAC) to carry out a CBA in the North Bank region of the Gambia. The region is prone to a number of hazards including wind storms, drought, pest invasions, salt intrusion as well as wild and domestic fires. Furthermore, rains are becoming increasingly unpredictable and in 2009 this caused severe flooding affecting food stocks and livestock.

OA developed a set of CBA materials to assess costs and benefits of its disaster risk reduction interventions with the purpose of showcasing the 'gains of investing in vulnerability reduction rather than responding to disasters only'. This methodology was firstly tested in El Salvador (see earlier case study) and further tested with two partners in the Gambia: ADWAC, and Concern Universal (see the next case study). The aim of the ADWAC case study was to analyse a series of potential interventions that have not yet taken place in order to inform programming decisions moving forward. The general objective was to identify relevant cost-efficient DRR activities to be included in a new DRR/livelihoods project proposal.

Summary of methodology

The ADWAC study was 'forward-looking' and the CBA was carried out in the lowland communities, where agriculture is the main occupation. Data analysis drew upon the *OA CBA Workbook*, the standard tool used by OA to generate the cost benefit analysis. Data were collected through transect walks, focus groups and additional surveying to complete the following:

- **Hazard assessment.** Hazards were identified by communities and assessed using a hazard assessment framework (i.e. determining magnitude, recurrence, exceedance probability).
- **Impact assessment.** Information on potential impacts of these hazards was collected using the sustainable livelihoods framework categories (physical, financial, human, social and natural). Where possible, these were quantified.

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- **Identification of potential risk reduction interventions.** Based on the vulnerability assessment, a select group of interventions were prioritized for quantitative analysis, namely: cereal/seed banking, improved storage, fertilizers, capacity-building, quick yielding rice, and water points. Pest management and milling machines were identified as bringing significant benefits, but with insufficient data to quantify these.
- **CBA.** The project was anticipated to benefit 185 households (3,000 people) across five villages. Analysis was carried out for several interventions grouped together and for individual interventions where applicable. It assumed a 10 per cent discount rate and a 10-year project lifetime.

Key findings

The findings showed a large difference in the cost-effectiveness of the interventions with some such as the quick yielding rice showing very positive results (e.g. a BCR without fertilizer of 73.3 and with costly fertilizer of 31.22), whereas others such as storage (BCR of 0.81) and improvements for vegetable gardens (0.44) showing negative returns. Clearly not all benefits could be quantified and therefore the findings *do not* show that these latter interventions are not necessarily a good investment; rather that ways to increase benefits and/or reduce costs need to be considered. Fertilizers account for some of the highest costs in the project intervention and therefore it was suggested that alternatives to chemical fertilizer distribution should be investigated. Similarly, although storage facilities on their own yield negative returns, they were found to be a necessary component of any measure that improves yields to protect from pests and other damage. Finally, given the importance of pest management to food security, it was recommended that further work be undertaken to evaluate possible measures in the programme area.

The CBA helped develop a more concrete project proposal for ADWAC, highlighting interventions where more cost-effective methods may be beneficial and helping to develop a proposal maximising benefits.

Lessons learned

- Project activities should be designed to ensure their long-term sustainability. The longer that benefits can be realised, the greater the return on investment. Many of the proposed activities, it was felt, could be sustained, in part through ongoing training. To minimise costs, all training/capacity-building should be designed and carried out within a 'train the trainer' framework to ensure benefits accrue and replicate.
- The CBA process was hindered by several limitations. These included a real lack of data, specifically in relation to agricultural interventions, where a host of factors impact crop yields; hence the impacts of improvements are uncertain.

OXFAM AMERICA: THE GAMBIA (2011)

Name of study: Assessing Risk Reduction among Refugee Host Communities in the Western Region of the Gambia

- **Organization:** Oxfam America
- **Date:** 2011
- **Region:** Africa
- **Hazard type(s):** Drought

Project summary

Oxfam America (OA) partnered with Concern Universal in 2007 to establish a DRR intervention in the Western Region of the Gambia. This region is located in the southern part of the country and suffers from: refugee influx from Senegal, profound poverty, indiscriminate use of forest products, food insecurity and limited access to proper sanitation. In addition, climate change and variability has severely impacted the agricultural system and, combined with environmental degradation, has increased community vulnerability. The OA/Concern Universal partnership implemented a project (in a series of phases), which included a number of key activities: community-based risk assessment, Participatory and Vulnerability Analysis (PCVA), peace-building, livelihood enhancement, knowledge and education, water and sanitation, and environmental protection. The overall aim was to enhance community resilience to the effects of drought, pests and floods by increasing community access to better livelihoods and water and sanitation conditions.

OA has developed a set of CBA materials to assess costs and benefits of its DRR interventions. This methodology was first tested in El Salvador and further tested with two partners in the Gambia: Concern Universal (as reported here) and ADWAC (see previous case study). The aim of the former was to analyse the DRR programme to evaluate cost-effectiveness and inform future programming decisions.

Summary of methodology

The CBA study was 'backward-looking' and included three of the six programme communities. It involved transect walks, focus groups and follow-up surveying. Data analysis drew upon the OA *CBA Workbook*, the standard tool used by OA to generate the cost benefit analysis. Where significant levels of uncertainty were present, sensitivity analysis was used to test the lower and upper bounds of analysis. The analysis separately quantified the following interventions: seeds and fertilizers (for maize, groundnut and sorghum/millet); fire belts; and tree planting to create woodlots. The analysis looked at each of these interventions separately, and for each specific cost associated with the activity, a proportion of the overhead costs associated with the programme (e.g. management and operational costs) were included. CBA was not used to assess **Oxfam Research Reports** are written to share research results, to contribute to public debate and to invite feedback on development and humanitarian policy and practice. They do not necessarily reflect Oxfam policy positions. The views expressed are those of the author and not necessarily those of Oxfam.

the impacts of installing improved pit latrines (due to the difficulty of quantifying health benefits). Similarly, the livestock vaccination intervention was not assessed in detail because benefits had not resulted from the programme and the analysis would reflect only the cost.

Key findings

In terms of project impact, survey respondents identified better availability and access to food, access to seeds, availability of farm implements, more trees, and access to sanitary facilities as the most important changes. The analysis showed that all three interventions are cost-effective, yielding the following benefit to cost ratio:

- **seeds and fertilizers (3.3)** by boosting yields in normal and drought time;
- **fire belts (38.7)** by protecting land and livestock and reducing time spent fighting fires; and
- **tree planting (2.6)** by using drought-resistant Gmelina trees, which can be cut and sold for wood when mature.

In summary, the findings suggest that the Concern Universal DRR programme has had a wide range of positive impacts on communities in the project area and that the quantitative analysis yields positive results. While the pit latrines could not be assessed, the data available suggest that they could be having significant positive returns. The exception is the livestock vaccination programme, which due to implementation difficulties (e.g. vaccinations taking place too late), resulted in a net cost to the programme.

Lessons learned

- There were difficulties in implementing certain projects. The analysis has shown that costs can outweigh benefits if the project suffers from implementation problems. This can in fact build resistance to future programmes through a loss of stakeholder confidence.
- There was insufficient evidence to suggest whether benefits would accrue in disaster times. Many of the interventions were more development-focused, yet increase resilience in the face of disasters. However, it was not possible to identify how well targeted these interventions were for reducing disaster risk in general, and in response to targeted priority hazards.
- Assessing the benefits of agricultural interventions is complex and data-intensive. It is difficult to attribute yield benefits to the intervention rather than the myriad of other possible factors. Furthermore, a number of surveys were required to tease out some of the detail in terms of yield changes.
- Baseline data collection was useful for focusing the fieldwork and filling data gaps. The pre-assessment helped focus future focus group discussions and flag anomalies.
- Another challenge of CBA was that although the overall process was perceived to be beneficial, the fieldwork intuitive and the findings useful, the data collection proved to be extensive involving several surveys and hindered by a succession of disasters that hit the region.

PRACTICAL ACTION: NEPAL (2008)

Name of study: A Cost Benefit Analysis of Practical Action's Livelihood-Centred Disaster Risk Reduction Project in Nepal

- **Organization:** Practical Action
- **Date:** 2011
- **Region:** Asia
- **Hazard type(s):** Flood, drought, landslides and wildlife intrusion

Project summary

This study presents a cost benefit analysis of a community-based DRR management project, led by Practical Action in two districts of Nepal over the period 2007 to 2010. The project itself was part of a five-year worldwide programme focusing on the roles and linkages between different stakeholders in *Mainstreaming Livelihood-Centred Approaches into Disaster Management*. Specific objectives for the project in Nepal were to: 1) improve the socio-economic status of communities vulnerable to natural disasters; and 2) enhance the capacity of stakeholders to adopt a livelihood-centred approach to DRR. Project components include firstly community-level activities (e.g. investment in irrigation, installation of electrical fencing to reduce wildlife intrusion, dam construction, activities to improve skills and productivity, crop farming and livestock husbandry, and off-farm diversification measures) and secondly advocacy and capacity-building (e.g. the formation of disaster management committees).

This study was intended to gather evidence on the cost-effectiveness of the Livelihoods-Centred Disaster Risk Reduction (LCDRR) approach with the objectives of: 1) providing donors/partners with evidence to demonstrate that the approach is cost-effective and deserves further support; 2) motivating government bodies at different levels to incorporate this alternative perspective into their disaster management and development planning; and 3) collecting more evidence on the costs and benefits of DRR in a food security/livelihoods context and within the framework of a changing climate thereby feeding into wider international discussions and research.

Summary of methodology

The study applied the established analytical framework of economic social cost benefit analysis (SCBA) comparing the present value of real income gains compared to a 'no-project' baseline. The analysis also includes future gains beyond 2010 using a social discount rate. The assessment was backward-looking and focused on the community-level project activities only.

- **Data sources.** Data were collected through a project document review and triangulated with extraneous data sources (e.g. FAOSTAT price statistics for agricultural commodities, flood damage functions). Only costs and benefits associated with community-level project activities were included in the assessment.

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- **Calculating the costs.** Direct project costs based on internal annual project budget accounts (e.g. staff time, administration costs, resource costs and support for partner NGOs) and in addition, the opportunity costs of human and material resources contributed by the target households and other local stakeholders (i.e. local labour time inputs diverted to project activities) were included in the analysis.
- **Calculating the benefits** involved a cautious and conservative evidence-based evaluation of the monetary value of productivity gains (due to water resource management, farmer training, improved livestock breeds and crop seeds); *and* of avoided losses (from wildlife instruction); *and* of the additional income (attributable to the various livelihood diversification measures such as beekeeping). This excluded a range of potential ancillary gains (e.g. reduction of losses from landslides, environmental improvements associated with tree plantation measures or health impacts associated with improvements in food security and diet diversification). Similarly, it did not include any long-term gains from the wider dissemination and policy-influencing activities.

Key findings

Community-based initiatives triggered by the LCDRR Nepal project were found to make a significant net contribution to the economic welfare of the target communities. Under cautious assumptions, the overall BCR ranges from 1.13 to 1.45. The present value of benefits exceeded the present value of total costs of project activities in all cases. For the central social discount rate of 10 per cent, the BCR ranged from 1.27 to 1.50.

The measures aimed at raising agricultural productivity in crop farming and livestock husbandry accounted for nearly 57 per cent of the total estimated benefits. Flood risk reduction investments (e.g. the dam) and off-farm livelihood diversification measures only contributed 5 per cent. However, this does not take into account the increased frequency of drought and flood as a result of climate change and the corresponding increase in benefits from investment in irrigation and flood protection. The results lend support to the view that the LCDRR approach delivers value for money and deserves further funding and scaling-up in terms of geographic coverage.

Lessons learned

- Practical Action should consider making cost benefit analysis an integral component of future LCDRR projects from planning and inception onwards.
- CBA is potentially more powerful as a forward-looking planning and decision support tool to assist in channelling scarce resources into activities with the highest net benefits.
- Involve an expert with knowledge in CBA methods in the participatory baseline vulnerability assessment at the start of a new LCDRR project to assist in eliciting and recording information on past disaster frequencies and damage in the form required for probabilistic cost benefit assessment. For example, an expert can help design household survey questionnaires, which are tailored more closely to the information required of at the end of the project.
- Ensure more systematic and organised recording of project inputs and observed outputs that allows clear allocation of project expenses and community contribution.
- Conduct a follow-up study in the same project site in a number of years to examine the longer-run impact of the measures initiated by the project.

IFRC: BANGLADESH (2012)

Name of study: The Long Road to Resilience: Impact and Cost Benefit Analysis of Community-Based Disaster Risk Reduction (CBDRR) in Bangladesh

- **Organization:** International Federation of Red Cross and Red Crescent Societies (IFRC)
- **Date:** 2012
- **Region:** Asia
- **Hazard type(s):** Flood
- **Weblink:** www.ifrc.org/Global/Publications/disasters/reducing_risks/Long-road-to-resilience.pdf

Project summary

The CBDRR programme in Bangladesh has been implemented in a number of phases, the latest geared toward the following 'key results areas': 1) raising community awareness towards preparedness and mitigation in part through VCAs; 2) mitigating risks through small-scale mitigation measures (e.g. raising of housing plinths, drilling shallow and deep tube wells, and constructing bridges and latrines); 3) enhancing livelihood security in particular for the most vulnerable (distributing productive animals, seeds, saplings and assets such as sewing machines, boats, nets and rickshaws); and 4) strengthening local disaster response capacity (e.g. community funds, response teams, first aid and rescue training, committees).

Among other objectives, the cost benefit analysis identified how project impacts translate into efficiency³ by analysing the net benefits resulting from DRR and assessing the cost-effectiveness of the interventions. This allowed a comparison of CBDRR programme costs against disaster response operations undertaken by the Bangladesh Red Crescent Society.

Summary of methodology

The evaluation followed a mixed-method approach, making use of both qualitative (document review, key informant interviews, workshops) and quantitative tools (household survey). Data were collected in four communities using transect walks and focus groups to discuss hazards and their impacts both 'with' and 'without' DRR. Limitations inherent to the CBA approach were highlighted and included the inability to assess the distribution of benefits and costs, the difficulties in assessing non-market impacts (e.g. health and environment) and the decrease in value of a CBA with time and scale. The assessment was backward-looking and involved:

- **Calculating the costs** through identifying total costs (although no annual expenditure overviews were available allowing translation of original expenditure to their present value) and attributing this to expenditure (material support rather than costs for workshops, training etc.) in the four study communities.
- **Calculating the benefits** by identifying both protective benefits and direct economic benefits. Protective benefits relate mainly to the raising of house plinths to avoid the risk of dam-

³ Efficiency: 'A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results' (OECD 2010)

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age to houses and contents. These were calculated in two ways. Firstly, by calculating the protective benefit value resulting from the difference between damages in 2007 and hypothetical damages in 2012. Secondly, they were calculated by multiplying the annual probability of such a flood recurring to establish the annually avoided risk. This amount was then multiplied by the expected lifespan (15 years) and adjusted for inflation. Direct economic benefits used in the calculations mainly related to the distribution of hybrid rice seeds, which resulted in a considerable yield increase in the communities.

Key findings

The study found that in economic terms, the investment has been worthwhile and in the four communities studied, benefits exceeded costs. The BCRs at present (i.e. efficiency to date) were between 1.18 and 3.04. However, when future protective benefits over the coming 15 years are included (future efficiency) BCRs were between 3.05 and 4.90. The 'real' BCRs could be much higher in part because a number of benefits were excluded including: 1) improved community development such as gains in participation and transparency; 2) a greater sense of security; 3) lives saved and injuries avoided; 4) future benefits from hybrid vegetable seeds; 5) other livelihood support benefits (e.g. productive animals); and 6) improved health and access to water and sanitation.

It was however identified that the CBDRR programme could have been more efficient if for instance it had incorporated measures to better protect paddy fields and agricultural assets from flood damage (community members estimated a hypothetical 2012 flood would cause the same damage as in 2007).

Lessons learned

- **Increase efficiency, by adapting programme focus.**
 - Continue to support community development and awareness, which is central to a cost-efficient approach to CBDRR (i.e. low costs and considerable benefits) partly by staying longer to consolidate impacts and maximise benefits.
 - Extend support to middle-income groups, given low costs (these groups can purchase inputs e.g. seeds themselves) but benefits are shared with the wider community (e.g. stabilising community food security).
- **Considerations for future cost benefit analysis:**
 - When to conduct a CBA – a sufficient time after the conclusion of the main programme activities allowing for two comparable hazards before and after the programme *and* to incorporate impacts that take time to emerge.
 - Making CBAs comparable – huge differences in assumptions, time horizons and included benefits means a simple comparison between ratios can be misleading.
 - Improving data on costs and benefits – need to improve quality of financial data attributable by year and location/community and similarly, a sound monitoring and evaluation system alongside baseline data to assess benefits.

SPREP: PACIFIC (2012)

Name of study: Cost Benefit Analysis Work Programme

- **Organization:** Secretariat of the Pacific Regional Environment Programme
- **Date:** 2012
- **Region:** South-East Asia
- **Hazard type(s):** Climate change
- **Weblink:** www.sprep.org/virtual-library

Note: this case study is based on the findings from the interim report (April 2012). The final report is due to be released in early 2013.

Project summary

The Pacific Adaptation to Climate Change (PACC) project is a five year UNDP/Global Environment Facility project (initiated in 2009) which covers 13 Pacific Island countries and aims to reduce community climate change and disaster risks in the water, agriculture and coastal sectors. It comprises three main components: 1) 'mainstreaming' climate change risks into government processes, policies and strategies; 2) piloting and/or demonstration of practical adaptation measures; and 3) communication of climate change risk and lessons learned.

Some project countries were found to be experiencing problems in appraising and selecting appropriate measures to implement. Similarly, they were finding it difficult to set up monitoring and evaluation frameworks to allow for robust evaluation. Cost benefit analysis was therefore incorporated into PACC pilot demonstration projects to help inform decisions on project option selection and design; and to support replication and up-scaling (based on CBA evaluations at the end of the pilot projects).

A study has however been completed for the Solomon islands – a cost benefit analysis in Ontong Java and Sikaina to improve the ability of the isolated island communities to address food production and food security.

Summary of methodology

Insufficient information is available to identify the specific CBA methodology used by the participating countries at this time.

Key findings

The cost benefit analysis programme is reported to be playing a major role in strengthening adaptation planning and enhancing capacity to effectively design and implement adaptation options. Seven countries have been working to implement work plans developed at training workshops and of these, two – the Solomon Islands and Tuvalu – have completed a CBA of their food security project and water sector demonstration project respectively. Five further countries have completed draft reports (Cook Islands, Niue, Palau, Marshall Islands and Samoa) and final reports are expected in early 2013. Detailed findings are therefore currently unavailable. How-

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ever, the CBA highlighted three broad options for the Solomon Islands including measures to reduce salt water contamination in food production areas, introducing root crop varieties and cultivars/plants tolerant to salinity, and modifying the soil and food production environment. The analysis suggests that the latter option has the highest probability of success in a reasonably short timeframe.

Lessons learned

Detailed learning from these case studies will be identified in a Lessons Learned Workshop and available in the final reports (due to be released in early 2013). However, initial feedback suggests that similar assessments for other projects (to support evidence-based policy and project proposals) are needed to access international climate change financing.

CARE INTERNATIONAL: KENYA (2012)

Name of study: Counting on Uncertainty: The Economic Case for Community Based Adaptation in North-East Kenya

- **Organization:** Care International
- **Date:** 2012
- **Region:** Africa
- **Hazard type(s):** Drought and flood
- **Weblink:**
www.careclimatechange.org/files/adaptation/Counting_on_Uncertainty_July12.pdf

Project summary

The study aims were to assess whether investing in community-based adaptation is economically efficient and effective – holding all else (i.e. future regional or national scale transformations) equal. The main objectives of the study were: 1) to assess the economic efficiency of investing in climate change adaptation in Kenyan arid and semi-arid lands using two communities in the region of Garissa as case studies; and 2) to provide a ‘forecasting’ CBA which can be replicated to other climate and socio-economic contexts, notably in Africa.

Summary of methodology

Two communities in Garissa County, North-East Kenya (one pastoral and one agro-pastoral) were consulted to provide case studies within a broader objective of investigating the case for investing in community-based adaptation. The approach merged traditional cost benefit analysis with the principles of social return on investment. The study modelled the cost and benefits of undertaking ‘action’ by comparing these to a ‘business-as-usual scenario’ to capture avoided losses. The study identified impacts of climate change up to 2030 by constructing a systems dynamics model, taking into account multiple scenarios reflecting uncertainty associated with local impacts of regional and global climatic transformations. The model included economic returns and social impacts (e.g. reciprocity structures and gender equality) as well as ecological impacts (e.g. key ecosystem services) and their interactions following a ‘triple bottom line’ approach. The assessment was forward-looking and involved the following three steps, which were undertaken by combining empirical research (questionnaires and stakeholder engagement) with secondary data drawn from other studies and international databases:

- **Building theories of change** in order to understand the social, economic and environmental impacts that climate had and was having through stakeholder engagement with primary and secondary stakeholders. This information was complemented with findings from Climate Vulnerability and Capacity Analysis (CVCA), which established community priorities and current coping strategies to climate variability.
- **Understanding quantitative social and economic capital evolutions** using empirical

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research with primary stakeholders (questionnaires and focus groups) to identify how their economic and social situations have evolved over time.

- **Collating robust assumptions, valuation of costs and benefits and construction of cost benefit models.** This involved constructing economic models (business as usual scenarios *and* adaptation scenarios), composed of sub-models (for climatic, economic-livestock, economic-agricultural, environmental and social capital) to simulate the costs and benefits of action versus inaction. This required extensive literature reviews and use of secondary data to fill the gaps. Instead of addressing the costs and benefits of adaptation in an inductive fashion (e.g. downscaling regional economic models), this work followed a deductive bottom-up methodology. The specific parameters of the modelling included the following:
 - *Selecting DRR/adaptation programmes.* DRR programmes that were modelled included education spread of early warning systems, dykes, fencing and community insurance schemes. Adaptation programmes modelled included: income diversification, investment in animal health and investment in human health.
 - *Estimating DRR/adaptation costs.* To estimate both short and long-term impacts of community-based adaptation, the initial input cost of adaptation interventions and the impact potential of selected adaptation activities were collected. Clearly given that precise adaptation strategies had not yet been defined for the communities, adaptation scenarios were derived from the CVCA and primary/secondary data sources. Ascertaining accurate costs for an adaptation strategy that is not yet determined was found to be challenging.

Key findings

The study illustrated an unequivocal economic justification for taking action and financing community-based adaptation to climate change in Garissa, Kenya (even when accounting for risk and uncertainty). Further, the study suggested that local and regional scale infrastructural investment and productive strategies could significantly magnify the benefits if designed so as to not undermine socio-economic livelihoods of communities. Under the most realistic scenarios, ratios of between 1.45 and 3.03 emerged, showing that investment in community-based adaptation is economically efficient. Even when using a higher discount rate, the costs of intervention were 2.6 times lower on average than the costs of not intervening to address climate change and extreme weather events. These results suggest that a big part of climate-related socio-economic losses and costs could be avoided through investment in local interventions. Even without anthropogenic climate change, the benefits were found to outweigh the costs and therefore funding community-based adaptation in Garissa, Kenya was confirmed as a 'no regret' investment.

Lessons learned

- There is a need to 'test' replicability of the CBA methodological approach for decision-making at a local level and on other communities. Further research is therefore required to determine the replicability of this approach to other geographies given that cultural, social, economic and environmental contexts will vary with climate change and climate variability.
- Social cost benefit analysis has limitations in its ability to select the appropriate adaptation strategy alone. Its limitations in the face of uncertainty mean that it should be viewed as one tool with an array of appraisal options.
- Taking account of economic, social and environmental capital and placing these in a currency that allows decisions to be made is crucial for ensuring that value for money is achieved in all investment decisions.
- Community-based adaptation resilience in the face of uncertainty suggests it is economically efficient and a well-suited response to climate change. A flexible approach is required, focusing not on one specific form of transformation but broadening potential directions (e.g. broadening capacity to respond to change whatever form this takes). Adaptation can be viewed as a flexible approach to avoid 'mal-adaptation' and the associated costs.
- Incorporate 'hard' and 'soft' measures in adaptation policy design to maximise value and

impact. Similarly, *economic diversification* is not always a solution. Interventions need to be thoroughly assessed, require dynamic planning and must be compatible with ecological characteristics.

- Investing in community-based adaptation presents numerous 'double' dividends for development and adaptation. Similarly, community-based adaptation benefits are likely to be enhanced by national-level interventions.

OXFAM INTERMON: BURKINA FASO, CHAD, MAURITANIA AND NIGER (2013)

Name of study: Demonstrating the Benefits of Early Response: Cash for Work in Sahel

- **Organization:** Oxfam Intermon
- **Date:** 2013
- **Region:** Africa
- **Hazard type(s):** Drought
- **Weblink:** not yet published

Project summary

Oxfam implemented cash for work programmes (CFW) as an early response to support food security and livelihoods of affected populations in the 2011 to 2012 food crisis in Western Africa. In order to appraise the concrete benefits that this intervention provided to affected populations, a community-based CBA methodology was used. The aim of the study was therefore to: 'provide evidence of the cost-efficiency of the Oxfam/partner early response in the 2011/2012 Sahel Food Crisis through the cost benefit analysis of interventions in four countries of the Sahel (Burkina Faso, Chad, Mauritania, and Niger)'. The main objective of the study was to determine the concrete benefits of early interventions through cash transfers in terms of: 1) maintaining and promoting livelihoods; 2) household coping strategies; and 3) specific benefits for women and pastoralists.

Summary of methodology

The assessment was backward-looking and involved the comparison of two scenarios 'without CFW' and 'with CFW' in order to document and quantify the changes. This was undertaken in the following four countries:

- **Burkina Faso:** in six villages representing 786 households (of the 7,424 households in-

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cluded in the CFW programme). In addition to cash transfers, the works undertaken primarily aimed to improve soil conditions.

- **Chad:** in three villages (of the 25 villages included in the CFW programme) representing 620 households. The main works included the rehabilitation of roads, the development of water retention pools and the development of bunds.
- **Mauritania:** in six villages representing 124 beneficiary households (of the 20 villages benefiting from the CFW programme). Households were again supported with cash transfers and engaged in work projects including rehabilitation of land and enclosures for vegetable gardens.
- **Niger:** in four villages representing 675 households (of the 15 villages involved in the CFW programme). Works agreed through a participatory process with communities included rehabilitation of land for fodder and agricultural purposes (using demi-lunes)⁴ and the rehabilitation of a road (not included in the analysis).

The study was divided into three phases.

- **Phase I: Preparation** – involved defining the study parameters and preparing for fieldwork. This included training local programme staff to conduct the CBA fieldwork, designing the fieldwork, selecting teams, selecting communities and designing focus group discussion questions.
- **Phase II: Data collection** – involved focus group discussions (FGDs) with men and with women. It comprised the following activities:
 - *hazard assessment* – focus groups participants were asked about the hazards that affect their communities, the impacts of these both with and without CFW and the magnitude of changes that have occurred;
 - *impact assessment* – the impacts of CFW were identified by communities (i.e. the benefits or avoided losses associated with the introduction of CFW in the community.);
 - *valuation of quantifiable impacts* – the proportional piling technique was used in order to quantify some impacts;
 - *identification of risk reduction measures and costs* – programme costs (total costs and the portion provided as cash transfers) were calculated.
- **Phase III: Data analysis and reporting** – involved country teams presenting their findings according to a common analysis and reporting framework, followed by in-depth discussions. Quantification of benefits was compared with programme costs and modelled in a cost benefit analysis. The cost benefit analysis was run for five years (with the exception of Mauritania where it was run for two years due to the short life cycle of rehabilitation measures), using a discount rate of 10 per cent.

Key findings

The findings suggest that early response through cash transfer is a very important piece of a more effective response. More specifically, the findings indicate that benefits outweigh costs, by a reasonable margin with BCRs of: **3.38** for Burkina Faso; **2.21** for Chad; **3.65** for Mauritania; and **1.11** for Niger. Differences between the countries largely relate to the types of benefits recorded – for example Burkina Faso quantified the benefits (e.g. 393 ha of rehabilitated land compared with 25 ha for Chad). The finding may also suggest that the use of demi-lunes for rehabilitation in Burkina Faso may be more cost-effective than the use of bunds in Chad – but further research is required to verify this.

The costs further impact these ratios and these generally correlate with the costs of programmes (and usually the length of the programme). For example, although Niger has the highest total benefit, its BCRs are the lowest because the costs of the programme were so high – the CFW programme was implemented over the longest period (four months compared to two months for Mauritania).

⁴ This is when earth or stone embankments are built in semi-circles to promote water retention on degraded land.

Lessons learned

- **Quality of data.** Reporting on impacts is subject to bias (particularly in the case where implementing partners are interviewing households, who may have expectations for further support). Data should therefore be triangulated with other sources and between programmes.
- **Lack of a comprehensive list of impacts.** This was the first CBA carried out by Oxfam for this kind of intervention and therefore the lack of a comprehensive list of impacts could mean some key impacts may not have been discussed.
- **CFW programmes were found to be beneficial.** Cash as an early response was found to be slowing asset depletion and preventing negative coping strategies. Similarly community development works were found to be adding a significant potential contribution to household resilience – although a longer-term focus on agricultural benefits may be necessary to justify costs.
- **Early response through cash for work can be a more cost-effective response to drought.** The evidence suggests that CFW as an early response is providing families with resources before they go into a deeper state of crisis, therefore minimising humanitarian response.
- **The programme is having a clear impact on women,** as cash is helping women to maintain income-generating activities such as small businesses, which can help them to have some financial independence and build confidence.

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