The Economics of Early Response and Resilience: Approach and Methodology

June 2013

Acknowledgements
The study team is very grateful to the numerous experts who were willing to discuss the study and feed in relevant data. Thank you to the DFID offices in Ethiopia, Kenya, Mozambique and Bangaldesh for all of their assistance with this study. We would especially like to thank WFP for collaborating with us on this study in Mozambique, Niger and Bangladesh. They provided detailed analysis that significantly augmented the findings. We would also like to acknowledge the Pastoralist Welfare Organization in Ethiopia, who kindly arranged for field visits, and the community members in Dire Dawa who graciously hosted us and shared their experiences.

Thanks to all of the experts who kindly provided peer review: Andy Catley, Feinstein International Center, and Charlotte Benson, Independent Consultant, who provided expert review for Phase I; and Sophie Pongracz, Andrew Clayton, Jane Petty and Colum Wilson at DFID for Phase II.

Thanks also to Sophie Pongracz and Tim Waites from the Conflict, Humanitarian and Security Department in DFID for commissioning and facilitating this work, and for their inputs and expertise throughout. Thanks to Duncan Barker, Peter D'Souza and Abi Perry who facilitated Phase II of the study.

This study has been funded by UKaid from the Department for International Development. However, the views expressed do not necessarily reflect the department's official policies.

Team Biographies

Team Leader: Courtenay Cabot Venton, freelance consultant, cabotventon@hotmail.co.uk. Courtenay is an economist, specializing in the economics of poverty reduction, disaster risk reduction, and climate change adaptation. She has been working in the economics of sustainable development for over 15 years. She was a senior consultant at Environmental Resources Management (ERM) in London before becoming an independent consultant. Courtenay acted as team leader for both phases of this assignment.

Kenya Study: Catherine Fitzgibbon, freelance consultant, cfitzgibbonwork@gmail.com.
Catherine is based in Kenya and has worked in the region for many years, most recently as Programme Quality and Design Director for Save the Children UK, Kenya Programme. Previous to this, she was Head of Operations for Save the Children in Ethiopia. Catherine acted as the Kenya expert for this research.

Ethiopia Study: Tenna Shitarek, freelance consultant/FARM Africa, tenicho@gmail.com.
Tenna is based in Ethiopia and has more than 15 years experience in the delivery of capacity building and livelihood improvement initiatives in Ethiopia, including evaluation and assessment of projects, implementing monitoring and evaluation systems, data collection and analysis. Tenna acted as the Ethiopia expert for this research.

Mozambique Study: Hanna Schmuck is a freelance consultant living in Mozambique since 2006, hannaschmuck@yahoo.de. After obtaining a PhD in Social Anthropology in 2000 from the Free University of Berlin, Germany, she worked with the Red Cross in South Asia, West, Central and Southern Africa. Since 2009 she has been working on consultancies in disaster risk reduction and climate change adaptation, mainly in Africa and Asia.

Niger Study: Jean-Martin Bauer, Programme Advisor, WFP. jean-martin.bauer@wfp.org.
Jean-Martin is an analyst at WFP's Analysis and Nutrition unit in Rome. Jean-Martin has a dozen years of experience in humanitarian operations and food security analysis. He leads WFP's HQ-based food security monitoring team. Prior to his current assignment, Jean-Martin served as market specialist at WFP's West Africa bureau, and in three WFP country offices in the Sahel.

Moise Ballo, Vulnerability Analysis and Mapping Officer, WFP, Moise.ballo@wfp.org. Moise is a geographer specialising in food security and vulnerability analysis. He is based in Niger and has been working in early warning, food security, vulnerability and poverty analysis and monitoring and humanitarian operations for 13 years. Prior to joining WFP, he was a teacher and researcher at the University of Bamako, Mali.

Bangladesh Study: Shuman Majumder, freelance consultant, shumajum@gmail.com
Shuman is an environmental analyst and epidemiologist specializing in environmental sustainability and climate change adaptation. Shuman has more than 16 years of experience in the environmental and sustainability sectors. His focus in Bangladesh has been on climate change and private sector adaptation.

HEA Analysis: Lorraine Coulter, Food Economy Group, lcoulter@foodeconomy.com. Lorraine is a livelihoods specialist with expertise in analysing quantitative and qualitative livelihood systems information, with a focus on livelihoods modelling. She acted as HEA technician for both phases of this research.

Research Assistant: Olivia Dooley, freelance consultant/Partners In Health, opdooley@gmail.com.
Olivia acted as research assistant for Phase I of this assignment, building on her work for Partners In Health, and CERES on climate risk.

TABLE OF CONTENTS

Acronyms

AHEaD	Analysis of Herd Dynamics model
ARC	Africa Risk Capacity Facility
CCA	Climate Change Adaptation
DFID	Department for International Development
DRR	Disaster Risk Reduction
FAO	Food and Agriculture Organization
FSNAU	Food Security and Nutrition Analysis Unit
FTS	Financial Tracking Service
GAM	Global Acute Malnutrition
GHA	Global Humanitarian Assistance
HEA	Household Economy Analysis
HERR	Humanitarian Emergency Response Review
IASC	Inter-Agency Standing Committee
MAM	Moderate Acute Malnutrition
MT	Metric tonnes
RFE	Rainfall estimates
SAM	Severe Acute Malnutrition
SRA/LRA	Short and Long Term Rain Needs Assessments
SWC	Soil and Water Conservation
ToT	Terms of Trade
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
WFP	World Food Programme

1 Introduction

1.1 Introduction

The impacts of natural disasters and complex emergencies have been increasing over recent decades, putting the humanitarian system under considerable pressure. In 2010 natural disasters affected more than 217 million people, killed more than 297,000 people and caused $123.9 billion in economic damages.[1] The types, dimensions, and dynamics of humanitarian crises are further increasing, in some cases exponentially.[2] A variety of factors are contributing to this increase, including climate change, increasing vulnerability due to erosion of natural, social and economic capacities, and fluctuations in the global economy.

The costs of humanitarian crises are equally growing – not only do disasters and complex emergencies result in significant economic losses, but they also require mobilization of large amounts of humanitarian aid from the international community. According to a recent study on funding streams for emergency response, aid from governments reached US$12.4 billion in 2010, the highest figure on record. At the same time the CAP reached its highest ever figure of US$11.2 billion, double that of 2006. This aid is heavily targeted to a few countries - over the past ten years, almost 50% of humanitarian aid (amounting to just under US$90 billion) was consistently spent in just nine countries.[3]

There is growing consensus that greater investment needs to be made in preparedness to reduce the impacts of crises, and an even greater imperative for further work to build the resilience of communities to be able to cope with these events themselves. The scales need to tip, with greater emphasis placed on building capacities and reducing vulnerabilities to allow countries and communities to reduce risk and recover themselves, and thereby reduce the high levels of aid dependency that are becoming systemic in some parts of the world.

And yet, despite a rhetoric that has called for reform for the past decade, only 4.2% of official humanitarian aid and 0.7% of non-humanitarian development assistance was invested in disaster risk reduction between 2006 and 2010.[4]

It is widely held that, broadly speaking, investment in building the resilience of communities to cope with risk in disaster prone regions is more cost-effective than

[1] Guha-Sapir, D. et al (2010). "Annual Disaster Statistical Review 2010: The numbers and trends." Centre for Research on the Epidemiology of Disasters (CRED), Brussels.

[2] IFRC (2011). "World Disasters Report 2011: Focus on Hunger and Malnutrition."

[3] Kellet J. and H. Sweeney (2011). "Synthesis Report: Analysis of financing mechanisms and funding streams to enhance emergency preparedness." Development Initiatives, UK.

[4] Global Humanitarian Assistance (2012). "GHA Report 2012".

the ever-mounting humanitarian response. Yet little solid evidence exists to support this claim. And while the past decade has seen significant attempts to reform the humanitarian system – particularly initiatives to expedite funding for emergency operations – efforts to increase the focus of humanitarian funding and response to risk reduction, remains a challenge.[5]

The June 2011 UK Government Response to the Humanitarian Emergency Response Review (HERR) presented disaster resilience as 'a new and vital component to [the UK Government's] humanitarian and development work.'[6] Building on this, the UK Government's Humanitarian Policy[7] puts resilience at the centre of its approach to addressing disasters, both natural and man-made. This includes commitments to embed resilience-building in all DFID country programmes by 2015, integrate resilience into their work on climate change and conflict prevention and improve the coherence of their development and humanitarian work.

Further to this, DFID has committed to improve the quality of funding by increasing "the predictability and timeliness of UK funding, for example by making early pledges to appeals, agreeing to multi-year funding, supporting global and country-level pooled funds, fast track funding and pre-qualifying NGOs and private sector partners."[8] Multi-year funding can facilitate early response and other gains, and hence this is also part of the research conducted here.

Following the UN General Assembly in September 2011, the UK has agreed to develop a proposal on how resilience can be taken forward within the international system. Evidence on the cost-effectiveness of disaster resilience will be crucial in progressing this agenda.

1.2 Aims of the Study

The purpose of this work is to support this agenda by providing analysis that helps to build a solid evidence base on the cost effectiveness of early response and building resilience to disasters as compared with the cost of late humanitarian response. The second phase of the work also seeks to identify the value for money of taking a multi-year approach to humanitarian funding.

[5] Ibid.

[6] www.dfid.gov.uk/Documents/publications1/hum-emer-resp-rev-uk-gvmt-resp.pdf?epslanguage=en

[7] "Saving lives, preventing suffering and building resilience"

[8] DFID (n.d.) "Saving lives, preventing suffering and building resilience: The UK Government's Humanitarian Policy". UK.

1.3 Scope of the Study

This study was conducted in two phases. Phase I was concluded in June 2012, and used Kenya and Ethiopia as case studies. Phase II was concluded in June 2013, with a focus on Bangladesh, Mozambique and Niger for case studies.

Phase I: The Horn of Africa, specifically Kenya and Ethiopia, were selected as a focus for this study, with the aim that the methodology can be replicated elsewhere. The Horn repeatedly suffers from disasters – complex emergencies[9], droughts and floods are prevalent. And yet relief and humanitarian aid remain the predominant response to these crises. Kenya and Ethiopia were selected not only for their vulnerability to disasters, but also for practical reasons (e.g. security issues).

Phase II: Following on the recommendations from Phase I, the intention was to expand the scope of the work to test the methodology in several more countries. Niger was selected because the Sahel faces similar protracted crises to the Horn, and it was felt that it was important to test the methodology in at least one Sahelian country. Mozambique was selected because it adds an element of complexity as both floods and droughts interact to create crises (cyclones do as well, though these were not included in this analysis). Finally, the study team wanted to include an Asian country, and in particular one that did not have HEA data, on which these analyses rely heavily, to test the methodology under a different set of data availability. Bangladesh was selected because it has been very proactive on disaster risk, and because it is subject to repeated and regular flooding, and therefore it was felt that data would likely be available to support the analysis.

[9] e.g. natural hazard and conflict combined, such as Somalia and South Sudan

1.4 Outline of this Report

This report describes the approach and methodology used to undertake the analysis, in particular defining key concepts for the analysis. It is intended to provide a detailed explanation of the methodology for all five country studies, while the country reports focus on the findings of each study. It sits within a suite of reports within the Economics of Early Response and Resilience (TEERR) Series (Table 1).

Table 1: Reports in the Economics of Early Response and Resilience (TEERR) Series

Report Title	Report Content
TEERR Synthesis of Findings:	Summarizes the key findings
TEERR Approach and Methodology:	This report includes the introduction to the study objectives, and the detailed methodology as well as limitations to the analysis.
TEERR Country Reports: • Ethiopia • Kenya • Bangladesh • Mozambique • Niger	The country reports contain a very brief introduction, description of the country/study context, the detailed findings from the analysis, and conclusions/recommendations. These draw together the data presented in the country supporting documents (see below) as well as the HEA report, to model outcomes.
TEERR HEA report:	Contains details of the HEA modelling, assumptions and parameters, as well as modelling output.
Country Supporting Documents	Each country is supported by a report that contains country level detail and data.

2 Key Concepts, Analytical Framework and Methodology

2.1 Key Concepts

What does resilience mean?

According to DFID, "disaster resilience is the ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses - such as earthquakes, drought or violent conflict – without compromising their long-term prospects."

Or, in other words, according to John Twigg's "characteristics of a disaster resilient community":

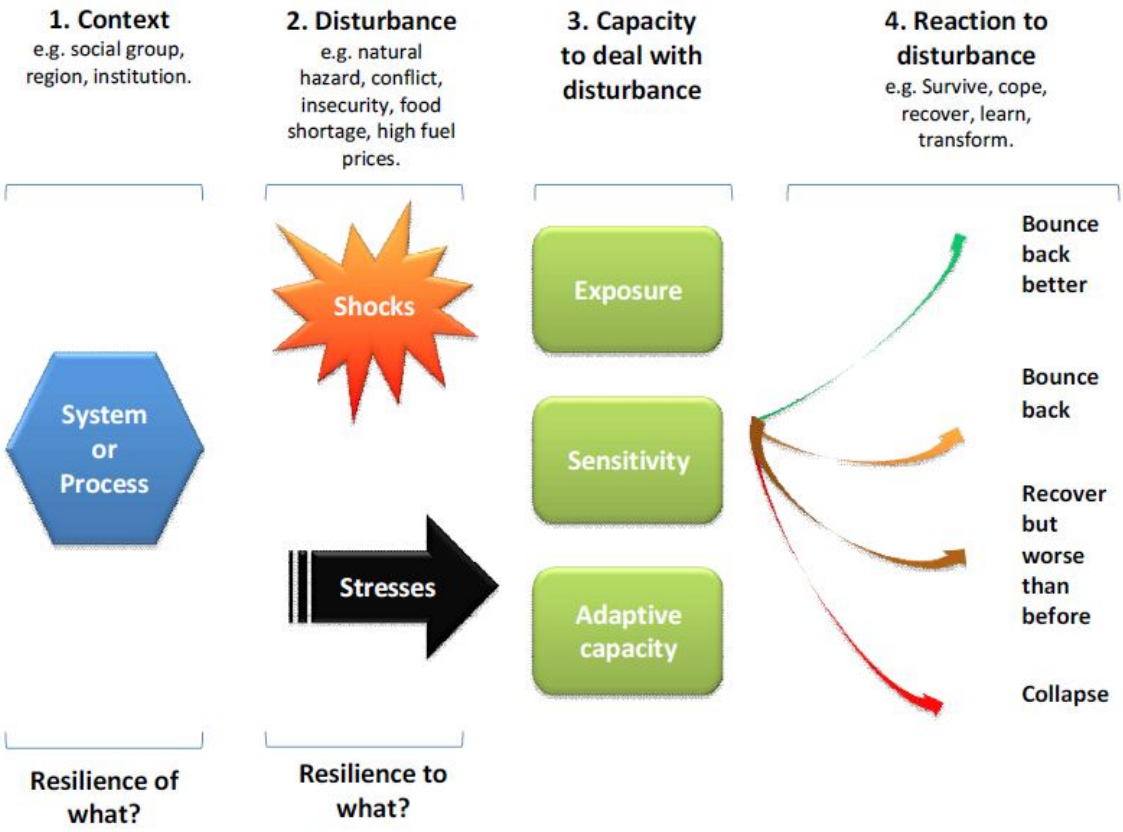
> "A focus on resilience means putting greater emphasis on what communities can do for themselves and how to strengthen their capacities, rather than concentrating on their vulnerability to disaster or their needs in an emergency."[10]

DFID's definition of resilience is comprised of four elements:

- Context – resilience of what?
- Disturbance – resilience to what?
- Capacity to deal with the disturbance – this includes the exposure to risk, the sensitivity or degree to which a system will be impacted by the risk, and the adaptive capacities of relevant actors.
- Reaction to disturbance – in the best case, the reaction to a shock is to "bounce back better".

[10] Twigg, J. (2007). "Characteristics of a Disaster Resilient Community". For the DFID Disaster Risk Reduction Interagency Coordination Group.

Figure 1: DFID's Approach to Resilience



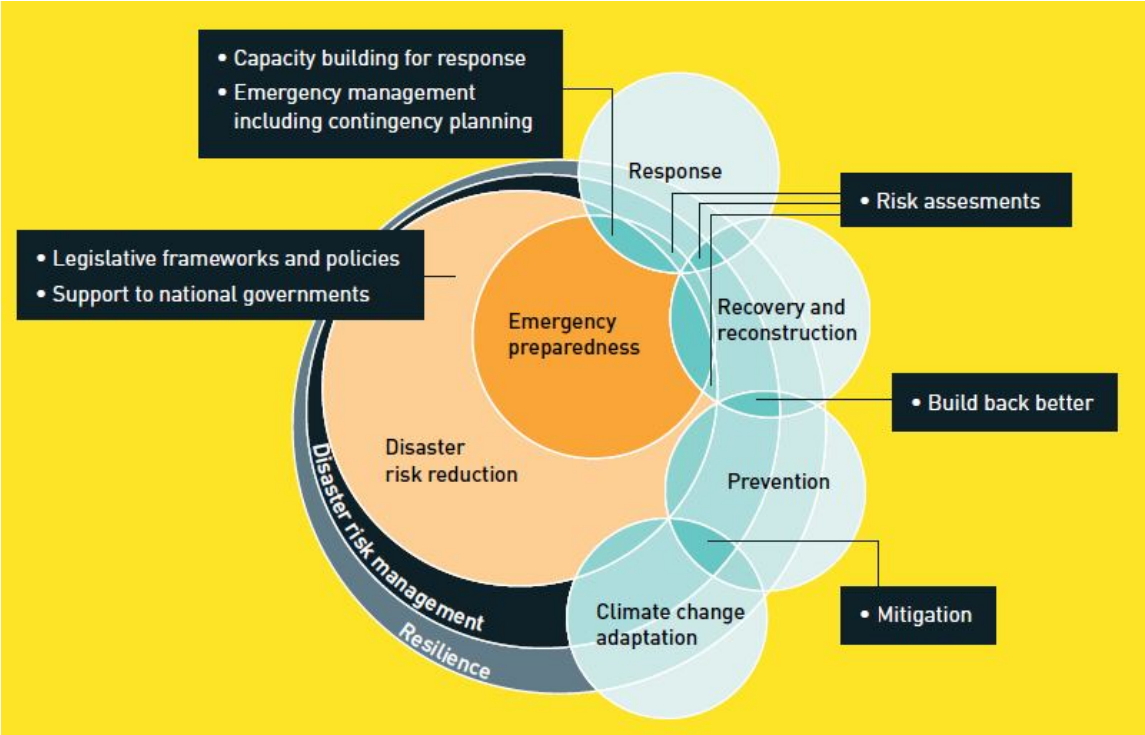
Resilience is a process, not an end product

Many attempts have been made to define "resilience" and as a result many agencies report confusion over what constitutes a resilience building activity, and how one measures when a community is "resilient".

Resilience is not an end-point - no community is immune to the impacts of shocks, and those factors that affect vulnerability and resilience are constantly changing. Rather, the aim is to engage in a process that is building the resilience of people to cope with shocks, and that allows for flexibility and choice so that people can adapt and make good decisions as circumstances change.

The figure below was developed for the Food and Agriculture Organisation (FAO)/Inter-Agency Standing Committee (IASC)-funded report on funding streams for emergency preparedness. It shows how resilience encompasses a broad range of interventions – from relief to reconstruction, as well as preparedness and prevention, disaster risk reduction (DRR) and climate change adaptation (CCA). Furthermore, resilience activities can take place at a variety of levels – including building capacity and institutional structures at a national level through to concrete activities such as ensuring access to basic services in a community. Building resilience is part of a process that encompasses activities from all of these spheres.

Figure 2: Concentric circles denoting connections between the various elements of DRR, resilience, emergency preparedness, etc.[11]



2.2 Analytical Framework

The aim of the study is to test a methodology for evaluating the *economics* of building resilience, particularly as compared with humanitarian response. Economic analysis is only one facet of the analysis – social, moral, political and institutional factors all have a bearing on prioritization. As a result, ***this study is not trying to provide a list of interventions that should be prioritized for reducing the impact of crises – rather it is providing insight into the economics of various choices, to contribute to a much wider decision-making framework.***

Furthermore, the themes discussed in this report are subject to high levels of uncertainty. For example, building resilience can mean many different things, to different groups of people, and therefore estimating a cost of resilience is very challenging. The approach in this paper has been to use conservative values throughout (using the higher end of costs, and the lower end of benefits) to ensure that any changes to the underlying assumptions and estimates only emphasize the overall findings.

[11] Kellet, J. and H Sweeney (2011). "Analysis of Financing Mechanisms and Funding Streams to Enhance Emergency Preparedness: A synthesis report." Development Initiatives, UK. Funded by the Food and Agriculture Organisation (FAO) on behalf of the Inter-Agency Standing Committee (IASC) Task Team on Funding for Preparedness.

The study seeks to compare the cost of three scenarios:

- Late humanitarian response;
- Early humanitarian response; and
- Building resilience to crises.

While humanitarian action is clearly required in certain situations, the overall goal is to ensure that human populations can cope with crisis and continue to develop. In Phase II, evidence was also gathered on the cost of **multi-year funding for humanitarian response**, as a mechanism for facilitating early response as well as other cost efficiencies. This research is in support of a parallel paper commissioned by DFID on the "Value for Money of Multi-Year Approaches to Humanitarian Funding".[12] This report highlights a number of potential areas of savings resulting from multi-year humanitarian response, including lower operational costs, flexibility for early response, and predictability of funding that facilitates long term investments. Clearly, some of these gains could be brought about through annual funding for early response (for example, while some gains (such as early procurement and decreased case loads), while other gains require a multi-year approach (for example, staff costs, pre-positioning, and longer term initiatives).

The evidence was not detailed enough to differentiate between these cost savings. However, it is clear that multi-year funding would provide a structure that would facilitate the cost savings that are described in their report under both early response and resilience. Further to this, in each country study, a text box is included that summarizes some of the gains that could be realized from a multi-year humanitarian funding model.

The analytical framework is built around four storylines to facilitate analysis (the multi-year storyline was only added in Phase II, and hence is only relevant to the country studies in Bangladesh, Mozambique and Niger).

Storyline A: Late response results in humanitarian intervention. The timing of the response is assumed to occur 'late', i.e. after onset of medium- to high-risk coping strategies have been adopted, including the sale of productive assets and after significant livestock deaths have occurred. Food and non-food aid are required to ensure that the population affected survives. Furthermore, while aid helps to ensure that people survive, a downward cycle of asset depletion is evident, and the caseload for humanitarian intervention is seen to increase over time (both in terms of the number of people requiring aid, and the number of months that aid is required on average). Malnutrition is high, with increases in the Global Acute

[12] Cabot Venton, C (2013). "Value for Money of Multi-Year Approaches to Humanitarian Funding." DFID, UK.

Malnutrition (GAM) rates, including both Moderate Acute Malnutrition (MAM) and Severe Acute Malnutrition (SAM). When the next crisis hits, households have typically not recovered asset levels from the previous one.

Storyline B: Early response is taken to ensure survival at the time of early warning of a crisis. In this case, action is taken before the onset of high-risk coping strategies uptake and before significant livestock deaths. Interventions are not necessarily different from those taken in Storyline A, but importantly they are taken at the first signs of a potential drought. Food and other aid are still required to ensure that the population affected survives. However, the impact is far less at this stage (populations have not yet reached destitution) and therefore per capita intervention costs are smaller, and the duration that aid is required is shorter. Furthermore, the unit cost of procuring and transporting food and other aid can be cheaper.

Storyline C: Investment is made in building the resilience of communities to cope with drought on their own. If the investment is made to the extent required up front, communities should be able to cope without external intervention for the foreseeable future (ceteris paribus). Clearly, resilience is not a static event; it requires evolving and adapting over time as a whole variety of factors can change to influence a community's coping capacity. It is also not expected that resilience will be built to a threshold that allows a community to cope with any event, no matter how extreme. However, the concept is to build resilience to a level that allows communities to cope with minimal external humanitarian or early intervention, given existing conditions.

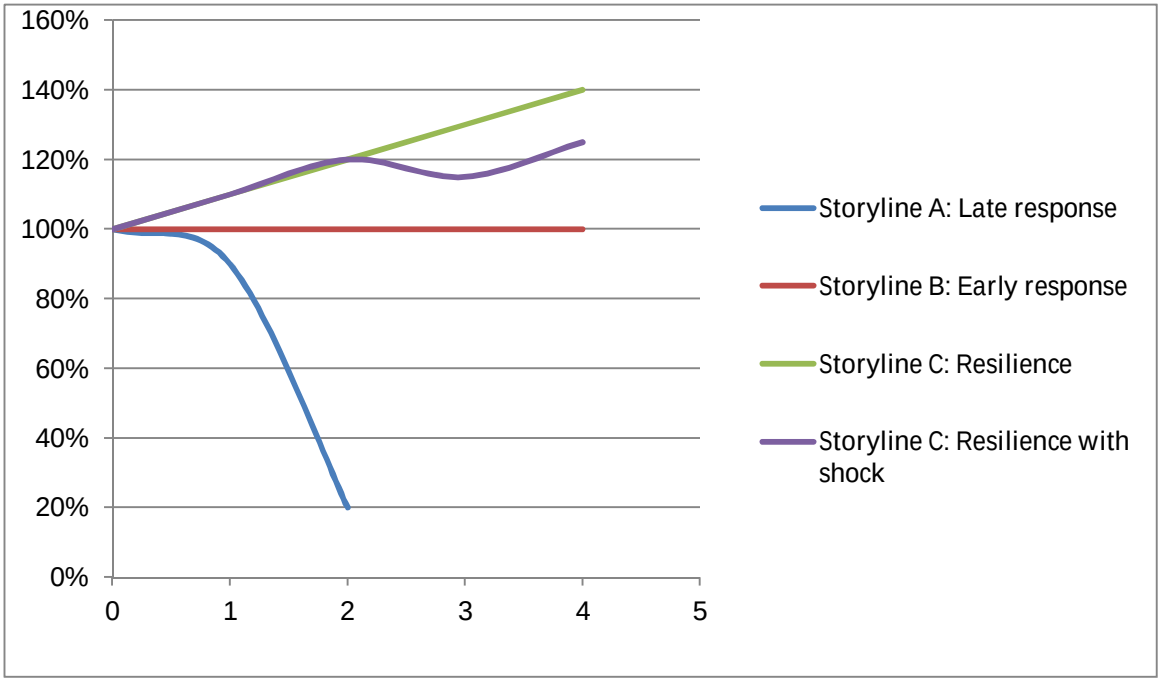
The cost of building resilience cannot be estimated directly with any great certainty. Resilience interventions, as detailed in the previous section, can represent a whole host of activities, and the effectiveness of these activities at building transformational change will vary depending on factors such as how they are implemented and the local context. In addition, resilience activities will change over time as existing conditions change. Nonetheless, in Phase II, the modelling included very specific agricultural interventions for Mozambique and Niger that were fed through the model to predict the change in caseloads.

Figure 3 is a very simple graphical representation of each of these three storylines. Under Storyline A, asset depletion rapidly erodes community ability to bounce back, and a downward spiral is seen as households head towards destitution. Storyline B assumes that aid is provided to allow families to subsist, but there is no upward mobility or asset building. Storyline C is depicted twice, first to show the gradual climb to greater resilience, as communities build their asset base. Clearly there could be setbacks as shocks will continue to affect these households, but the assumption is

that they can reorient themselves back onto a path of growth (represented by the Storyline C with shock line).

Figure 3: Theoretical Representation of Storylines

Plots assets (100% is level of assets necessary to protect livelihoods[13]; y-axis) against time (x-axis)



The Household Economy Analysis (HEA)

This study relied heavily on data generated from the Household Economy Analysis (HEA), developed by Save the Children UK and analysed for this study by the Food Economy Group. This section provides a brief overview of the methodological approach that underpins the HEA.

HEA is a livelihoods-based framework for analysing the way people obtain access to the things they need to survive and prosper. It was designed to help determine people's food and non-food needs, and identify appropriate means of assistance, whether related to short-term emergency needs or longer term development program planning and policy changes.

HEA is based on the principle that an analysis of local livelihoods and how people make ends meet is essential for a proper understanding of the impact – at a household level – of hazards such as drought or conflict or market dislocation. These predictions at a household level can then be used to guide wider institutional and policy analysis.

[13] See Figure 6 for definition.

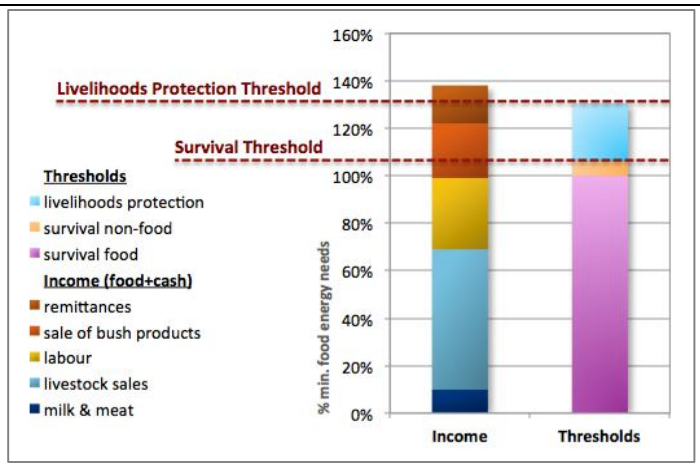
The objective of HEA-based analysis is to investigate the effects of external hazards and shocks (whether negative or positive) on future access to food and income. Three types of information are combined: (i) information on baseline access to food and income; (ii) information on hazard (i.e. factors affecting access to food/income, such as livestock production or market prices) and (iii) information on household level coping strategies (i.e. the strategies households can use to protect and/or increase access to food or income when exposed to a hazard).

HEA scenario analysis compares conditions in the reference year to conditions in the current or modelled year, and assesses the impact of such changes on a households' ability to meet a set of defined minimum survival and livelihoods protection requirements (see **Error! Reference source not found.**).

Figure 4: HEA Emergency Response Thresholds Compared to Total Income Levels

The Survival Threshold represents the total income required to cover:

a) 100% of minimum food energy needs (2100 kcals per person), plus
b) The costs associated with food preparation and consumption (i.e. salt, soap, kerosene and/or firewood for cooking and basic lighting), plus
c) Any expenditure on water for human consumption.



The Livelihoods Protection Threshold represents the total income required to sustain local livelihoods. This means total expenditure to:

a) Ensure basic survival (above), plus
b) Maintain access to basic services (e.g. routine medical and schooling expenses), plus
c) Sustain livelihoods in the medium to longer term (e.g. regular purchases of seeds, fertilizer, veterinary drugs, etc.), plus
d) Achieve a minimum locally acceptable standard of living (e.g. purchase of basic clothing, coffee/tea, etc.)

In HEA outcome analysis, projected 'total income' – or the sum of all food and cash income households secure, converted into a common unit or currency (either percentage of kilocalories consumed (%kcals) or cash) – is compared against two thresholds – a survival threshold and a livelihoods protection threshold. These thresholds are defined on the basis of local patterns of expenditure.
Figure 3 summarizes the components of each threshold.

A herd dynamics model – Analysis of Herd Dynamics (AHEaD) – developed by Mark Lawrence of the Food Economy Group has been used to project herd losses and

gains for Kenya and Ethiopia (data for a similar analysis in Phase II countries was not available). The model was developed in 2011-12 to capture the relationship between rainfall (quality and quantity of rains by season) and herd dynamics components. Assumptions about the relationships built into the model have been developed using HEA baseline data on herd dynamics, baseline data and field information from the Food Security and Nutrition Analysis Unit (FSNAU) of FAO, and secondary data on pastoral livestock production in East Africa and the Horn of Africa.

The HEA methodology used in this analysis estimates deficits (measured in metric tonnes (MT) of food required) and number of people affected (i.e. with a deficit). For Kenya and Ethiopia, the model also estimates livestock losses. Deficits are measures for three drought scenarios: low, medium and high. Each scenario is built using historic data on rainfall and terms of trade characteristics to define each magnitude of event. The HEA modelling is only used for drought events.

More detail around the methodology and parameters of the analysis is given in Section 3.3 below, as well as the HEA report that accompanies this report.

2.3 Methodology

The study began with a scoping exercise, during which consultations were undertaken with key experts working in related fields and/or the region. The aim was to gain a better understanding of the key issues, and also to help focus the study and identify how it could be structured to best address data availability/gaps and build on existing work. The Phase II study collaborated closely with the World Food Programme (WFP) to gather further evidence on the cost savings for food and nutrition that can be possible through early/multi-year humanitarian response. Each country study was led by an in-country expert, to facilitate data collection, consultation, and analysis.

The data was then analysed from two perspectives, each of which are described in greater detail below. In both cases, the data was evaluated using multiple sources to allow the study team to triangulate and ensure that data was robust.

- *Bottom-up Analysis:* The HEA modelling provides detailed data on the impacts of drought events on household economies. This approach used relevant data at a household level to compare costs of response for a given area. It is the more detailed component of the analysis, because the study team was able to gather much more detailed data at this level to build up the storylines.
- *Top-down Analysis:* There was also a reasonable amount of evidence on the costs of response at a national level, aggregated for the country as a whole.

The HEA models the impact of response, using historic rainfall estimates (RFE) and terms of trade (ToT) as inputs to model low, medium, and high magnitude drought scenarios. Details for each country can be found in the HEA Report.

- In the case of Kenya and Ethiopia, high magnitude droughts are estimated to occur every 3 to 5 years – a 5-year cycle is assumed in the modelling to be conservative. Because the model runs over five years, it shows how an event in year one continues to have an impact on households for successive years (in other words, a deficit in year 1 can require on-going food aid, albeit for a shorter time, in successive years, due to asset erosion). It can be used, therefore, to quantify the need over 5 years as a result of an event in year 1. The cost of aid is inflated by 5% with each drought event (every fifth year) to reflect the increasing humanitarian caseload.[14]
- In the case of Mozambique and Niger, the HEA analysis was constructed for a full 20 years, using the expected return period of high, medium and low magnitude events, and is therefore likely to give a more comprehensive picture of on-going deficits and costs.

In each case, figures were modelled over a 20-year lifetime (an analysis for 10 years is also presented where applicable for comparison), discounted at 10%[15], and using the return periods for crisis years described above. The total discounted costs over 20 years are then compared across the three storylines, to make a comparative analysis.

Throughout the analysis, where a range of values is applicable, the study team always picked values that would give a conservative outcome – in other words, if the underlying assumptions are tested, the results should only become more pronounced.

2.3.1 Data Analysis – "Bottom-up approach"

The bottom-up approach relied heavily on the HEA analysis and herd dynamic model for four of the country studies. The HEA model was undertaken for the livelihood zones for which data was available in each country, specifically:

- Ethiopia: Southern Ethiopia, which covers the majority of the vulnerable population, equivalent to 2.8m affected people (out of a total population of 94m).

[14] Data on increases in caseload were not available, but consultation with numerous stakeholders suggested that it is increasing by approximately 5% with each event.

[15] Discount rates are used in these types of analysis to reflect the time preference for money – in other words, a dollar today is worth more to someone than a dollar tomorrow. 10% is in line with central bank rates in both countries, as well as rates used for development projects.

- Kenya: HEA data in Kenya is much more limited, and so the analysis was run for one livelihood zone - Wajir Southern Grasslands in Northern Kenya, for a population of 367k (out of a total population of 44m).
- Mozambique: 16 livelihood zones in the Zambezi Valley and the Limpopo Basin, representing 2.6m people (out of a total population of 24m people) were modelled.
- Niger: 28 livelihood zones in agricultural and agro-pastoral areas, representing 5.2m people (out of a total population of 17m people) were modelled.

In the case of Bangladesh, HEA has not been implemented (with the exception of one fishing livelihood zone in the south of the country on a very small scale), and hence it was not possible to conduct a bottom-up analysis.

Storyline A: Cost of late humanitarian response

The cost of late humanitarian response is estimated using three components

- Unit costs for food aid and non-food aid,
- Caseloads, and
- Losses.

Estimating the cost of food and non-food aid:

- The cost per MT to deliver food aid was estimated for each country.
- The cost of non-food aid was estimated by using data on actual costs, or costs as a percentage of total aid.

Estimating caseloads:

Caseloads are estimated in the HEA model, both as number of people with a food deficit, as well as MT of food required. This was multiplied by the cost estimates for food and non-food aid, to estimate the total cost of response. Importantly, this analysis models the cost of filling household deficits – this can be quite different from the actual aid supplied, which can often fall short of need.

Estimating losses:

In Kenya and Ethiopia, livestock losses are modelled using the herd dynamics model (AHEaD) and valued using average animal values (see

- Table 1[16]). It should be noted that a) these livestock are lost over successive years as a result of the drought in the first year and b) the average does not reflect the significant variation in livestock losses that will occur in each household.

[16] It is important to note that, while the most relevant livestock values were used, values are subject to high levels of fluctuation.

- In Mozambique and Niger, it was not possible to estimate losses using the HEA. Very limited loss data exists in both countries. A cost benefit analysis of the Africa Risk Capacity Facility (ARC)[17] estimated that late response (i.e. 6 months +) costs an additional $1,294 per household. This estimate includes reduced income potential of children under age 2 (U2) who receive reduced nutrition, reduced household growth (measures as income) due to reduced consumption and increased distress sales, plus direct losses from livestock deaths. This estimate was made for six African countries, including both Mozambique and Niger, though the findings are not specific to these two countries and therefore should be interpreted with some caution.

Table 1: Estimated Value of Livestock

	Kenya[18]	Ethiopia[19]
Camel	$513	$635
Cattle	$323	$328
Shoat (sheep/goat)	$33	$61

Storyline B: Cost of early response

Estimating the cost of food and non-food aid:
The cost of aid was estimated using a variety of sources, though most data came from WFP. Costs associated with early response are lower, primarily as a result of early procurement (during harvest time), and decreased transport costs.

Estimating caseloads:
HEA modelling estimates caseloads, both in terms of number of people with a deficit, as well as the magnitude of the total deficit, measured in MT. These are lower as a result of early response.

- In the case of Kenya and Ethiopia, early response was modelled using commercial destocking of 50% of adult animals[20] that would have otherwise died (this results in a similar level of destocking on a per capita basis to actual evidence, though it is clear that there is not the current capacity to do destocking at this level across either country). The model uses a second early response scenario that combines a change in rainfall as a proxy to estimate the potential impact of an

[17] Clarke D and R. Vargas Hill (2012). "Cost-Benefit Analysis of the African Risk Capacity Facility."
[18] National Livestock Information System, Ministry of Livestock Development, Government of Kenya. Based on national average livestock prices from 2004-2010.
[19] Data is taken from the Ethiopian Livestock Market Information System, for February to May 2012. http://www.lmiset.net/Pages/Public/Home.aspx
[20] Households do not typically destock young animals.

improvement in animal condition on household economies, combined with commercial destocking – the model incorporates the reduction in aid costs and losses as a result.
- In the case of Mozambique and Niger, an early response has been defined in the HEA modelling as a response at the time of early warning of the drought – before the adoption of high-risk coping strategies (including sale of productive assets) and before significant livestock deaths.

Estimating losses:
- In Kenya and Ethiopia, livestock losses are modelled using the herd dynamics model.
- In the case of Mozambique and Niger, ARC estimates that early response (i.e. 4-6 months after first failed rain) costs an additional $49 per household – this is the cost of reduced nutrition for U2s losing 14% of lifetime earnings.

Storyline C: Cost of building resilience

The cost of building resilience is very difficult to estimate – most interventions can build resilience, but their costs, and outcomes, can vary substantially depending on how they are implemented and on the local context (to the extent that the same intervention can build resilience in one community and erode it in another). The intention in this analysis was to use best estimates for what it might cost to build resilience, in order to allow a comparison with the cost of late humanitarian response.

Estimates for the cost of building resilience in Kenya and Ethiopia were taken from a combination of 1) estimates of the costs for specific measures (e.g. WASH, livestock, livelihoods, etc), as estimated by NGO budgets and 2), the cost per person of some wider resilience building programmes in each country. In the case of Mozambique and Niger, the HEA modelling was able to accommodate increases in agricultural yields as a result of Soil and Water Conservation (SWC) practices, based on evidence from field experiments in each country. As a result, the resilience modelling in these two countries is very specific and built on actual evidence.

Further, added to these costs, is "residual risk", i.e. on-going food aid and losses that will continue to occur in a drought.
- In Kenya and Ethiopia, because there is little evidence as to the speed or magnitude with which this change will take place, a very conservative assumption is taken, to include 100% of the required aid under Storyline B2 in the first year, 50% in year 5, and 25% each year thereafter, to reflect a decreasing reliance on aid.
- In Mozambique and Niger, the model gave an estimate of reduced caseloads under a resilience scenario, and the remaining food gap was used as an estimate of residual risk.

Finally, investment in resilience will result in additional direct and indirect impacts. For instance, SWC can facilitate greater diversity of crops grown, while herd maintenance can ensure that families have animals for milk and meat, as well as to sell at market.

Beyond these impacts, these interventions can contribute to increased incomes, improved nutritional outcomes, decreased health costs and improvements in education. These have been shown in the literature to deliver returns that are quite substantial. However, the returns are context specific, and depend on a wide range of factors including the local context, the combination of interventions, and the timeframe of the intervention. A very conservative assumption of benefits of $1.1 for every $1 spent is assumed in the model.

2.3.2 Data Analysis – "Top-down approach"

Storyline A: Cost of late humanitarian response

As above, the cost of late humanitarian response is estimated using three components – food aid/non-food aid, caseloads, and losses.

Estimating the cost of food and non-food aid:

The cost of aid was estimated using national level figures on aid requirements. A variety of sources were triangulated in the case of each country study, including UNOCHA's[21] Financial Tracking Service (FTS) for humanitarian aid, Global Humanitarian Assistance (GHA), and short and long-term rain needs assessments (SRA/LRA) in the case of Kenya, as well as modelled humanitarian aid in the ARC study referenced above.

In the case of Bangladesh, while HEA data was not available, it was possible to construct the average aid cost per person, and this was combined with the average number of people affected by disasters each year in Bangladesh, to give a total aid figure for comparison with FTS/GHA estimates.

Estimating losses:

Aid is not the only cost incurred in a drought – numerous losses in lives, livestock, milk and meat production, health impacts, and economic activity, all add to the economic burden. The value of these losses can be hard to measure, but are significant, as once a family gets past the initial stage of relief, they have to recover their livelihoods and asset base, rebuild their herds, etc.

[21] United Nations Office for the Coordination of Humanitarian Affairs

Losses were estimated based on a variety of different sources for each country, depending on data availability. The country reports should be referred to for specific details.

Storyline B: Cost of early response

Early response will result in reduced caseloads as well as decreased costs. However, estimating early response at a national level is very difficult to do, and systematic data on this did not exist in any of the country studies.

As a proxy, the percentage reduction in cost under early response as modelled by the HEA in the bottom-up assessment was applied to the total cost of humanitarian aid to estimate the potential decrease. While the HEA was modelled for specific populations, in three of the countries (except Kenya), it was modelled for the majority of the livelihood zones affected by drought, and therefore is a reasonably robust approximation of the avoided losses that might be seen at a national level. In Mozambique, where both floods and drought were evaluated, reductions under HEA were applied to drought costs, while reductions in a comparison of the 2000 and 2013 floods were applied to flood costs.

In the case of Bangladesh, it was possible to estimate the reduction in the cost of early response, using studies that had quantified: 1) the reduced unit costs as a result of early procurement; 2) reduced caseloads due to early treatment of malnutrition; 3) reduced losses; and 4) saved lives due to evacuation.

In the case of Kenya and Ethiopia, the total cost also includes an estimate of what it would cost to implement commercial destocking, as well as additional measures to improve animal condition – it is not feasible to introduce commercial destocking across the whole of the two countries; rather these costs are used as a proxy to account for the cost associated with implementing an early response measure.

Storyline C: Cost of building resilience

It is very difficult to estimate how much it would cost to build resilience at a national scale for each country – as discussed previously, resilience is a process, and can encompass a very wide range of activities. Nonetheless, costed estimates from various national development, disaster risk reduction, and adaptation plans are used to provide a proxy for the cost of building resilience. Further to this, resilience measures will not reduce the impact of drought completely, and hence a scaled continuation of residual risk is included in the cost estimate.

In the case of Bangladesh, detailed analysis has been done on the impacts of cyclones and floods as a result of climate change, and as a result this study also includes a comparison of the three storylines under climate change.

Resilience activities also have many additional benefits that accrue outside of disaster times, such as health and education improvements, increased income, etc. As with the bottom-up approach, attempts to incorporate some of the indirect benefits of building resilience are built into the analysis at a return of 1.1 for every dollar spent.

2.4 Variations between the countries

There are some important variations between the country analyses, which should be carefully noted when interpreting the findings. In particular, the approach used in Phase I was built upon and added to for Phase II. It is important to note that the differences mean that the cost figures are not always comparable between the countries.

Changes to the approach in Phase II:

- The HEA modelling was updated in Phase II.
    - In Phase I, the study modelled the impact of a high magnitude drought in Year 1, and its subsequent impacts for the following five years. This was modelled with a 5 year return period over 20 years. In Phase II, high, medium and low magnitude droughts were modelled over the full 20 years, based on historic data.
    - Phase I was able to incorporate the herd dynamic model to do more detailed analysis of the impact of herd losses. This level of data was not available for Phase II and hence was not incorporated to the same extent.
    - The resilience scenario was improved significantly in Phase II, by modelling the impact of a specific SWC practice using empirical evidence from each country. Having said this, the early response scenario in Kenya and Ethiopia modelled commercial destocking, which could also be viewed as a resilience building measure (investment in functioning livestock markets), and hence can present a strong case for resilience as well. As a result, these scenarios should be viewed as presenting concrete evidence for investment in resilience.
- In Phase II, the study team worked in closer collaboration with WFP to build up a strong evidence base for the decrease in costs of aid that can come about as a result of early response (for example, through early procurement, prepositioning, etc). WFP analysed data from various programmes that facilitate early response (for example, the forward purchasing facility) as well as programme data.
- The hazards were expanded from drought in Kenya, Ethiopia and Niger, to include flood and drought in Mozambique, and floods and cyclones in Bangladesh.
- Bangladesh has virtually no HEA data and as a result the study had to be designed very differently. Bangladesh was chosen on purpose to test the

approach and the ability to generate findings without the availability of HEA data.

Implications for Findings:

- Good loss data makes a large difference to the findings. For example, the Kenya national level analysis incorporates findings from the Kenya PDNA on losses associated with the 2009/2011 drought. These loss estimates are much higher than the Ethiopia analysis, which had to rely on much more limited loss data. Bangladesh had detailed estimates on losses under climate change, which also helped the analysis.
- HEA baseline data is much more comprehensive for Ethiopia, Mozambique and Niger, than it is for Kenya. The implication is that the modelling covers a much wider range of households, poverty groups, and pre-existing conditions. As a result, some of the impacts are different – for instance, the impact of destocking is much greater in the Ethiopia model, because destocking tends to have a greater impact on wealthier households with large herd sizes that can sell more animals, and the Ethiopia sample contained a wider range of poverty groups.
- Further to this, the baselines in Wajir were conducted in 2005/06, which was already below average for rainfall. These act as the reference year for the rest of the analysis. By contrast, the reference years for Ethiopia were almost entirely slightly above normal in terms of rainfall. Not only is Wajir generally an area vulnerable to drought and market shocks, they also have low total income and had a large deficit in the reference year, and a very significant proportion of their total income came in the form of food aid during the reference year. This makes for very high deficits, faced by the majority of the population. It also usefully demonstrates how drought affects a population that is still recovering from the previous drought. The result is that deficits, and hence costs on a per capita basis are higher for Wajir than southern Ethiopia.

2.5 Limitations

- Phase II was beset by external limitations – severe floods in Mozambique, insecurity in Niger due to the Mali crisis, and strikes and cyclones in Bangladesh. This made it very difficult, at times, to access stakeholders for interview and to get access to materials and data sets in offices. While these events slowed progress, the study teams worked around them to the best of their availability.
- There is nothing comparable to the HEA in Bangladesh, and hence a significant limitation was the inability to do a bottom-up analysis. However, one of the reasons that Bangladesh was chosen is because of the wealth of information that is available on disaster risk reduction and related themes, and this was used to the maximum extent to model the cost comparison.

- This type of study is very dependent on the availability of good data. Because this analysis was so data intensive, the study team sought to gather the most robust data possible, often comparing numerous sources. The study was also directed to some degree by the data, designed to work with what was available. Data variability was high – impact of droughts, livestock prices, costs of even simple measures such as installing water access, all had widely differing estimates. To accommodate these differences, the study team always took a conservative approach, such that any sensitivity analysis (e.g. analysis that tests the assumptions underlying the model) is likely to only accentuate the conclusions reached in this report.
- The cost of resilience is particularly hard to estimate because "resilience" can cover so many different activities. Hence the analysis relied heavily on proxy values to give an indication of what could be achieved for a given cost. The exception is the bottom up analysis in Mozambique and Niger, where specific data on resilience interventions in agriculture were modelled, and therefore the analysis is robust and founded on empirical evidence. Further, the Kenya and Ethiopia studies relied on very specific empirical evidence on commercial destocking, which could also be interpreted as a resilience building measure over the long term.