FINAL REPORT:

Assessing the impact of ICF programmes on household and community resilience to climate variability and climate change

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1. Introduction

This report details the findings of a short assignment on the measurement of resilience commissioned by the UK Department for International Development (DFID) as part of DFID's support to the UK's International Climate Fund (ICF). The purpose of the assignment was to review existing methodologies for measuring resilience and to present a methodology for the measurement of resilience that allows ICF projects to report against certain ICF Key Performance Indicators (KPIs), specifically KPI4 (*numbers of people with improved resilience as a result of project support*).

2. Definitions and conceptual framing of resilience

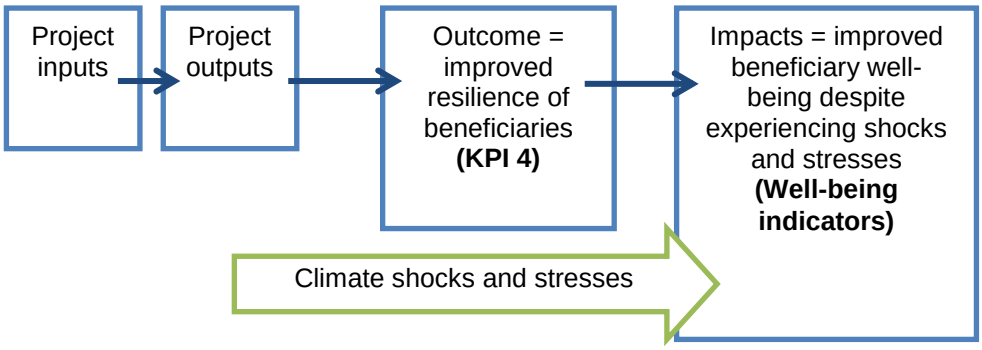
DFID's working definition of resilience is:

> *"the ability of countries, governments, communities, and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses, while continuing to develop and without compromising their long-term prospects".*[1]

The DFID Resilience Framework describes the resilience of a system or process to specific shocks and stresses, in terms of its capacity to deal with these shocks and stress, and in terms of how it responds to them (bounces back better, to previous state, worse or not at all). The factors that influence resilience will vary according to the system or process with whose resilience we are concerned, the shocks and stresses to which it is exposed, and the environmental and policy contexts in which it operates. To measure resilience, we need to understand it in terms of these contextual factors.

When we are concerned with the resilience of people (as in the case of reporting against KPI4), **we can define resilience in terms of the underlying factors that make people more or less able to anticipate, plan for, avoid, cope with, manage, recover from and adapt to the stresses and shocks to which they are likely to be exposed**. Project outputs will seek to influence these factors in a way that improves resilience. Increased resilience in turn should reduce the extent to which stresses and shocks adversely affect human well-being and result in losses and damages. **Improved resilience therefore is located between project outputs and project impacts (on well-being and losses/damages), at the outcome level**, as illustrated in the general theory of change for resilience diagram below.

[1] DFID Resilience Approach Paper; The DFID conceptual framework for resilience is included in the annex



Theory of change (ToC): without the programme beneficiaries would have been less resilient to climate related shocks and stresses and therefore performance of well-being indicators (e.g. income, deaths) would be worse than in the with programme scenario

3. Measuring the effectiveness of adaptation projects

The ultimate measure of a project's impact on resilience will be the extent to which it can be associated with reductions in the adverse effects of shocks and stresses. This can be measured directly if a shock or stress occurs during the project monitoring period. The impact of the project will need to be compared with a 'counterfactual' scenario in which the same shock or stress occurred but in which the project had not been implemented. This might involve comparison with a previous similar event or with a control population, or the modelling of 'expected' effects based on historical relationships between climate variables measuring the frequency and/or severity of shocks/stresses and well-being or loss/damage indicators.

However in many cases we need to understand the resilience being built by a project in advance of a shock or stress occurring. By identifying the underlying factors that make people more or less resilient to specific shocks and stresses, we can develop resilience indicators that are predictive of the effects of shocks and stresses. **These resilience indicators, defined at the outcome level, can be measured even if shocks and stresses do not occur. They thus provide us with an interim or bridging mechanism for monitoring and evaluating project results, that goes beyond the measurement of outputs but does not require us to wait until a shock or stress has occurred.** If a shock or stress does occur during the project monitoring period, we can test the validity of these resilience indicators by examining how well they correlate with project level impact indicators that measure changes in losses, damages and well-being due to project interventions.

4. Review of existing methodologies for measuring resilience

The study described here reviewed a selection of existing methodologies for measuring resilience, and assessed their applicability to ICF projects. These were selected from an existing review by TANGO International (Frankenberger and Nelson 2013), to represent a range of methodologies; many studies employ a variety of techniques, but there is also considerable methodological overlap, with different studies using similar approaches and methods. None of the methodologies reviewed provides an operational framework for measuring changes in the resilience of individuals (for reporting against KPI4) that can be attributed to project activities. The extent to which the methodologies use participatory methods to identify context-specific indicators of resilience is very limited. Some methodologies are little more than broad frameworks, while others incorporate a degree of methodological complexity that might be impractical in project contexts.

Nonetheless, the review of existing methodologies highlights the importance of multidimensional approaches and suggests a number of broadly defined 'dimensions of

resilience' that might be used to inform the identification of resilience indicators, while allowing a diversity of context specific indicators to be defined. It also illustrates the problems of comparisons across contexts using conventional approaches to indicator development. Finally, it illustrates the need for a novel methodology for application to ICF projects that addresses attribution and that provides guidance on the selection of appropriate context specific indicators. These indicators should map onto programme and project logical frameworks, be compatible with the DFID Resilience Framework, and fit within a coherent theory of change for resilience.

5. Review of resilience in ICF projects

The study reviewed the M&E plans and associated indicators for 14 active ICF projects and 13 project proposals under the *Building Resilience and Adaptation to Climate Extremes and Disasters* (BRACED) programme, which is part of the ICF. Despite some clustering of indicators into generic types as part of the review process, over 70 indicator types were identified, indicating the high diversity of indicators used in the projects (this includes output, outcome, and impact indicators). There was greater consistency in the types of indicators identified in the BRACED projects than in the active ICF projects. There is a high degree of variation across both ICF and BRACED projects in how indicators are associated with log-frames, with very similar indicators (including ICF KPIs) being used at different levels by different projects. Many projects employ composite indices, for example Community Resilience Index, HH Food consumption score, Disaster Preparedness Index, Community Asset Score, and Forest Sector Governance Rating. Many projects define indicators that specify whether policy change has occurred, and/or whether an adaptation/resilience plan has been developed. However, there is often little attention to the significance or effectiveness of policy changes or the practical result from the development of plans. Projects are generally heavily output-focused, and little attention is paid to the causal pathways linking project outputs to actual improvements in resilience and human well-being. Most projects describe activities and indicators related to learning, but these generally do not go beyond dissemination (e.g. to examine the impacts of dissemination on policies and practices).

At the impact level, projects tend to use indicators related to (e.g. nutritional and economic) well-being, the adverse impacts of climate-related disasters (e.g. numbers killed or injured, economic losses), and the state of the environment. At the outcome level, projects define a variety of indicators that are compatible with measures of *numbers of people with improved resilience* as required for reporting against KPI4. These indicators might be used to measure numbers of people with improved livelihoods (managed using climate-resilient practices); numbers with access to key services, infrastructure, and social protection; numbers covered by appropriate risk reduction investments; numbers with adequate 'buffer capacity' in terms of assets, savings, food stocks, etc.; and numbers covered by effective adaptation/resilience policies.

6. A methodology for measuring resilience in ICF projects

A methodology is proposed for measuring resilience at the individual level that will enable projects to report against ICF KPI4. This methodology is based on the identification of context-specific indicators by individual projects, informed but not prescribed by a consideration of a number of dimensions of resilience where this is appropriate and helpful. These dimensions, based on those identified in the review of existing methodologies described above, are (i) assets, (ii) access to services, (iii) adaptive capacity, (iv) income and food access, (v) safety nets, (vi) livelihood viability, (vii) institutional and governance contexts, (viii) natural and built infrastructure, and (ix) personal attributes.

The methodology allows for a diversity of qualitative, quantitative, individual and composite indicators. The measurement of resilience and the use of indicators to report against KPI4 consists of the following steps:

i. **Identification of beneficiaries, shocks and stress, and their consequences**, based on the DFID Resilience Framework and informed strongly by the use of participatory methods.
ii. **Identification of factors that influence resilience**, that are targeted or may be influenced by a project, as well as other factors that might be beyond the scope of the project.
iii. **Development of indicators** to represent/measure the factors influencing resilience that are relevant to the project.
iv. **Development/refining of a project theory of change,** to ensure consistency between the theory of change, the understanding of resilience developed in (1) and (2), and the indicators developed in (3).
v. **Establishment of mechanisms for identifying unexpected consequences** and confounding factors, principally through the tracking of indicators representing factors that are not targeted by the project but that might be adversely influenced by it.
vi. **Development of a sampling methodology**, addressing issues of sampling frequency, disaggregation, and methods of data gathering.
vii. **Calculation of numbers with improved resilience**, based on, for example (i) numbers improving their score in a single composite resilience index minus those with deterioration in score, (ii) numbers improving their scores in multiple composite indices with no deterioration in any remaining indices minus numbers showing deterioration in multiple indices, or (iii) numbers with improved scores in a minimum number of individual indicators minus numbers with deterioration in scores in minimum number of individual indicators.
viii. **Assessment of project contribution**, i.e. of what proportion of numbers identified in (7) have improved resilience *as a result of project support*, based on information such as beneficiary feedback or comparisons with control groups.

The above steps represent evolving guidance, which will be further refined prior to and during the implementation phase of the BRACED programme.

7. Recommendations and next steps

The methodology presented in this report focuses on the measurement of resilience outcomes, which is a key element in the M&E of adaptation and resilience building projects. However, ideally, the measurement of resilience will be embedded in a wider M&E framework that will also measure a project's ultimate impacts in terms of (i) improved human well-being in the face of (intensifying) climate stresses and shocks, (ii) reduced mortality from climate stresses and shocks, and (iii) reduced asset losses and other negative consequences of climate stresses and shocks. Further work is therefore required to link the measurement of changes in resilience at the outcome level with such measurements of impact. This will require the development of methodologies for assessing project contributions to measured changes in well-being, mortality and other losses, for example through the use of counterfactual or 'no-project' scenarios, or comparisons with control groups experiencing similar exposure to shocks and stresses. A wider M&E framework will also provide project staff with a means of testing or validating resilience indicators, by examining how well correlated they are with appropriate impact indicators, or how useful they are as 'predictors' of project impacts. The interpretation of impact indicators will also require the gathering of contextual climate data so that the effects of changing exposure can be taking into account. Future guidance should address the development of impact indicators, their use in the validation of resilience (outcome) indicators, and the use of climate data to contextualise impact indicators. This might be pursued through the development of a wider set of guidance on project M&E.

SECTION 1

Introduction

This report details the findings of a short assignment on the measurement of resilience commissioned by the UK Department for International Development (DFID) as part of DFID's support to the UK's International Climate Fund (ICF). The purpose of the assignment was to review existing methodologies for measuring resilience and to present a methodology for the measurement of resilience that allows ICF projects to report against certain ICF Key Performance Indicators (KPIs). The assignment paid particular attention to the need to establish methodologies for assessing project results under the *Building Resilience and Adaptation to Climate Extremes and Disasters* (BRACED) programme,[2] funded under the ICF.[3]

The report discusses how resilience is defined and framed by DFID, with particular attention to DFID's Resilience Framework. It discusses the case for measuring resilience instead of or alongside more conventional development/well-being indicators that are commonly used to represent the impacts of development interventions. Key challenges associated with the measurement of resilience are discussed, such as those arising from the timescales over which climate change will unfold and the need to assess the performance of development and adaptation interventions in the context of dynamic climate (and other) risks.

The report reviews existing and emerging methodologies for measuring resilience and assesses their applicability to ICF and BRACED projects. It also examines how the measurement of resilience is treated in existing ICF M&E plans, and in BRACED project proposals. It draws on these findings to develop a novel methodology for the measurement of resilience at the household and community levels as part of the monitoring and evaluation (M&E) of ICF and BRACED projects.

This novel methodology addresses ICF KPI4 (*Number of people whose resilience has been improved as a result of ICF support*), which is the KPI most relevant to the measurement of resilience. The new methodology represents a revision of this guidance, and is presented in Annex 1 and discussed in the main text of this report.

The new methodology locates the measurement of resilience within a theory of change that links project interventions with changes in resilience, and in turn links these changes in resilience with longer-term changes in human well-being. Within this framework, indicators of resilience are measured at the outcome level. These are assumed (based on the theory of change) to predict changes in well-being, which are measured at the impact level. The new methodology focuses on the measurement of these resilience outcomes, via the identification of context-specific indicators that represent the factors that are important in influencing resilience.

We also present a draft outline for a framework for project-level M&E (2), that addresses how the measurement of resilience outcomes can be linked with the measurement of longer

2 https://www.gov.uk/building-resilience-and-adaptation-to-climate-extremes-and-disasters-programme-braced

3 https://www.gov.uk/government/policies/taking-international-action-to-mitigate-climate-change/supporting-pages/international-climate-fund-icf

term impacts on human well-being and losses from climate-related disasters. This framework addresses the attribution of well-being impacts to resilience outcomes, and the interpretation of impact indicators in the context of changing climatic and other stresses.

The methodology for measuring resilience presented in Annex 1, and the draft outline framework for wider project-level M&E are compatible with the DFID-supported *Tracking Adaptation and Measuring Development* (TAMD) framework[4] (Box 1).

The methodology presented here enables the success of adaptation/resilience-building projects to be assessed over relatively short timescales using 'predictive' indicators of resilience. These indicators need to be developed based on a sound understanding of local contexts, but avoid the need to measure losses in lives, assets or well-being from climate stresses and extremes that may not occur until after a project has ended. The M&E framework in Annex 2 provides a means of validating such assessments using such measurements where climate stresses and extremes do occur. Both the resilience methodology and the M&E framework enable project M&E to go beyond the measurement of outputs, and to measure outcomes and longer term impacts, where data and resources permit. The focus of adaptation M&E on outputs rather than outcomes or impacts has been identified as a major shortcoming of existing approaches (IEG 2013), and is something that the TAMD framework seeks to address (Brooks 2013).

Box 1 Measuring resilience and the TAMD Framework

The *Tracking Adaptation and Measuring Development* (TAMD) framework has been developed through a DFID funded research project led by IIED. TAMD provides a framework for the assessment of adaptation based on the tracking of (i) institutional climate risk management processes and mechanisms (Track 1), and (ii) changes in vulnerability, resilience and human well-being on the other (Track 2). The methodology presented in this report (Annex 1) represents a means of tracking resilience at the local level that can be readily accommodated within Track 2 of TAMD. The methodology presented here is essentially a revised version of that previously developed for ICF KPI4, which was based on the TAMD methodology for measuring vulnerability.

The project-level M&E framework outlined in Annex 2 of this report links the measurement of resilience with the measurement of well-being and losses associated with climate stresses/extremes. This further develops ideas about attribution and theories of change highlighted by TAMD. The M&E framework also provides some guidance on how to interpret measured changes in well-being and losses in the context of changing climate and other stresses, addressing another key issue highlighted by TAMD.

It is hoped that the methods presented here will inform wider discussions about the measurement of resilience and the M&E of adaptation, and be adopted or modified for use outside the ICF and BRACED contexts.

[4] See http://www.iied.org/tracking-adaptation-measuring-development for more details of TAMD, including videos, working papers, country reports, and methodological notes.

SECTION 2

Definitions and conceptual framing of resilience

The term 'resilience' is used widely in a variety of contexts, and its definition varies significantly. One context that is particularly relevant to the area of climate change adaptation is ecology, in which resilience refers to the ability of a system to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes.[5] Increasingly, the concept of resilience has been applied to 'social-ecological systems', a term that recognises the interdependence of human societies and ecological and other 'natural' systems. In this context, resilience has been described as referring to "the magnitude of the disturbance that can be absorbed before a system changes to a radically different state as well as the capacity to self-organise and the capacity for adaptation to emerging circumstances" (Adger 2006).

Resilience thus refers to the ability of a natural, social, or coupled social-ecological system to withstand shocks and rebuild itself when necessary. However, building resilience in the context of development and poverty reduction requires more than simply enabling a social or socio-ecological system to revert to its previous state once a disturbance or shock has occurred. Development, adaptation, and resilience-building interventions, particularly those undertaken in the context of poverty or extreme poverty, seek to improve human well-being. In such contexts, interventions to build resilience should enable people not only to 'bounce back' aftershocks, but to improve their circumstances despite the occurrence of shocks. More generally, interventions to build resilience must recognise that socio-ecological systems are not static, but change and evolve even in the absence of stresses such as those associated with climate change. Climate change further complicates this situation by necessitating adaptation that might involve the modification of existing systems, processes and behaviours, or their replacement with new ones that are better suited to changed conditions.

For the above reasons, DFID uses a working definition of resilience as:

> *"the ability of countries, governments, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses, while continuing to develop and without compromising their long-term prospects".*[6]

This definition acknowledges the need for development to have a transformative impact on people's lives, as well as enabling them to cope with stresses and shocks associated with climate variability and change, as well as other, non-climate related factors.

The concept of resilience is closely related to that of vulnerability, which is related to the susceptibility of people or systems to harm when they are exposed to a disturbance or shock such as climate *hazard* (Box 2). To a certain extent resilience may be viewed as the inverse

5 See: http://www.resalliance.org/index.php/resilience

6 DFID Resilience Approach Paper; the DFID conceptual framework for resilience is included in the annex

of vulnerability. In the context of climate variability and change, resilience will depend on the capacity of people and systems to anticipate, plan for, cope with, recover from, and adapt to evolving climate hazards and their primary effects (e.g. on environmental systems and natural resources). The relationship between resilience and vulnerability is discussed in more detail in Annex 3.

Box 2 Climate Hazards

Human populations already experience a variety of climate *hazards*, which can be defined as physical manifestations of climate variability and change with the *potential* to have negative effects on the environment and on society. Examples of climate *hazards* are meteorological droughts (i.e. defined in terms of rainfall deficits below a particular threshold, usually the long-term mean), episodes of intense rainfall that might result in flooding or crop damage, tropical storms, and longer-term change such as sea-level rise or changes in average or extreme temperature or rainfall.

The extent to which a hazard is associated with such negative effects will depend on the underlying vulnerability of the exposed population or system.

Climate hazards may be:

i. sudden onset (e.g. storms) or slow onset (e.g. droughts);
ii. recurrent (e.g. most weather extremes) or 'singular' (e.g. glacial lake outbursts); and
iii. transient (weather extremes) or effectively permanent (e.g. sea-level rise, long-term increases in aridity).

Climate change will increase the frequency, severity, and likelihood of many of these hazards, which will interact with non-climate hazards to affect people's well-being, the extent of losses and damages from climate-related phenomena, and the extent to which development interventions can deliver and secure desired gains in human well-being.

Phenomena such as floods may be viewed as climate hazards, although the severity of a flood may be mediated by local factors such as land use and urbanisation. In this respect, floods might be viewed as consequences of climate hazards such as extreme rainfall and storm surges that are mediated by human activity. Assessment of flooding might seek to separate direct meteorological drivers of flood risk (e.g. rainfall intensity) from drivers resulting from local human activities (e.g. deforestation or other factors influencing soil infiltration) or other changes in the environment (e.g. change in vegetation or soil properties due to drought).

2.1 The DFID Resilience Framework & Adaptation Theory of Change

DFID has developed a Resilience Framework, illustrated in Figure 1, which describes resilience in terms of four elements:

Element 1: Context, which refers to the system or process whose resilience is being examined (i.e. 'resilience of what?'). Systems might include human populations or social groups, communities, households (and indeed individuals), countries, institutions, regions, ecosystems, infrastructure, etc. Processes might relate to governance or the delivery of services.

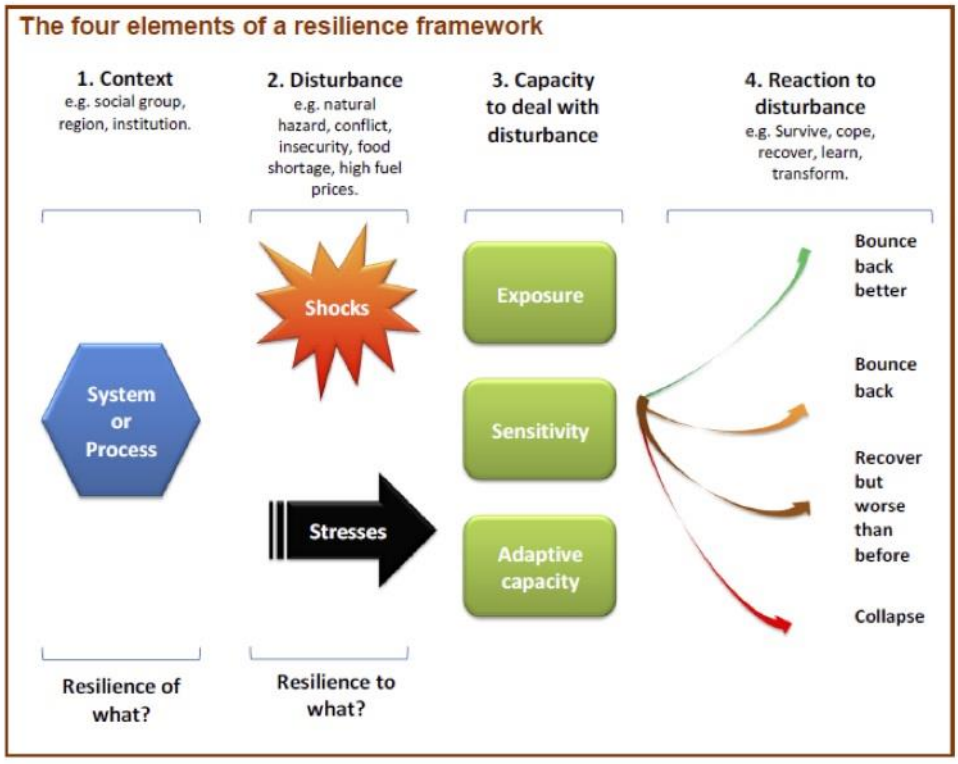
Element 2: Disturbance, in the form of a shock or stress to which the system or process of interest is exposed (i.e. 'resilience to what?'). Disturbances can take many forms, and may be climatic, environmental, social, political, or economic in nature. In terms of climate

variability and change, these disturbances will take the form of climate *hazards* and related phenomena.

Element 3: Capacity to deal with disturbance, which depends on the degree to which the system or process in question is exposed to the disturbance, the sensitivity of the system or process to the disturbance, and the capacity of the system or process to adapt to changes associated with the disturbance. These dimensions describe sets of characteristics of a system or process that make it more or less likely to experience harm when exposed to a disturbance (see below for a more detailed discussion of these dimensions, including of the relationship between the exposure dimension and the disturbance element of resilience).

Element 4: Reaction to disturbance, in terms of whether the system or process continues to function as it did prior to the disturbance (bounce back), better than it did prior to the disturbance (bounce back better), worse than it did prior to the disturbance (recover but worse than before, or not at all (collapse)). A resilient system will bounce back or recover so that it functions in a way that is similar to or more efficient than the way it functioned before the disturbance, a non-resilient system will collapse or have its functioning significantly impaired as a result of the disturbance. Where recovery is only partial, collapse might occur after successive shocks, with the system or process becoming less resilient after each shock.

Figure 1 The DFID Resilience Framework



The resilience framework deliberately contextualises resilience in terms of the system or process whose resilience is of interest (Element 1), the stresses and shocks to which this resilience refers (Element 2), and the impacts or consequences of these stresses and shocks, in terms of which resilience is defined (Element 4).

By interrogating and understanding these three contextual elements, we can identify the specific factors or characteristics that make a system or process resilient in any given

context (Element 3). These factors will be different in different contexts. For example, the factors that make a community or household resilient to drought will not be the same as those that make it resilient to storms or floods. While factors such as poverty and physical accessibility (e.g. for the delivery of aid) will be important in both contexts, factors such as building construction and design, access to shelters/higher ground, and elevation of dwellings/settlements will be extremely important in terms of resilience to floods, but irrelevant in terms of resilience to drought. Other factors such as proximity to rivers, or groundwater levels, may influence resilience to these two types of hazard in opposite ways.

The Resilience Framework thus illustrates the problems associated with any attempt to identifying 'universal' indicators of resilience. It does, however, provide a framework that aids in the identification of resilience indicators that are contextually relevant. These indicators might be grouped into common categories or 'dimensions of resilience', for example representing access to services, availability of contingency resources, access to social safety nets, and so on. The nature of such dimensions of resilience is discussed in more detail below.

SECTION 3

Resilience and the challenge of adaptation M&E

3.1 Adaptation effectiveness in a development context

The ultimate goal of adaptation is to ensure that human well-being can be maintained or improved in the face of stresses and shocks associated with climate change and variability. Climate change means that some existing climate-related stresses and shocks will intensify, and that some human populations will experience novel climate-related stresses and shocks. These stresses and shocks will interact with a variety of non-climatic stresses, meaning that adaptation cannot ignore non-climate factors. In the absence of adaptation, the intensification of climate stresses and shocks may undermine, offset, or even reverse the gains in human well-being that development interventions seek to deliver or facilitate.

The ultimate effectiveness of adaptation and resilience-building interventions will be measured in terms of whether or not intended improvements in human well-being are delivered and secured in the face of climate change, and whether or not the negative effects of climate stresses and shocks on human populations are reduced and managed appropriately. These negative effects might be measured in terms of losses and damages and/or changes in human well-being as represented by a variety of conventional development indicators.[7]

3.2 How do we determine whether adaptation is successful?

Effective adaptation *may* mean that no significant adverse effects are experienced when a human population or system is exposed to a climate stress or shock. However, it is more likely that adaptation will act to reduce the magnitude of such effects, rather than eliminate them altogether. For example, this may involve a reduction in losses and damages from climate-related disasters below some historical baseline, or a reduction below a projected baseline assuming no adaptation. In the latter case, losses and damages may increase relative to the historical baseline, but remain below projected/modelled values assuming no adaptation. Whether or not this constitutes effective adaptation is a matter for debate. However, adaptation that prevents an 'even worse' situation by definition has some value, even if it does not deliver or secure the benefits desired by development planners and policy makers.

Under such circumstances, evaluations based on the tracking, in absolute terms, of losses and damages and/or conventional development/well-being indicators would fail to capture, or would underestimate, the benefits of adaptation. There are two complementary ways of

[7] Conventional development/well-being indicators might include commonly used indicators of poverty, inequality, health status, and other indicators such as those collated in the annual UNDP Human Development Report (http://hdr.undp.org/en), or associated with the Millennium Development Goals (https://www.un.org/millenniumgoals/). Loss and damage indicators might include indicators such as mortality per 100,000 population, losses in $US, reductions in crop yields, and data such as those represented in databases such as the Emergency Disasters Database (EM-DAT: http://www.emdat.be/).

addressing this problem. The first is to compare measured losses, damages, and changes in well-being with a 'counterfactual' scenario in which no adaptation intervention(s) had taken place, but in which exposure to climate hazards was the same as in the measured case. The second is to ensure that any changes in exposure are taken into account when interpreting measured changes in losses, damages, and well-being. These two approaches are discussed in more detail below.

3.2.1 Use of counterfactual scenarios

There are a number of ways of comparing measured losses, damages and changes in well-being indicators with a 'no-intervention' counterfactual. These include:

1. Using an experimental design in which the effects of shocks/stress can be compared between communities that have been targeted by adaptation interventions and those that have not. Such comparisons, based on the methodology of randomised control trials originating in the health sector, are increasingly common in development contexts (Stern et al. 2012; Gilbert 2013; Hughes 2013). These approaches are statistically powerful, but may not be possible in practice for a number of reasons that include the availability of a suitable control community/population, resource limitations that make the gathering of control data impractical, and ethical objections to the use of a population as a control when they do not benefit from an intervention. Bamberger and White (2007) estimate that randomised control trials may be applicable to as little as 5% of development finance, a figure cited by Prowse and Snilstveit (2009) and by DFID in the context of programme impact evaluations (Stern et al. 2012).

2. Where formal comparisons based on randomised control studies cannot be made, the likely impact of shocks and stresses with and without an adaptation intervention can still be estimated or modelled. This may involve comparing the effects of shocks/stresses on a target community with those in 'similar enough' communities outside the area in which the intervention takes place. Another way is to compare the impact of similar shocks before and after the intervention. If the intervention is being introduced in phases, the effects of shocks might be compared between communities representing different phases of the intervention (i.e. with more or less 'adaptation'). These approaches are sometimes referred to as 'quasi-experimental approaches' and statistical analysis may be possible in such cases. However, care should be taken in attributing differences between comparison cases to an intervention, and attention should be paid to other potential drivers of change that might be unrelated to the intervention.

3. Even where statistical analysis is not possible due to lack of data or lack of a 'similar enough' counterfactual, the concept of the counterfactual can be extremely useful in qualitative evaluation. The monitor or evaluator can ask 'what would have been the likely impact of this shock/stress without adaptation?' Participatory exercises can be undertaken with communities and key informants to ground such comparisons firmly in local knowledge and to ensure significant rigour. These exercises can be used to ask how and why the consequences of a shock/stress may have been different before an intervention. Such qualitative approaches can also take the discussion a stage further and ask how and why an intervention did (or did not) affect the consequences of a stress or shock.

Most adaptation interventions are likely to use a combination of the approaches described in (2) and (3) above, combining qualitative and quantitative information. All the approaches described in (1) to (3) above require some specialist skills. If these are not available within

the agency responsible for implementing an intervention it is recommended that the project designers obtain some specialist advice.

3.2.2 Assessing adaptation effectiveness in relation to varying hazard severity

Shocks and stresses associated with climate hazards vary from year to year, sometimes following a multi-year cycle. Climate change is altering patterns of climate variability across the globe, meaning that the frequency, timing and severity of climate-related shocks and stresses are deviating from what is considered to be historically 'normal'. Climate change is also associated with long-term trends in the frequency and severity of some hazards, meaning that losses, damages, and changes in well-being associated with climate-related shocks and stresses would exhibit trends even if all other factors remained unchanged. Understanding the extent to which measured changes in losses, damages, and well-being as the result of such changes in climate hazards is important for the evaluation of interventions, and also for their design and implementation.

Where an intervention underperforms relative to a target (e.g. reduced losses/damages), the action needed to address this underperformance might be quite different depending on whether it is the result of reduced resilience (or increased vulnerability), or of greater exposure to shocks and stresses.

In the former case, it might be that an intervention has not delivered the promised improvements in resilience, or that these improvements have been offset by confounding factors that have acted to reduce resilience. Under such circumstances, it might be possible to address poor performance by rectifying shortcomings in intervention design or implementation.

In the latter case, the intervention might have prevented an even worse situation (as revealed by a counterfactual), or the increase in exposure resulting from an intensification of climate hazards might simply have overwhelmed the target system, making the intervention redundant. Under these circumstances, a more fundamental redesign or rethinking of the intervention might be required to address the increased exposure.

To examine the role of changing frequencies and severity of climate hazards in driving changes in losses, damages and well-being, appropriate metrics for characterising climate hazards need to be identified. These metrics may be simple climate indices such as rainfall in a given period, mean or extremes temperature, or flood level[8]. However, rainfall variability can be as important or more important than the absolute amount of rainfall, particularly where rainfall and human activities that depend on it are strongly seasonal. Even when two hazards are similar in severity as measured by meteorological or climatological parameters, differences in factors such as timing might be crucial in determining their consequences. It is therefore vital that metrics used to represent climate hazards are constructed with careful attention to what is important in any given context. For example, length and intensity of hot dry spells during critical phases of the growing season, or the duration of field inundation following a flood, might be much better metrics than mean or extreme temperatures, or the amount of rainfall falling in a given period.

In some cases there may be robust statistical relationships between climatological variables and development indicators. For example, the World Bank (2006) describes a relationship

[8] Changes in flood severity over time may not necessarily reflect changes in climate. Climatic factors such as rainfall duration and intensity, storm intensity and storm surge severity will all influence flood severity. However, flood severity is also influenced by local anthropogenic factors such as land use and urbanization. In this sense, floods might be viewed as impacts of climate hazards rather than as hazards themselves.

between rainfall variation around the mean and GDP growth for Ethiopia and similar relationships may exist between certain climatological variables/indices and indicators of loss, damage and well-being that are relevant at more local scales of interest to adaptation projects. Under such circumstances historical relationships between climatological variables and loss/damage/well-being indicators might be used to model a counterfactual scenario in which there was no intervention. However, the cases in which such relationships have been or can be established are likely to be extremely limited.

It is more likely that evaluators will take into account the relative severity of successive shocks/stresses when interpreting changes in losses, damages and well-being, and assessing the contribution of an intervention to these changes. This 'contextualisation' might be largely descriptive in nature, involving observations of whether negative effects associated with climate stresses and shocks have increased, decreased or remained stable over a period in which shocks have not changed significantly or have become more or less frequent and/or severe. Where figures are available (e.g. climate records), these can be used to triangulate the qualitative information from key informants on the ground.

It must also be recognised that the relationship between hazards and consequences is far from linear, even in the absence of changes in non-climatic drivers of vulnerability and determinants of resilience. For example, where populations experience a succession of shocks, an apparent reduction in economic losses might be the result of erosion of assets by previous shocks meaning that people simply have less to lose. Interpretations of changes in losses, damages and well-being over time, in the context of changing climate shocks and stresses, therefore need to be undertaken with caution and supported by qualitative, narrative-based information that grounds these interpretations in the experience of beneficiaries.

3.2.3 The timescale challenge when evaluating adaptation based on the effects of climate stresses and shocks

All of the approaches discussed above require the impacts of an intervention to be measured in relation to the negative effects of climate-related stresses and shocks on a target system or population. This involves assessment of whether or not these effects have been reduced relative to a historical or projected baseline. Such assessment needs to be based on measurement of the actual effects of climate-related stresses and shocks, after these stresses and shocks have occurred. The approaches described above therefore require that data be available over a period that is sufficiently long for stresses or shocks to be experienced by a target population or system.

This might not be a problem for an intervention whose purpose is to address existing stresses (e.g. environmental degradation) or long-term hazards of a progressive nature that are already evident (e.g. desertification or sea-level rise), although any intensification of such hazards will need to be taken into account in analysis of their societal effects. However, it is particularly problematic for the evaluation of interventions whose purpose is to improve the capacity of people or systems to cope with and/or adapt to transient shocks that occur relatively infrequently. In the context of a typical project of three years duration, 'relatively infrequently' means less than once every one to two years – the minimum frequency with which shocks must occur for there to be even a reasonable prospect of assessing a project's impacts against just one shock within the project lifetime. Ideally the effects of multiple, successive shocks would be monitored over time so that project impacts can be evaluated using (normalised or standardised) trends in these effects.

This problem may be addressed by continuing to monitor climate hazards and associated losses, damages and changes in well-being once a project has ended, and by *ex post* evaluations that take place sometime after the end of an intervention. Adaptation

interventions therefore should seek to establish mechanisms for monitoring relevant indicators beyond project lifetimes.

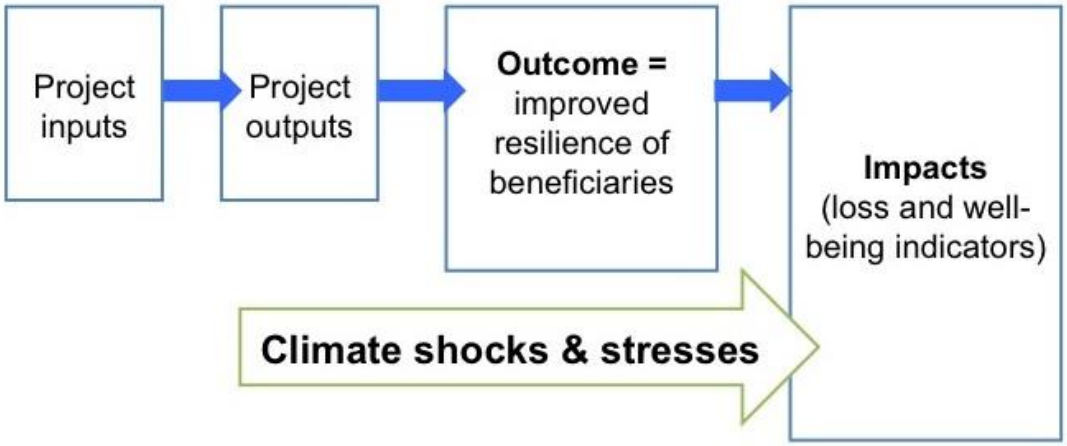
3.3 Assessing project effectiveness using measures of resilience

An alternative to approaches based on measuring the effects of climate stresses and shocks 'after the event' is to measure the underlying factors that make people, processes and systems more or less likely to experience negative effects when they are exposed to stresses and shocks – i.e. the factors that make them more or less resilient to such stresses and shocks. Provided these factors can be identified, they can be targeted by a project and monitored regularly even in the absence of stresses and shocks. The measurement of resilience thus represents an interim or bridging process that goes beyond the measurement of project outputs but is not dependent on measuring the effects of climate stresses and shocks after they have occurred.

Project evaluation can then be based on an assessment of whether a project has contributed to increased resilience, as measured in terms of improvements in key indicators of resilience. These indicators will represent the most important factors related to people's ability to anticipate, plan for, cope with, recover from, and adapt to stresses and shocks, identified through a variety of processes including participatory assessments that seek to determine what factors are most important in determining who fares best and worst when a community or population is exposed to a stress or shock. With reference to the DFID Resilience Framework, resilience indicators will be contextualised with respect to the system, process or population group whose resilience is of interest (Element 1), the stresses and shocks to which they are or need to be resilient (Element 2), and the impacts or consequences of these stresses and shocks, with respect to which resilience is defined (Element 4).

Ideally, resilience indicators will be tracked alongside relevant indicators of human well-being and losses and damages that tell us about the effects of shocks and stresses associated with climate hazards. These indicators can be linked in a theory of change that describes how project outputs are expected to increase resilience, and the pathways through which increases in resilience are expected to reduce the negative effects of climate-related stresses and shocks. Within such a theory of change, increased resilience may be viewed as a project *outcome* that contributes to longer term project *impacts* involving improvements in human well-being and reduced losses from climate-related stresses and shocks, in the face of climate change that acts to intensify these stresses and shocks (Figure 2).

Figure 2 The relationship between project outputs, outcomes (improved resilience) and impacts (improved human well-being) in a general project theory of change.



***Theory of change**: without the programme, beneficiaries would have been less resilient to climate shocks and stresses (hazards); therefore performance of development indicators (e.g. income, nutrition, deaths from climate-related disasters) would be worse than in the 'with-programme' scenario.*

The framing of increased resilience as a project outcome, and of improved well-being and reduced losses and damages as an impact makes sense in a wider development context. The purpose of development and development interventions is (or at least should be) to help improve human well-being and lift people out of poverty, and improved well-being and reduced poverty are generally viewed as impacts in the context of development projects. Project results that contribute to the realisation of such impacts are generally viewed in terms of outcomes, and improved resilience (like adaptation) is a means of keeping development 'on track' and improving human well-being rather than an end in itself.

This interpretation is somewhat at odds with DFID's Draft Theory of Change for Adaptation, (developed before the DFID Resilience Framework). The Theory of Change for Adaptation describes a high-level impact indicator in the following terms: "*Vulnerable people in poor countries prepared and equipped to respond effectively to existing climate variability and the magnified impacts of Climate Change*." This is effectively a very general indicator of improved resilience. Instead, we propose a coherent general theory of change in which improved resilience is viewed as an outcome that contributes to an impact defined in terms of improved human well-being and reduced losses and damages from climate-related stress and shocks. In the context of this theory of change, resilience indicators are outcome indicators, and impact indicators will include indicators of loss and damage, and relevant human development indicators that represent aspects of human well-being that are affected by climate stress and shocks.

3.4 The case for measuring resilience

Defining and measuring resilience is important for a number of reasons:

1. Resilience is the key predictor of how vulnerable an individual, community, region or country is to future shocks and stresses. It therefore gives us a warning of where problems may arise in advance of a shock or stress and helps us prioritise where future investment in adaptation should be made;

2. In the design of adaptation interventions resilience is the vital link between project activities (associated with inputs and outputs) and intended long-term impacts of a project (reduced losses and damages resulting from shocks and stresses, and improved human well-being). Resilience is a vital step in an intervention theory of change, and represents something against which we can monitor progress without waiting for specific shocks and stresses.
3. Indicators of resilience can be measured throughout an intervention (e.g. annually), meaning that they can be used for monitoring project results as well as for project evaluation. Project activities might be modified if it is concluded that resilience has not been enhanced.

Although it would be possible to measure **only** post-stress/shock loss and well-being impact indicators, and effectively ignore resilience as an intermediate step or outcome, this is problematic for the following reasons:

1. The causal link between an intervention's outputs and these impacts involves one more 'step' to that between outputs and changes in resilience, making analysis of causal links and attribution of changes to an intervention more complex.
2. There is likely to be a greater time lag between the measurements of an intervention's outputs and its post-shock/stress impacts than between the measurement of outputs and resilience outcomes, creating additional uncertainty and 'noise'.
3. The evidence produced (whether or not a correlation was found) would be missing the predictive link between output and impact – limiting our understanding of the processes represented in the theory of change and missing opportunities for learning that might result in improvements to an intervention's design or implementation.

Experience in defining and measuring resilience to climate change in specific contexts is currently limited and robust evidence linking measured changes in resilience with observed post-shock/stress changes in losses, damages and well-being is lacking. This is both a **threat** and **opportunity.**

Threat – without this evidence it is difficult to justify significant additional investment in building resilience. Even when the investment is made, the lack of knowledge means the project design may be weak and the ability to monitor medium-term progress independent of what are often rather unpredictable shocks and stresses is much reduced.

Opportunity – theory driven definition and measurement of resilience indicators is possible, although these may be quite context specific. Once these are being regularly measured and evaluated against actual post-shock/stress changes in losses and well-being, our evidence should grow rapidly. This will drive both improvements in the design of resilience-building interventions and also provide evidence for or against additional investment in the sector.

Improving our understanding of resilience and how to measure it is therefore a high priority for ensuring successful adaptation that delivers improved human well-being.

The remainder of this report addresses the measurement of resilience. A review of existing methodologies for measuring resilience, and their applicability to ICF and BRACED projects is followed by a discussion of how resilience can be measured in ICF and BRACED project contexts in order to monitor and evaluate project performance. A methodology for measuring resilience in ICF/BRACED project contexts is detailed in Annex 1 of this report. Annex 2 presents a draft outline for a more general methodology for conducting M&E at the project level that combines outcome indicators that measure resilience, impact indicators that track changes in well-being and climate-related losses and damages, and climatological indicators

that can be used to normalise or contextualise impact indicators. These indicators are linked to the DFID Resilience Framework and accompanied by step-by-step guidance.

SECTION 4

Review of existing methodologies for measuring resilience

4.1 Selection of methodologies for review

A key element of the study described in this report was a review of existing frameworks and methodologies for measuring resilience, and an assessment of their applicability to ICF and BRACED projects. This review was not intended to be exhaustive, and did not seek to provide a comprehensive survey that included the numerous vulnerability frameworks that have been described in the climate change literature over the past decade and a half (e.g. Hahn et al. 2009; Notenbaert et al. 2012; Sonwa et al. 2012; see also Füssel 2005; Füssel and Klein 2006).

A survey of existing approaches to the measurement of resilience in the context of food security has already been carried out by TANGO International (Frankenberger and Nelson 2013). This survey provides a good overview of existing and emerging approaches, and was therefore used as the basis for this review, the specific purpose of which is to assess the relevance and applicability of these approaches to the ICF/BRACED context.

The TANGO paper reviews approaches that encompass a variety of techniques, including statistical and multivariate techniques, the use of composite indicators, and impact evaluations. Each of these techniques in turn is represented by a variety of methods. Annex 4 provides a summary of the range of techniques and associated methods represented by the studies reviewed by TANGO.

A number of studies cited in the TANGO paper were selected for review in relation to their potential applicability to ICF and BRACED projects. The studies were selected to represent a range of methodologies; many studies employ a variety of techniques, but there is also considerable methodological overlap, with different studies using similar approaches and methods.

4.2 Description of methodologies reviewed

Seven methodologies were reviewed, from ACCRA, FAO, Oxfam, Tulane University, the University of Florence, WFP, and World Vision/Tufts University. Summary descriptions of these methodologies are provided below, along with some general comments about their likely applicability to ICF and BRACED projects. The following section describes a set of criteria against which applicability to ICF/BRACED projects is measured, and presents the results of a more formal assessment of the applicability of these methodologies.

1. ACCRA: Local Adaptive Capacity Framework (http://community.eldis.org/accra)
The Local Adaptive Capacity Framework (LAC) was developed by the Overseas Development Institute (ODI) with Oxfam as an analytical lens for social protection, DRR, and livelihood programmes research. It is an outcome of extensive consultations with various stakeholders in Ethiopia, Uganda and Mozambique. In this framework, adaptive capacity is broken down into five characteristics (“ACCRA’s five characteristics of adaptive capacity”)

such as asset base, institutions and entitlements, knowledge and information, innovation, and flexible forward-thinking decision-making and governance. LAC also contextualises adaptive capacity by incorporating questions related to “situational context”. As an analytical lens, LAC may be used for a variety of purposes including for project design or M&E. However, in order for the LAC to be used for M&E, it still has to be translated to the specific requirements of programmes, e.g. via the mapping of the five characteristics onto outputs, outcomes, and impacts before it can be fully functional. It may also be applied to diverse contexts albeit rather limitedly for the purpose of the BRACED programme since it focuses on adaptive capacity, which is just one of the components of resilience in the DFID resilience framework (and indeed in other frameworks). Because LAC is a high-level framework, its utility depends to a great extent on how it will be operationalised to suit programmatic requirements and provide guidance on results measurement. The LAC does not appear to have been applied in any project contexts at the time of writing, with its use to date limited to the framing of research, advocacy and capacity building (based on the information on the ACCRA website).

2. FAO: Livelihoods Strategies and Household Resilience to Food Insecurity: An Empirical Analysis to Kenya (Alinovi et al. 2010).

Drawing on the resilience analysis framework (Alinovi et.al. 2008), this study explored livelihood strategies and their determinants amongst different socio-economic groups in Kenyan households. Given the exploratory nature of the study, the methodology used to measure resilience was not designed to determine a programme’s impact and therefore it does not try to establish attribution/contribution or measure results. A resilience index was estimated using a two-stage factor analysis. The determinants of resilience were identified without adjustment to shocks. The application of factor analysis to the estimation of resilience in this study may be statistically robust and may avoid double-counting, but it lacks the essential requirement of contextualising the indicators that constitute resilience. The selection of indicators was a completely mechanical exercise, i.e. data-driven which limited the analysis to available and measurable indicators. Factor analysis is a sound method that can be used to estimate an index for a multidimensional construct such as resilience. However, some modifications including but not limited to contextualisation of indicators and taking account of risks and/or hazards will have to be made to this method as applied by FAO to meet the requirements of BRACED projects.

3. Oxfam GB: A Multidimensional Approach for Measuring Resilience (Hughes 2013).

The approach developed by Oxfam GB measures resilience based on a number of indicators that were hypothesised to characterise "resilience" using the Alkire-Foster index. The approach was created originally as a measure of multidimensional poverty and was a modified form of the unidimensional, income-based Foster, Greer, and Thorbecke family of poverty measures (i.e. headcount ratio, poverty gap, squared poverty gap). As such the measure was originally a measure of shortfall/deprivation more than achievement (e.g. well-being). Under this approach, the selection of indicators, their weighting, the indicator cut-offs, and interdimensional threshold are arbitrarily set. Similarly, Oxfam GB’s application relied on field staff for the selection of indicators. Measurement is based on characteristics/proxies only and without consideration of the shock. The measures of resilience developed through the Alkire-Foster approach were then applied in an ex-post impact evaluation to assess the effectiveness of an Oxfam programme. The evaluation used primary data and baseline data were collected through respondent recall.

Oxfam GB presented a clear conceptual framework for measuring and operationalising resilience, largely drawing on a characteristic approach. In an application, the framework was mapped onto the project log-frame which defined the outcomes at the community and household levels. It addressed attribution/ contribution through an ex post quasi-experimental approach, which can easily be designed to be periodic. The methodology can be applicable to a diverse range of contexts and as such indicators (and weights and

thresholds) will vary by context. To mitigate arbitrariness, the study provided adequate justifications on the selection of indicators that constitute resilience. In an application (in the context of DRR Programming in Ethiopia's Somali Region), indicators were built on the conceptual framework and project log-frame and were comprehensive (but perhaps too comprehensive and risked double-counting and/or lacked theoretical explanations behind and between some of the indicators). Participation was also limited to field officers that presumably consulted their project beneficiaries.

4. Tulane University: Haiti Humanitarian Assistance Evaluation from a Resilience Perspective (Tulane University and State University of Haiti 2012).

The study analysed resilience and the effects of humanitarian assistance on resilience outcomes in the aftermath of the 2010 earthquake in Haiti. The Haiti Resilience Impact and Change Model was developed specifically to measure the relationship between a shock, resilience, and humanitarian assistance. The evaluation utilised multiple research methods drawing upon secondary data and analysis as well as primary data collection including household survey data, community level key informant interview, and focus group discussions. Principal Component Analysis (PCA) was used to construct standardised dimension scores for the components of resilience. The indicators were then analysed in the post-earthquake context to measure the impact of humanitarian assistance on resilience using multiple regression and propensity score matching. Attribution was addressed through a comparison of resilience outcomes between those that receive and did not receive humanitarian assistance which was further disaggregated into the frequency of receiving benefits. In addition to these quantitative techniques, participatory and qualitative methods were used in the definition of resilience and tailoring it to the Haiti context, identification of key thematic areas that describe dimensions of resilience, identification and development of key indicators and stratifications to be assessed in the primary data collection stage, establishment of the need to track resource flow of humanitarian assistance, etc. Interviews were used to survey perception of major stakeholders. As a consequence of the complementarity of all these methods and stakeholder participation, the study demonstrated a high degree of rigour. The methodology however has limited comparability because of the specificity of definition of resilience and indicators used in the Haitian context. Further, despite its analysis of resource flows in the humanitarian assistance, there was no clear assessment of the costs associated with achieving resilience outcomes. Nevertheless, the methodology can be modified to meet specific programmatic requirements, e.g. ongoing evaluations and resilience tracking, etc.

5. University of Florence: A resilience-based approach to food insecurity: The impact of Mitch Hurricane on Rural Households in Nicaragua (Ciani, no date).

Building on Vaitla et. al. (2012), the study aimed to develop a methodology that can quantitatively assess resilience to food insecurity based on a livelihoods framework. The ultimate objective of the study however is not to measure resilience but to test whether it is a determinant of food security and explore this relationship with a dynamic conceptualisation (and model specification) of resilience. Resilience index was calculated through factor analysis. While the study alluded to the importance of qualitative approaches in resilience assessment, it was a part of the review of literature only. Therefore, there was no indication that the study utilised qualitative or participatory approaches for any purpose. The attempt of the study to include a dynamic specification of resilience through time using a panel dataset is commendable. This type of analysis however demands huge amount of resources for data collection and a careful specification of the statistical model. If applied for the purposes of evaluating project/programme achievements, comparability of results will be limited given the potential differences in the sampling frame, indicators deemed to be statistically significant, and the resulting relationship between the dependent (i.e. resilience index) and independent (e.g. household characteristics) variables. Because the methodology is a largely statistical exercise, assessment of unintended outcomes are limited

to unexpected quantitative results such as perverse or insignificant relationship between variables.

6. World Food Programme (WFP): Cited in TANGO paper (Frankenberger and Nelson 2013) (no original documentation identified/available)

The WFP study cited in the TANGO paper used longitudinal data (annual post-harvest household surveys) to measure changes in historical food security indicators in Niger, with a focus on the speed and extent of recovery after a drought in 2009. Recovery rate (at one year post-shock) and recovery time were used to measure resilience as determined by three indicators - coping strategy index, food consumption score, and cereal stock duration. The study as cited appeared to be more of an exploratory study limited to the analysis of quantitative data. The indicators appear to be data driven and the approach limited to trend analysis. Applicability to ICF/BRACED projects is extremely limited, with little scope for addressing contribution/attribution, learning, and comparability across projects, or value for money at the programme level.

7. World Vision/Tufts University: Resilience and Livelihoods Change in Tigray, Ethiopia (Vaitla et al. 2012).

The study measured changes in household resilience over time through primary panel data by identifying factors that play a role in livelihoods change and measuring resilience trajectories. The "Livelihoods Cycle Framework" was employed to measure resilience. Shocks that test household resilience were included and were both exogenous and endogenous to the household including recurring annual climatic, price, and health shocks experienced during the hunger season. As it was not the study's objective to measure project achievements, the framework used was not premised on a theory of change and does not directly address attribution/contribution. The methodology can be applicable to diverse contexts since the components of resilience can be modified according to context, but subject to data availability. There was limited indication that qualitative techniques were utilised alongside the statistical analysis, e.g. hazard scores were scored through community ranking. Indicators used were a mix of resources and results, but focus is on household asset portfolios. Physical, economic, social connectivity and some household characteristics were excluded. Similar to the study undertaken by the University of Florence, the methodology requires panel data which are costly because of the frequency and size of the data collection. There might be a cheaper and more inclusive way of achieving the same goals. Comparability is possible to a certain extent only and must include a thorough discussion of the variations in shocks and their magnitude, years of study, etc. Aside from unexpected, quantitative results arising from the statistical analysis, the methodology has no built in mechanism to take into account of other unexpected results that can be fed back into projects for learning.

4.3 Assessment of methodologies against criteria

A set of six 'applicability criteria' was developed in consultation with DFID, against which the applicability of the various methodologies to ICF and BRACED project contexts could be assessed. These six criteria were derived from an initial list of 22 criteria identified by the consultants, and are listed in Table 1. The assessment of applicability was carried out through qualitative review of the methodologies, and necessarily contained an element of subjectivity.

Applicability criteria *In order to be applicable to ICF and BRACED projects, a methodology or framework should:*
1. Have a clear conceptual foundation that allows an intervention's outputs to be linked with measurable resilience outcomes at the community, household and individual level through a coherent theory of change (ToC). The ToC should address issues of attribution/contribution, be informed by empirical evidence as far as possible, avoid questionable generalisations, and be testable against experience during and after implementation.
2. Be applicable at the project level across a diverse range of contexts, while paying attention to those contexts and the diverse range of factors that influence resilience.
3. Blend quantitative and qualitative methods, including participatory methods that strike a balance between practicality and comprehensiveness, employing clear and meaningful indicators that capture outcomes and impacts as well as inputs/outputs.
4. Be sufficiently versatile to be used for multiple purposes, including project quality control (monitoring), assessment of project success/effectiveness (evaluation), comparison across projects (relative performance, while acknowledging different contexts and constraints), and assessment of value for money or programme-wide performance.
5. Be able to identify, measure and explain unexpected outcomes and feed these back into project design and implementation through mechanisms for learning and the dissemination of lessons (including after the end of the project).
6. Be cost effective and represent value for money, in terms of (i) providing project quality control that can be used to improve project effectiveness during implementation and thus make projects more effective, and (ii) wider learning that improves understanding of resilience in project context and more generally, informing the design of future interventions and M&E systems. Methodology should not be prohibitively expensive in terms of time, expertise and resources required.

Table 1 Criteria applied to existing frameworks and methodologies to assess their applicability to the ICF and BRACED programmes.

Table 2 provides a summary of the assessment of the applicability of the methodologies reviewed to ICF and BRACED project contexts. A more detailed version of this assessment is included in Annex 5.

Methodology	Assessment against criteria (summary)
1. ACCRA	**(1)** A framework only, applicable in social protection, livelihoods, and disaster risk reduction research.
	(2) Applicable in diverse contexts but only addresses adaptive capacity.
	(3) Not specified whether characteristics of adaptive capacity have been subject to statistical testing; criteria selection highly participatory (governments, CSOs, ACCRA members).
	(4) Potentially useful but needs to be operationalised at project level (e.g. map to logframe). Little potential in present form for addressing VfM.
	(5) Potential for capturing unintended outcomes if operationalised appropriately.
	(6) Absence of description of data requirements makes estimates of VfM difficult. Limited to adaptive capacity dimension so limited learning potential for resilience.
2. FAO	**(1)** Specific to food insecurity, based on literature and research; exploratory/descriptive.
	(2) Applicability subject to data availability as limited to existing data.
	(3) Selection of indicators completely data-driven: no blending of methods or participatory element.
	(4) More an academic exercise than project-relevant tool. Measure will not yield any VfM assessment.
	(5) Measurement not concerned with outcomes so not able to address unintended outcomes.

Methodology	Assessment against criteria (summary)
	(6) Use of existing data reduces costs of data acquisition, but limited potential for delivering VfM through learning and project quality control.
3. Oxfam	**(1)** Clear framework for measuring and operationalising resilience, based on 5 dimensions. Mapping onto project logic to define outcomes in example application. Ex-post attribution/contribution assessment.
	(2) Applicable in diverse project contexts, uses context-specific indicators.
	(3) Quantitative focus, consultations with Oxfam field officers was limit of participation.
	(4) Applicable to resilience tracking, comparability across projects not addressed. No mechanism to assess VfM or costs associated with delivering results.
	(5) No mechanism to address unexpected project outcomes.
	(6) Potential significant cost implications associated with identification of, and gathering of data for context-specific indices.
4. Tulane	**(1)** Resilience evaluation framework to measure relationship between shock, resilience & assistance.
	(2) Evaluation of humanitarian assistance could be adapted at project level for various contexts & factors
	(3) Focus groups to identify challenges to recovery, resilience characteristics & role of humanitarian assistance in recovery. Dimensions of resilience identified using diverse methods. Highly participatory.
	(4) Definition of resilience & indicators highly context specific. No VfM assessment or assessment of cost of assistance (except descriptive portfolio analysis).
	(5) Unexpected outcomes of humanitarian assistance determined through qualitative inquiry.
	(6) Costs not detailed in the evaluation report but likely to be significant due to highly context-specific and participatory nature of measures used.
5. Florence	**(1)** Resilience & food security based on livelihood approach to test whether resilience is a determinant of food security, rather than to measure resilience. Attribution/contribution addressed empirically.
	(2) Applicable to diverse contexts.
	(3) Importance of qualitative approaches discussed as a part of literature review specific to methods. Not participatory.
	(4) Separate indices for agricultural and non-agricultural households associated with lack of comparability of results. Descriptive comparisons across projects, with caveats. No consideration of value for money.
	(5) No built in mechanism to address unexpected results & learning; recognition of unexpected results of statistical analysis.
	(6) Focus on quantitative methods and existing data may reduce costs compared to methods requiring primary data collection.
6. WFP	**(1)** Exploratory study/analysis of resilience in Niger after a shock, addressing three scales, no formal framework and was not particularly hinged on a conceptual framework.
	(2) Not project focused. Trend analysis potentially applicable depending on data availability and quality. Lack of guidance on indicator selection; does not address attribution/contribution.
	(3) Quantitative methods only. No indication of participatory method.
	(4) Utility is limited; no mechanism that can allow internal learning. Comparability across projects possible but in descriptive terms only, e.g. trend through time given x shock but not for performance assessment purposes. No mechanism for VfM assessment.
	(5) Identification of unexpected outcomes limited to statistical results.
	(6) Focus on quantitative methods and existing data may reduce costs compared to methods requiring primary data collection.
7. WV/Tufts	**(1)** Employed "Livelihoods Cycle Framework" to measuring resilience; no explicit theory of change; although not directly addressed, richness of primary panel data lends itself to attribution/contribution assessment.
	(2) Can be applicable to diverse contexts - indices are generic enough and components can be modified according to context; similarly for measuring of

Methodology	Assessment against criteria (summary)
	shocks.
	(3) Limited indication of qualitative techniques, indicators are mix of resources and results focusing on household assets. No indication of participation in indicator identification. Not intended for project evaluations.
	(4) Potentially versatile but costly due to frequency & size of data collection. Limited comparability based on discussion of variations in shocks. No mechanism for addressing VfM
	(5) No built in mechanism to address unexpected results & learning; recognition of unexpected results of statistical analysis.
	(6) Use of panel data costly because of the frequency and size of the data collection.

Table 2 Summary of assessment of the methodologies reviewed, against the six criteria in Table 1.

Most of the methodologies reviewed are applicable to the question of whether resilience has increased. However, few are applicable to the question of whether or not any change in resilience can be attributed in whole or in part to a specific intervention. This is because the purpose of the methodologies is generally not to assess the effectiveness of an intervention. An exception is the Tulane study, which addresses the role of humanitarian assistance in recovery after a disaster (in this case an earthquake).

Some of the methodologies are in reality little more than frameworks. The ACCRA framework addresses adaptive capacity only, and therefore is not applicable to the measurement of resilience at large.

Only the Tulane study sought to address unexpected outcomes, and this was done through qualitative enquiry. Two of the frameworks identified unexpected statistical relationships between variables. However, they did not incorporate mechanisms for addressing unexpected outcomes or for addressing these in a learning context.

Four of the methodologies were very heavily quantitative and data driven. Some relied on existing data so were limited in their flexibility with respect to the use of relevant context-specific indicators. Others invested resources in the development of context-specific indicators.

Comparability across different project contexts is limited in many cases as a result of the use of highly contextual data. One study (Florence) used different indicators for agricultural and non-agricultural households, meaning that these could be meaningfully compared. The extent to which the methodologies incorporated participatory methods was surprisingly limited. The only methodology that showed clear evidence of participatory assessment of resilience was that of Tulane.

The methodologies employ a variety of statistical and other methods, including statistical modelling, principal component analysis, cluster analysis, and factor analysis. Some of these may require specialist skills that may not be available within project contexts (although projects could budget for the relevant expertise).

Overall, the methodologies that are most relevant to ICF and BRACED projects are probably those of Tulane University (Tulane University and State University of Haiti 2012) and Oxfam (Hughes 2013). Both of these are represented by frameworks that have been applied in operational contexts described in the relevant documentation.

The Tulane study is notable for the extent to which it incorporates participation to develop context-specific indicators, its mix of quantitative and qualitative methods, its analysis of

unexpected outcomes, and its rigour. However, the Tulane study exhibited some shortcomings in the way it compared populations in very different circumstances. It addressed the impact of humanitarian assistance on post-earthquake recovery rather than of project interventions on resilience to climate-relates stresses and shocks, although its methodology could probably be quite readily adapted. Of all the methodologies that define dimensions of resilience, Tulane appears to be the least consistent with the other methodologies, and the least relevant to resilience to climate change (Tulane is unique among those methodologies reviewed in not defining a dimension explicitly related to adaptive capacity). Another aspect of the Tulane study was that it was probably the most computationally and methodologically complex of all those reviewed. The Tulane approach, which was developed and implemented by an academic institution, might be seen as overly complex or resource intensive within a project context.

The Alkire-Foster method adopted by Oxfam is relatively straightforward from a conceptual perspective. However, it does require the assigning of weights to indicators and the identification of cut-off points to define thresholds of resilience. Such exercises can be quite arbitrary and highly subjective, and this might be seen as problematic in project contexts where it is not obvious how these weights or thresholds should be defined. Nonetheless, the Oxfam methodology does present a coherent and credible framework for the measurement of resilience, in the form of five dimensions of resilience that are particularly appropriate to the issue of resilience to climate change and variability. These dimensions are:

1) Livelihood viability
2) Innovation potential
3) Contingency resources & support access
4) Integrity of natural & built environment
5) Social and institutional capability

These dimensions are used to guide the development of 37 context-specific indicators in a case study of agro-pastoralism in the Ethiopia Somali region. Cut-offs were defined for each indicator to identify those classed as ‘non-deprived’ with respect to that indicator. The indicators do not appear to have been identified in a participatory manner, and indicators of status are mixed with measures of the adverse effects of past climate shocks under the livelihood viability dimension.

None of the methodologies reviewed incorporate any mechanisms that lend themselves to the assessment of value for money.

4.4 Applicability of methodologies to ICF/BRACED contexts

None of the methodologies reviewed is directly applicable in its existing form to the measurement of resilience for the purposes of assessing the effectiveness of ICF or BRACED projects. The methodology that comes closest is probably that of Oxfam, based on the definition of a set of credible dimensions of resilience and the construction of indicators using the Alkire-Foster method to create an index that measures “*the percentage of households demonstrating greater ability to reduce risk and adapt to emerging trends and uncertainty”* (Hughes 2013). For this methodology to be applicable to ICF/BRACED projects it would need to measure improved resilience of individuals rather than households, and address the issue of attribution to demonstrate that such improvements occurred ‘*as a result of ICF support*’. Further guidance would also be required on indicator selection (which should be more participatory), and the identification of weights and cut-offs might be problematic. We would also argue against mixing outcome-type measures of status or circumstances with impact-type indicators of climate-related losses, as is evident in the Ethiopia case study.

While no one methodology reviewed here is directly applicable to the measurement of resilience to assess the performance of ICF and BRACED projects, the review does generate some useful results. First, it highlights the importance of multidimensional approaches and provides us with a number of sets of dimensions of resilience that can be compared and used as the basis to define some general dimensions of resilience for project monitoring and evaluation. Second, it illustrates the problems of comparison across contexts using conventional approaches to indicator development. Third, it illustrates the need for a novel methodology for application to ICF/BRACED projects that addresses attribution and provides guidance on the selection of appropriate context specific indicators that map onto project logical frameworks and are compatible with the DFID Resilience Framework and a coherent theory of change for resilience.

These points will be developed further in section 6 below, following a review of how resilience is currently addressed in ICF and BRACED project M&E plans.

SECTION 5

Review of resilience in existing ICF and BRACED projects

5.1 Approach and projects reviewed

The ICF and BRACED programmes provide a foundation for the M&E of resilience in the form of log-frames and impact/key performance indicators defined at the programme level. In addition, individual projects have their own log-frames and indicators that provide a foundation for project-level M&E of resilience. It is possible to interrogate these log-frames and indicators: (a) now/at the design stage, to see if they are adequate in theory to meet the relevant applicability criteria (Table 4.1), and (b) during implementation, to see how they perform in practice in terms of the M&E of resilience and associated learning, and (c) ex-post to measure the longer term well-being impacts of the resilience built.

As part of this study, the indicators identified/used by a selection of ICF and BRACED projects were subjected to a rapid review. Fourteen ICF projects were reviewed, selected on the basis of their relevance to resilience and the availability of adequate documentation of M&E plans and indicators. The projects examined were those whose titles suggested a resilience purpose and for which log-frames were available to the consultants. The review of ICF projects was based on the information in the ICF Evaluability Assessment, made available by DFID.[9] Thirteen BRACED project proposals were reviewed, representing a random but representative sample of the 22 projects eligible for project development support. The review focused on the indicators that had the closest link to the concept of resilience; most projects also identify other project-specific and process indicators.

The resilience-related indicators identified in the project log-frames were clustered into groups, with each group being described in terms of a generic indicator (i.e. an indicator described in general terms, of which all the project indicators in that indicator group represent operational versions of the generic indicators). There was a high degree of subjectivity in the identification of these generic indicators, and the list of such indicators grew as the review proceeded and the diversity of project resilience indicators increased.

5.2 General observations

A number of observations were made on the basis of this rapid, subjective review, and these are detailed below.

Number and diversity of indicators

The total number of indicators used across the projects was very large and varied.[10] Even when project indicators were combined as generic indicators the number of indicators was greater than 70, indicating a large variation in the indicators used across projects. There

9 In the form of the Evaluability Spreadsheet and Annex 2 of the Evaluability Assessment (Evaluation Mapping Framework).

10 There seems to be more commonality within projects in the BRACED Programme than the general ICF – which perhaps indicates a stronger steer given in the bid preparation documents.

seems to be more commonality across projects in the BRACED Programme than in the ICF programme at large.

Variation in indicator definitions
Two ICF Key Performance Indicators (KPI1 and KPI4) are widely used across projects. A number of projects use number of people killed or injured in climate related disasters, as well as conventional development indicators such as those associated with the MDGs. However, many projects employ indicators that are quite similar in nature and purpose, but subtly different in construction. For example, a cluster of BRACED projects employ indicators relating to women's role in leadership that have slightly different definitions, making comparison difficult. There is potential to harmonise some of these indicators, for example through the work of the proposed BRACED Knowledge Manager.

Levels at which indicators are used
There is a high degree of variation across both ICF and BRACED projects in how indicators are associated with log-frames, with very similar indicators being used at different levels by different projects. Archetypal impact indicators are used at impact level, objective level and even output level by different projects.

Composite indices
Many projects employ composite indices, for example Community Resilience Index, HH Food consumption score, Disaster Preparedness Index, Community Asset Score, and Forest Sector Governance Rating. Many of these are agency or context specific. However there may be opportunities for comparing and learning how best to use and compare some of these indices in a resilience setting.

Policy Change
A high proportion of projects include a component on policy change, associated with a simple indicator of whether or not change has occurred. However, there is generally little discussion of which policies need to change and why, and the causal pathways that lead from policy change to desired outcomes and impacts. There is a risk that policy change is seen as an end rather than a means, and it may be desirable to ensure that policy changes are defined consistently across BRACED as outputs which need to be linked to outcomes (e.g. changes in behaviour) and impacts (e.g. changes in resilience or well-being). The importance of understanding causal pathways between policy and resilience cannot be overstated, and these pathways should be addressed in a project's theory of change and through project monitoring, as well as through evaluation.

Plans and strategy
Echoing the approach to policy change, a significant number of projects include an indicator on whether an adaptation/resilience plan or strategy has been developed. However, there is often little clarity on what level of planning is most appropriate (e.g. community, local government, national government), or on what difference a(nother) donor funded plan will make. Indicators tend to concentrate on the plan as an end in itself (although some do measure stakeholder participation in producing the plan). There are practically no indicators that try to define the outcomes from implementing the plan in terms of enhanced resilience or well-being. Understanding the causal pathways between resilience planning and actual resilience is a fundamental aspect of the learning that BRACED should seek to deliver.

Evidence and Learning – most projects describe activities and indicators relating to the generation of evidence and the dissemination of learning. While this is positive, in most projects the indicators go only as far as the dissemination stage, and do not seek to measure whether dissemination leads to changes in practices that deliver desired outcomes and impacts (enhanced resilience and well-being).

Transformational change
This term is used quite widely, but very vaguely. There is an ICF Key Performance Indicator that seeks to capture the extent to which a project contributes to transformational change: **KPI 15: Extent to which ICF intervention is likely to have a transformational impact.** This includes a technical definition of transformational change and a discussion of how to assess such change in the context of ICF projects, which can inform project M&E plans further.

5.3 Indicators in ICF and BRACED projects

5.3.1 Impact level indicators

A number of BRACED projects define indicators at the impact level based on the well-being/development results actually achieved, defining indicators of resilience at the outcome level. This may be at odds with the draft DFID Theory of Change for Adaptation, but it is compatible with an interpretation of the resilience framework in which enhanced resilience is an outcome that contributes to improved well-being (Figure 2), and also with the way impacts are defined for development interventions at large.[11] In relation to shocks such as those associated with climate hazards, such an approach makes sense, with resilience outcomes representing changes in the state or circumstances of a system or population before a shock, and the impacts of enhanced resilience on well-being being measured after a shock.[12]

Some typical indicators used at the impact level by BRACED and ICF projects are:

(a) Number of people dying/injured from climate related disasters;
(b) 'Conventional' development or well-being indicators such food security, nutrition, savings, assets, employment, HDI, MDG indicators etc.;
(c) Reduction in $ losses due to climate related disasters; and
(d) State of the environment.

As argued above in Sections 3.3 and 3.4, there is a strong case for separating measures of **actual** losses, damages, and changes, defined at the impact level, from **theoretical or assumed** measures of resilience, defined at the outcome level, that are intended to predict impacts. The validity of our assumptions about resilience may be tested by examining correlations between these outcome and impact measures – i.e. are resilience outcomes successful predictors of impacts as measured in terms of the effects of climate stresses on well-being? An examination of such correlations can be combined with an analysis of the causal pathways and mechanisms linking resilience with well-being. Such an approach provides powerful learning opportunities that can enhance our understanding of resilience, and how it mediates the impacts of stresses and shocks related to climate and other hazards.

Clearly, a project will have no control over the timing of shocks, in reference to which impacts will be measured. In addition, the multiplicity of factors mediating the impact of a shock on human well-being makes attribution complex. However, these are typical problems

11 Many of the ICF projects reviewed use indicators more typically associated with outcomes as impact indicators.

12 The impacts of enhanced resilience will be apparent in the extent to which a system or population is adversely affected by a shock, relative to a reference baseline that might be based on comparisons with previous shocks prior to a project intervention, on normalized impact indicators, or comparisons with a counterfactual scenario based on the modeling of relationships between climate variables and well-being indicators.

associated with the measurement of impacts. Furthermore, within the context of projects whose aim is to build resilience to climate variability and change, there is an overwhelming case to be made for the use of impact indicators that focus on the results of, and recovery from, shocks. In general, this is not reflected in the way conventional development indicators ((b) above) are employed in BRACED project M&E plans.

We suggest the following clusters of impact indicators, which are not intended to be exhaustive or comprehensive:

(a) Number of people dying/injured/requiring emergency assistance/livelihood damage from climate related disasters (disaggregated by gender, caste/ethnicity etc.) and related to severity and frequency of shocks;
(b) $ losses of infrastructure (disaggregate by public and private sector) and income (disaggregated by gender, caste/ethnicity etc.) and related to severity and frequency of shocks;
(c) State of the environment (increasing/decreasing ability to provide environmental services and mitigate shocks); and
(d) Qualitative assessment from sentinel affected individuals on changes to experienced vulnerability, warning, disaster response and ability to recover (disaggregated by gender, caste/ethnicity etc.) and the reasons for change (or lack of change).[13]

5.3.2 Outcome Level Indicators

Based on the above framework in which predictive measures of 'theoretical' resilience are applied at the outcome level, and actual changes in well-being indicators are used at the impact level, ICF KPI4 (number of people with improved resilience as a result of ICF support) represents a suitable generic outcome indicator that may be applied both at the project level and across the ICF and BRACED programmes. KPI4 clearly has the advantage for DFID in feeding into its national and regional aggregated reporting requirements. An advantage of KPI4 is that it is additive and is also relatively easily disaggregated (e.g. in terms of gender, disability etc.), provided this disaggregation is applied and preserved in project reporting.

In practice, KPI will need to be constructed from measures of numbers of people, disaggregated by gender and other factors, whose resilience has been improved *as measured by a suite of project specific indicators that capture contextually relevant influences on/determinants of resilience*. Some key issues include (i) what aspects of resilience are being measured, (ii) how the degree of change in resilience is measured, (iii) who judges whether resilience has improved, (iv) how resilience is measured across different sections of a population (women, most vulnerable, people practicing certain livelihoods, etc.), (v) how changes in different aspects or dimensions of resilience are aggregated, (vi) how changes in resilience in different project contexts, as measured by different types of resilience indicator, are aggregated, compared, and interpreted.

While projects might measure changes in resilience based on indicators that are identified in a 'bottom up' manner in the context in question, a number of sub-divisions under the 'headline' KPI4 indicator might be proposed, all using the same measure of 'number of people'. A particular project might only deliver on a subset of these:

(a) Number of people whose main **livelihood**(s) (crop land, livestock, other) is managed using climate-resilient practices as a result of support

[13] This may be as simple as asking a sample of individuals 'do you feel safer as a result of Project X, why or why not?'.

(b) Number of people covered by private, third sector and state **resilient service provision** including markets as a result of support
(c) Number of people with access to **ecosystem services** which are stable and climate-resilient as a result of support
(d) Number of people covered by appropriate **risk reduction investment** (infrastructure and capacity) in place to priority climate related (and other) disasters as a result of support
(e) Number of people with good-enough access to climate related/other **early warning** as a result of support
(f) Number of people with access to good enough climate **resilient WASH** (water, sanitation and hygiene) as a result of support
(g) Number of people with access to good-enough **social protection** in time of acute need/disaster
(h) Number of people with adequate climate resilient **'buffer capacity'** (assets, savings, food stocks, social capital, and insurance) as a result of support.
(i) Number of people covered by good enough adaptation/resilience policy which results in improved implementation practice as a result of support.

The advantage of this approach is that it measures the outcome of all interventions in terms of their outcomes for *people,* and links easily to KPI4. The measures listed above clearly still require operationalization in project contexts, for example to identify what constitute 'appropriate climate resilient agricultural practices', 'good enough' early warning or social protection, and so on. This also encourages projects to be explicit about what is 'appropriate' or 'good enough', creating space for comparison, debate, and learning.

SECTION 6

A methodology for measuring resilience in ICF and BRACED projects

6.1 Background to the measurement of resilience in the ICF

Any methodology for measuring changes in resilience in the context of ICF and BRACED projects needs to fulfil the criteria set out in Table 1. Such a methodology needs to be sufficiently flexible to be applied in diverse project contexts, while also being useful in terms of reporting against relevant Key Performance Indicators (KPIs).

The ICF indicator most relevant to the measurement of resilience is KPI4:

> **"Number of people whose resilience has been improved as a result of ICF support."**

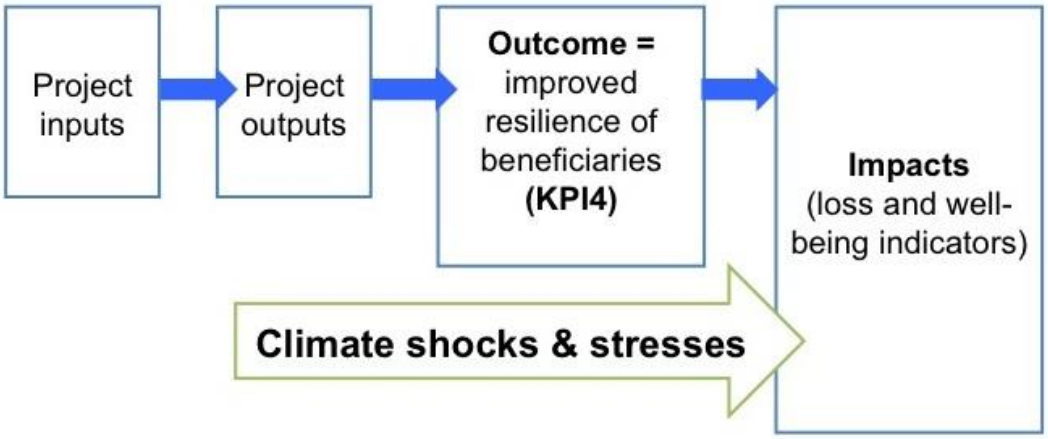
The current DFID guidance on using this indicator is elaborated in an existing methodological note. Proposed revised guidance for this indicator is given in Annex 1. There are three basic points to note in relation to the framing of KPI4:

(a) At one level KPI4 is universally applicable because it measures 'numbers of people' – which should be calculable even in projects dealing with policy change, infrastructure, institutional capacity etc.
(b) It leaves open to the local context the definition of 'resilience being improved' – which makes it both universally applicable but dependent on local definition;
(c) It is intervention linked '…as a result of ICF support', so we are only considering that part of locally defined resilience that can be attributed to the intervention.

6.1.1 Locating KPI4 within a Theory of Change

Because KPI4 is intervention linked, it is important to locate its measurement within a clear theory of change (Figure 3).

Figure 3 KPI4 located with the theory of change proposed for the measurement of resilience and project-level monitoring and evaluation.



Theory of change: without the programme, beneficiaries would have been less resilient to climate shocks and stresses (hazards); therefore performance of development indicators (e.g. income, nutrition, deaths from climate-related disasters) would be worse than in the 'with-programme' scenario.

The theory of change illustrated in Figure 3 locates resilience, as measured by KPI4, clearly as an outcome. The specific improvements in resilience with which we are concerned are those resulting from a project's inputs and outputs. We expect these improvements in resilience to result in impacts in the form of lower losses and damages, and reduced negative effects on well-being, when the resilient system or population is exposed to a climate hazard.

A useful feature of the theory of change is that, although we may be in a learning phase about what variables best deliver resilience at the outcome level, there is significantly more experience at measuring both the output indicators and the impact indicators. This creates an opportunity, particularly at a portfolio level, for moving from supposition about 'what creates resilience' to empirical evidence, as discussed in more detail below and in Annex 2.

6.1.2 Strengths and weaknesses of KPI4

KPI4 has a number of advantages over the methodologies reviewed above. Principal among these is its flexibility, which results from the fact that it does not seek to prescribe indicators or tie measurement to specific dimensions of resilience. The methodologies reviewed above tend to be associated with particular resilience contexts (e.g. food security, post-disaster recovery), which means there is limited scope for aggregation across different projects for evaluation at the programme level; one of the purposes of KPI4 is to allow aggregation of results at the programme level.

KPI4 can be measured in terms of any appropriate context-specific indicators. Once such indicators have been identified, improvements in resilience can be identified based on how many people report, or are associated with, changes in those indicators in a particular direction. Projects are free to identify their own indicators of resilience that can be used to report against KPI4, and to determine their own criteria for establishing whether resilience has improved, according to context and circumstances (e.g. improvements in one or more indicators, in a minimum number of indicators, or in composite indices constructed from these indicators).

Whereas many of the methodologies reviewed above are quite complex, KPI4 lends itself to the development of more straightforward measurement methodologies and does not require complex statistical analysis, or the identification of weights or thresholds (although it does not preclude such approaches if these are deemed appropriate within a project M&E plan).

A major strength of KPI4 is that it is expressed in terms of individual resilience. This makes it applicable across a much larger proportion of intervention types than a household or community resilience indicator. It also makes it empirically coherent. In times of stress and adaptation, measuring household or community resilience is problematic for the following reasons:

(a) Households and communities change composition in response to stress and as part of adaptation. Household members may migrate or re-configure, temporarily or permanently breaking up the household, but conferring greater resilience on some or all of the previous members.
(b) Similarly, at a community level, migration is an important adaptation strategy. The links between those individuals living within a household or community and those outside are vital contributors to resilience that tend to be missed if the household (or hearth hold) or community is considered as a geographically bounded entity.
(c) Finally we know that in times of shock and change, intra-household and intra-community difference is very marked – gender, age, disability, ethnicity, caste etc. are all critical determinants of resilience, which cannot be adequately addressed if the unit of analysis is the household or community.[14]

This does not mean that the household or community is not important to resilience – both are vitally important. However, it is much more straightforward to analyse how the household and community contributes to each individual's resilience than to attempt to monitor community or household resilience as an end in itself. Individual resilience also maps better on to the development indicators in the theory of change.

Another strength of KPI4 is that it is easy to disaggregate by age, gender, disability, ethnicity, wealth group etc. Being an 'individual focused' metric, it is also very easy to analyse by household or community type (e.g. resilience of children in female headed households compared to male headed households). KPI4 gives us the opportunity to explore conceptually disaggregated individual resilience and to monitor actual disaggregated outcomes.

A weakness of KPI4 is that the 'degree of enhanced resilience' is not standardised. Therefore one project may make 10,000 people slightly more resilient and another may make 1,000 significantly more resilient. Which is the greater outcome? As long as this is understood, and the degree of enhanced resilience is described within the monitoring system, then this issue is manageable. Therefore, although it may be instructive in trying to understand value for money to quote the 'cost per individual with increased resilience', it cannot be assumed that the lower cost automatically means better value for money. Thus such figures are starting points in the analysis, rather than end points.

The existing methodological note for KPI4 includes somewhat complex instructions for dealing with multiple dimensions of continuously varying resilience indicators (scaled in quintiles). While this methodology is robust, in many cases much simpler methods for counting the number of people with improved resilience would be suitable. This issue is addressed in proposed revisions to the methodology given in Annex 1.

[14] For example, in some villages, up to 80% of those who died in the boxing day tsunami were female (Keys et al. 2006).

6.1.3 The importance of context, and context-specific indicators

There is remarkably little evidence supporting the validity of universal indicators of resilience. Even those factors thought to be 'generally applicable' do not bear scrutiny across contexts, and therefore are dangerous if suggested as 'model indicators'. For instance:

(a) Diversity of income or livelihoods is often used as a proxy indicator for resilience.[15] While sometimes correct, there is little evidence that this is universally applicable. Specialising in a particular high return enterprise (enabling investment in other aspects of resilience such as a cement house) may be a more resilient strategy than maintaining five low return livelihoods. Alternatively, deciding which livelihood is most climate resilient and concentrating resources on that may confer better resilience than keeping five livelihoods going at a low level. The extent to which income or livelihood diversity is a reasonable proxy for resilience will depend heavily on context, and on what alternative livelihood options are available to people.

(b) Having 'assets' is often used as a proxy for resilience. While assets often do confer a degree of resilience (e.g. the option of converting these assets to cash to cope with or recover from crises, or to invest in adaptation), inflexible assets may also increase exposure to risk or lock people into a livelihood pattern within which adaptation is difficult. Therefore the type of asset in relation to local context may be the critical factor.

(c) Availability of services (water, health, markets, and transport infrastructure) is often considered as conferring resilience. However, in times of emergency, centrally organised services may be more vulnerable to disruption than less sophisticated reliance on traditional water sources, healers, home food stocks, bicycles etc. Therefore the type of service may be more important than the pre-shock service level.

It seems there is no substitute for generating locally relevant determinants of resilience. This is likely to involve participatory enquiry and a locally grounded understanding of emerging risks. Once there is a robust understanding of how resilience is locally determined, this can inform both project design (inputs and outputs) and the selection of what should be monitored as a way of measuring resilience (outcomes).

6.1.4 Dimensions of resilience

While there appears to be little mileage in seeking to identify or define universal indicators of resilience that can be applied in operational contexts, it is much more feasible to identify a relatively small number of 'dimensions' of resilience. These dimensions of resilience are broadly defined categories or groups of factors that are generally applicable but whose precise nature and relative importance vary across contexts. The identification of such dimensions of resilience can help practitioners to identify the specific factors that might be important for resilience in specific contexts, and can inform the development of context-specific indicators of resilience.

I. Dimensions of resilience in the DFID Resilience Framework

The DFID Resilience Framework effectively defines three dimensions of resilience: exposure, sensitivity and adaptive capacity (see also Annex 3).

Exposure might be broken down into a component related to the large-scale exposure of a population to a climate hazard (i.e. everyone experiences the hazard), and another component related to the *differential* exposure of individuals within that population to the

[15] Including by some projects in the BRACED portfolio which use 'number of income sources' as an indicator.

physical manifestations or immediate effects of that hazard. For example, people living nearer to the coast or in lower-lying areas will be more exposed to a storm surge than those living further from the coast or in higher-elevation areas.

Sensitivity suggests the set of factors that make people more or less likely to experience harm when they are exposed to a hazard, i.e. the factors that mediate their ability to cope with and recover from shocks or stresses associated with climate hazards in the short term (e.g. the nature of livelihoods and how responsive these are to climate stresses and shocks). To the extent that some of these factors may relate to geography or the physical environment, there may be an overlap between sensitivity and the differential component of exposure.

Adaptive capacity is associated with people's capacity to anticipate and plan for future stresses and shocks, and to alter their practices (e.g. livelihood strategies, agricultural practices, management of risks associated with extremes) over time in response to experienced or anticipated changes in stresses and shocks. People may need to adapt (i) to changes in the frequency and severity of recurrent hazards with which they are already familiar, (ii) to 'singular' hazards that unfold over long timescales (e.g. sea-level rise, long-term increases in aridity), (iii) to new hazards that may emerge as a consequence of climate change, and (iv) so as to cope better with existing hazards.

The relative importance of sensitivity and adaptive capacity will depend on context, and on the objectives of a project. For example, where people already suffer regular adverse impacts associated with existing hazards that are not expected to change significantly over time, a project whose objective is to enhance resilience to existing hazards might focus on reducing sensitivity. Where people cope well with existing hazards but are concerned with the intensification of hazards or the emergence of new hazards in the future, a project is likely to focus on developing adaptive capacity. In practice, most projects are likely to be concerned with enhancing the capacity of people to cope with existing hazards, and building their capacity to adapt to anticipated but uncertain changes in hazards in the near, medium and longer term. Nonetheless, the three dimensions of resilience in the DFID Resilience Framework provide a useful context for the identification of the various factors that are important for resilience, and for the development of appropriate resilience indicators.

II. Dimensions of resilience in other frameworks

Dimensions of resilience are defined in some of the existing methodologies and frameworks reviewed in section 4 above. The number of dimensions defined in these frameworks varies, but is greater than the number defined by the DFID Resilience Framework (Table 3). The framing of resilience in terms of different dimensions follows a similar trend in the analysis of poverty, based on the recognition that a multidimensional approach is required to address the multiple, interacting factors that drive poverty (Alkire and Forster 2009; Hughes 2013), and that the same principle applies to resilience (and vulnerability).

Table 3 lists the dimensions of resilience (and in one case of adaptive capacity) identified in the methodologies/frameworks reviewed in this report that employ dimensional frameworks.

ACCRA	FAO	U. Florence	Tulane U.	Oxfam
Asset base Institutions & entitlements Knowledge & information Innovation Flexible forward-thinking decision	Agricultural assets Non-agricultural assets Agricultural practice and technologies Income & food	Agricultural assets Non-agricultural assets Income & food access Access to services	Wealth Debt & credit Community networks Coping behaviours Protection/security Human capital Psychosocial	Social & institutional capacity Contingency resources & support Livelihood viability

ACCRA	FAO	U. Florence	Tulane U.	Oxfam
making and governance	access Access to basic services Social safety nets Adaptive capacity Stability	Institutional social safety nets Community social safety nets Adaptive capacity Physical connectivity Economic connectivity Household structure Household technological level	status	Innovation potential Integrity of natural & built environment

Table 3 Dimensions of resilience/adaptive capacity as defined in five methodologies/frameworks reviewed by this study. The ACCRA dimensions are described as representing five characteristics of adaptive capacity, so represent a narrower focus than the wider resilience-based frameworks. The Oxfam dimensions are quite broadly defined, and encompass aspects described under many of the dimensions of the other methodologies.

There is a high degree of coherence across the frameworks represented in Table 3, particularly once some of the dimensions are unpacked.

The importance of formal and informal **safety nets** in the form of social/community networks and/or institutional support in times of hardship is highlighted in all five frameworks. FAO identifies '*social safety nets*', while the University of Florence distinguishes between institutional and community safety nets, and Tulane University refers to '*community networks*'. Oxfam explicitly identifies social protection and support networks as aspects of the '*contingency resources and support'* dimension.

A dimension related to or including **assets** is identified in all five cases. FAO and the University of Florence distinguish between agricultural and non-agricultural assets. Tulane University identifies a '*wealth*' dimension that covers 'financial and physical capital' as well as 'income expenditures and food security/consumption'. 'Savings, food and seed reserves' are mentioned under '*Contingency resources & support access*' in the Oxfam framework, along with social protection, support networks and emergency services.

Access to services and is identified as a dimension by FAO and the University of Florence, while ACCRA addresses '*Institutions and entitlements'*. The Oxfam working paper describes 'equitable access to essential services' as a component of '*Social & institutional capability'*. Tulane University describes access to services as arising from the skills and abilities conferred on households by the '*human capital*' dimension.

The ACCRA framework is designed explicitly to address adaptive capacity. **Adaptive capacity** is identified as a component of resilience by FAO and the University of Florence, and represented by the 'innovation potential' dimension of the Oxfam framework. Only Tulane University omits a dimension related to the capacity to adapt in the longer term; its '*coping behaviours*' dimension is somewhat related to adaptive capacity as it addresses behaviours that might be deployed if a household's situation becomes more difficult, but this focuses more on the negative aspects of coping in the form or erosion of household resources.

Income and food access is a dimension for FAO and the University of Florence, and is accommodated under the '*wealth*' dimension of the Tulane framework. It might be argued that this dimension is strongly related to the '*livelihood viability*' dimension in the Oxfam framework, and accommodated (at least to a certain extent) under the ACRAA '*wealth*' and '*institutions & entitlements*' dimensions.

The dimensions discussed above are represented consistently across the frameworks considered, and as such can form the core or primary dimensions of a multidimensional framework for measuring resilience in the context of the ICF and BRACED programmes. These dimensions are:

i. Assets
ii. Access to services
iii. Adaptive capacity
iv. Income and food access
v. Safety nets

The frameworks reviewed also identify a variety of other dimensions that are not as consistently represented across cases, but which nonetheless may be important. These include dimensions related to:

i. Livelihood viability (in the context of stresses, shocks & uncertainty) (Oxfam)
ii. Knowledge and information (ACCRA; also arguably implicit in some of the Oxfam dimensions);
iii. Governance contexts (ACCRA; also implicit in some of the Oxfam dimensions);
iv. The integrity/functioning of the natural and built environment (Oxfam);
v. Physical and economic connectivity/isolation (Florence)
vi. Household structure and characteristics (Tulane)
vii. Individual well-being in the form of 'psychosocial status' (e.g. of household heads) (Tulane)
viii. Debt and credit
ix. Physical security and conflict (Tulane);
x. Stability, as measured in terms of shocks and losses experienced over time (FAO)

The final dimension, *stability*, is discounted, as it represents a retrospective measurement of the consequences of climate-related shocks and stresses in terms of economic losses. In the framework proposed here this would be an impact indicator rather than an outcome indicator capturing factors that predict the future effects of climate stresses and shocks.

Livelihood viability refers to the "Extent livelihood strategies can thrive in spite of shocks, stresses, and uncertainty" (Hughes 2013). In the Oxfam case study in the Ethiopia Somali region, livelihood viability is described using a variety of indicators related to poverty, food security, gender, livestock management, access to drought warnings, drought preparedness and the effects of past drought and disease (Hughes 2013).

Livelihood viability might be defined as the amount of change in climatic (or other) conditions that can be accommodated without livelihoods being significantly compromised. The smaller this amount of change is, the more likely it is that climate change will undermine livelihoods. This way of defining livelihood viability is very close to ecological definitions of resilience, which measure resilience in terms of the magnitude of disturbance that can be accommodated by a system (Adger 2006). This way of framing livelihood viability might be particularly applicable to the BRACED programme, which has a strong focus on Sahelian countries with highly variable climatic regimes (i) in which people pursue livelihoods that often operate at the margins of viability, (ii) that have experienced large changes in rainfall

amounts and variability in the recent past, and (iii) in which the future evolution of climate is highly uncertain.

Knowledge and information are components of adaptive capacity in the ACCRA framework in which they constitute a dimension, and can be included along with other factors under the proposed adaptive capacity dimension of resilience. Access to information relating to early warnings of climate hazards might be included under access to services.

Dimensions viii (**governance**) and ix (**natural and built environment**) both refer to the wider social, political, infrastructural and environmental contexts that mediate people's actions and options, and hence their resilience. These might be represented by a dimension relating to *governance and institutional contexts*, and another relating to *natural and build infrastructural contexts*. The former might accommodate considerations of **conflict and security** (dimension xiii), which are strongly related to governance. The latter might incorporate **connectivity/isolation**, which will be related to the quality of built infrastructure such as roads, and to geographic factors such as physical location (e.g. remote or inaccessible mountain or desert region).

As KPI4 is concerned with the resilience of individuals the relevance of a dimension relating to the structure and characteristics of a household (dimension xi) needs to be considered carefully. While conditions within a household will be very important for individual resilience, there can be strong intra-household variations in resilience, and this might best be captured by a dimension relating to **personal circumstances** rather than household structure and characteristics. Such a dimension might encompass factors related to the Tulane *psychosocial status* (xii) dimension, as well as personal *debt and credit* (xiii). Disaggregation of KPI4 and its constituent indicators or indices by gender or other factors (age, health, livelihood, membership of marginalised group, etc.) will also help to address intra-household variations in resilience.

Based on the above discussion of dimensions of resilience within existing frameworks, the following set of dimensions is proposed for the ICF and BRACED contexts:

1. **Assets,** including physical and financial assets, food and seed reserves, and other assets that can be deployed or realised during times of hardship to help people absorb losses, and recover from stresses and shocks.
2. **Access to services**, including water, electricity, early warning systems, public transport, and knowledge and information that helps people plan for, cope with and recover from stresses and shocks.
3. **Adaptive capacity**, including factors that specifically enable people to anticipate, plan for and respond to longer-term changes (for example by modifying or changing current practices and investing in new livelihood strategies), that are not represented by the other dimensions.
4. **Income and food access**, indicative of the extent to which people may be poor or food insecure *before* the occurrence of a stress or shock.
5. **Safety nets**, including access to formal and informal support networks, emergency relief, and financial mechanisms such as insurance.
6. **Livelihood viability**, in terms of the extent to which an individual's livelihood can be sustained in the face of a shock or stress, or the magnitude of shock or stress that can be accommodated before a livelihood ceases to be viable.
7. **Institutional and governance contexts**, including the extent to which governance processes, institutional mechanisms, policy environments, conflict, and insecurity constrain or enable coping and adaptation.
8. **Natural and built infrastructural contexts**, including the extent to which coping and adaptation is facilitated or constrained by the quality of built infrastructure (e.g. roads), the quality/functioning of environmental systems/natural resources (e.g.

health of ecosystems providing livelihoods), and geographical factors (e.g. remoteness).

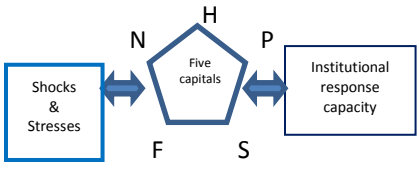
9. **Personal circumstances**, including any factors not covered by other dimensions that might make an individual more or less able to anticipate, plan for, cope with, recover from, or adapt to changes in stresses and shocks. These might include health, debt, low socio-economic status, etc.

The dimensions identified here are intended to be comprehensive, but not prescriptive. The relevance of the various dimensions listed above will vary across contexts, and a project might use a subset of these dimensions, or define additional or alternative dimensions if this is deemed appropriate. In this sense the dimensions defined above can be viewed as a loose framework for the identification of factors that are important for resilience. Where key resilience factors are identified using 'bottom up' participatory methods (as is strongly recommended), they can be mapped against the dimensions in order to identify any potential gaps. The dimensions therefore represent a useful tool for checking that the factors most relevant to the measurement of resilience have been identified. Once these factors have been identified they may be used as a basis for the development of a set of context-specific resilience indicators.

To a certain extent, the dimensions of resilience defined above echo the structure of the DFID Livelihood Framework (Scoones 1998). They also overlap significantly with the KPI4-type indicators (in the format 'numbers of people') derived from the analysis of ICF and BRACED project M&E plans in section 5.3.2. Table 4 compares the elements of the DFID Livelihood Framework, the ICF/BRACED-derived indicators, and the above dimensions of resilience.

In all of the above cases, the precise factors that determine resilience, and thus any resilience indicators, remain context specific. The KPI4-type indicators derived from the ICF and BRACED project documentation are constructs that need to be converted into single or multiple indicators that can actually be measured 'on the ground'. They thus serve a similar purpose to the dimensions in the other columns. Whichever of the three sets of dimensions is used, these dimensions still need to be 'operationalised' for any given local or project context. All three sets of dimensions provide an organising architecture that can be used to frame the measurement of resilience. All three sets of dimensions may be operationalised in terms of the 'numbers of people…' format.

While the ICF/BRACED-derived indicators/dimensions do not map precisely onto the dimensions derived from the various methodologies for measuring resilience, there is substantial equivalence between these two sets.

Livelihood Framework derived dimensions	BRACED/ICF intervention derived dimensions	Existing framework derived dimensions
 **In each case we are interested in indicators measuring the intervention induced change to:** (a) Frequency or severity of **shock/stress** (e.g. improved flood management or early warning);	**These can be considered as components of KPI4:** (a) Number of people covered by appropriate **risk reduction investment** (infrastructure and capacity) in place to priority climate related (and other) disasters as a result of support (b) Number of people with good-enough access to climate related/other **early warning/DRR** as a result of	(d) Assets (e) Access to services (f) Adaptive capacity (g) Income and food access (h) Safety nets (i) Material & financial assets/wealth (j) Coverage by early warning systems & other risk reduction measures (k) Environmental

Livelihood Framework derived dimensions	BRACED/ICF intervention derived dimensions	Existing framework derived dimensions
(b) **Physical** Capital (e.g. new resilient infrastructure/means of production); (c) **Environmental** capital (e.g. improved ability to provide ecosystem services like food, shelter, fuel, water, landslip protection etc.); (d) **Human** capital (new skills, adaptation knowledge etc.); (e) **Financial** capital (e.g. increased savings, food stocks, appropriate assets etc.); (f) **Social** capital (e.g. changes to support networks, mutual obligations etc.) (g) **Institutional response** capacity (e.g. local government DRR capacity etc.). In each case the dimension could be enumerated in terms of 'numbers of people with improved…..' backed by robust local understanding of what is 'improved'. This would help with later mapping on to KPI4. *Based on DFID Livelihood Framework*	support (c) Number of people whose main **livelihood(**s) (crop land, livestock, other) is managed using climate-resilient practices as a result of support (d) Number of people covered by private, 3rd sector and state **resilient service provision** as a result of support (e) Number of people with access to **ecosystem services** which are stable and climate-resilient as a result of support (f) Number of people with access to good-enough **social protection/safety nets** in time of acute need/disaster (g) Number of people with adequate climate resilient **'buffer capacity'** (assets, savings, food stocks, social capital, and insurance) as a result of support. (h) Number of people covered by good enough **adaptation planning and/or disaster response capacity** as a result of support. In each case the actual definition of the indicator will need to be locally determined.	sustainability/resilience (l) Household structure and human capital (m) Physical connectivity (n) Physical security (o) Knowledge/awareness (p) Wider societal/institutional resilience (q) Quality/resilience of the built environment

Table 4 Comparison of dimensions of resilience as represented by the DFID livelihood framework, a survey of ICF and BRACED project M&E plans, and the dimensions derived from a review of methodologies for measuring resilience.

6.1.5 Individual indicators versus composite indices

A number of studies have sought to create composite indices of resilience, vulnerability or risk, at various scales (e.g. Yohe et al. 2006; Malone and Brenkert 2008; Monterroso et. al. 2012; Pandey and Jha 2012; Orencio and Fujii 2013; Kreft and Eckstein 2014). Such indices generally are constructed from a number of individual indicators that are assigned various weights and combined using a mathematical formula. This formula is generally based on a conceptual framework that views vulnerability or resilience in terms of a varying number of dimensions, typically exposure, sensitivity and adaptive capacity. Often, these dimensions themselves are represented by composite indices, and it is these that are combined to produce the single index (e.g. Pandey and Jha 2012).

Composite indices have the advantage of apparent simplicity, and can be very useful for advocacy purposes. However, they have been subject to criticism on a number of grounds (McGillivray and Noorbaksh 2004), including the following:

i. Composite indicators are often constructed from indicators whose selection is ad hoc; the selection of these indicators is very often driven as much by data availability rather than any detailed interrogation of the links between the indicators used and the concepts under investigation
ii. There is a tendency towards universalism in the use of such indices, based on the explicit or implicit assumption of uniform needs and contexts. This is often a result of composite indices being constructed to meet a demand for 'off-the-shelf' indicators that can be used to compare vulnerability or resilience across very different contexts, associated with quite different risks and drivers of resilience/vulnerability.
iii. Composite indices often combine very different types of indicators, for example predictive indicators of means (e.g. income, assets) with retrospective indicators of outcomes/results (well-being, psychosocial measures, losses and damages). Many indices combine outcome and impact indicators, or indicators associated with Elements 2, 3 and 4 in the DFID resilience framework. Examination of the relationships between these indicators can be extremely useful in project evaluation and in for understanding pathways of resilience and vulnerability, but this only makes sense if these different types of indicator are kept separate.
iv. Co-variation or correlation, meaning that the indicators combined are often far from independent of one another, effectively leading to double counting and bias.
v. Weightings are often applied in a highly subjective and somewhat arbitrary manner, and may amplify problems of correlation and effectively double counting.
vi. Composite indicators can provide an over-simplified view of the complex factors that combine to influence resilience or and vulnerability, and tell us little or nothing about the drivers of these phenomena.
vii. Composite indices are not well-suited to reflect phenomena such as differential vulnerability or resilience within households or communities; existing composite indices tend to be constructed from indicators that already represent the aggregated household or community level.

As with poverty, the need to take a multidimensional approach to the analysis of resilience is increasingly recognised (Alkire and Forster 2009; Hughes 2013). This is best achieved through the use of multiple indicators or indices that represent the diversity of interacting factors and processes that influence resilience. The use of disaggregated indicators means that changes in resilience can be understood in terms of changes in specific drivers, which is beneficial in terms of identifying and understanding unexpected changes in project contexts, and for identifying where project activities might need to be modified to address these surprises. In addition, the use of disaggregated indicators or indices avoids many of the problems associated with weightings, and discourages simplistic narratives of change.

Nonetheless, using a large number of disaggregated indicators whose values may variously increase and/or decrease makes it difficult to paint a coherent picture of resilience. Policy makers in particular will wish to know whether or not resilience has increased as a result of project interventions. Simple, unitary metrics therefore have a place in the M&E of resilience.

There are a number of (related) ways of addressing the problems associated with composite indices while also delivering a clear message about the direction and degree of change in resilience, and these are discussed below.

1. Composite indices comprising discrete components
It is possible to construct composite indices from a number of sub-indices, each of which represents a different dimension of resilience. The composite index provides a single

‘headline’ figure that can be used to track ‘resilience’ at large. The sub-indices mean that the different dimensions of resilience can be interrogated separately.

2. Livelihood-type resilience frameworks
Different dimensions of resilience may be defined, and changes in resilience along each of these dimensions represented graphically in a manner echoing the graphical representation of the five ‘capitals’ (human, social, physical, financial and natural) in the original DFID livelihood framework (Scoones 1998; Adato and Meinzen-Dick 2002; Fraser et al. 2011).

3. Discrete indicators
Resilience might be represented by a number of discrete indicators. Changes in resilience might be described in terms of the percentage of indicators exhibiting a positive and/or negative change. Further detail might be provided in terms of the degree of change averaged across the indicators, or the number of indicators in which changes exceed certain thresholds.

All three of the above approaches could be applied consistently across projects within a programme such as BRACED, and all three provide a combination of consistency and flexibility. The first two approaches would require projects to report against the same components or dimensions of resilience; although the indicators used to construct the sub-indices (1) or represent the different dimensions (2) could be different, acknowledging the context-specific nature of the drivers of resilience.

The third approach provides the greatest flexibility, as it does not require projects to map indicators to the same pre-defined components or dimensions of resilience.

Projects could employ any number of indicators, and these indicators could be very different across projects, with the percentage of indicators exhibiting an improvement (perhaps above a certain threshold) constituting a single, ‘universal’ indicator that could be used to compare project performance. However, the extent to which such a measure is appropriate for inter-project comparison is debatable, given that project will not only use different indicators, but also different numbers of indicators. The relationships between indicators will be different across projects, meaning that in some instances it might be appropriate to base ‘improved’ resilience on an improvement in a certain percentage of indicators, while in others improved resilience may require improvement in all indicators, or in a key sub-set of indicators. For example, improvement in an indicator based on access to a resource (e.g. an ecosystem) or process (e.g. an institution or governance process) might be meaningful only when combined with another indicator representing the quality of that resource or the extent to which the process functions properly.

In practice it is suggested that projects will probably use a combination of the above three approaches. Some projects might construct a composite indicator or resilience, or a number of such composite indicators representing different dimensions of resilience. Others might base M&E on discrete, disaggregated indicators. Provided the approach is contextually appropriate, and the rationale for defining ‘improved resilience’ is sound, projects can use whatever method works best to the KPI4 headline figure of ‘numbers with improved resilience’, and this figure can be aggregated across projects.

6.2 A methodology for measuring resilience

A flexible methodology for measuring resilience in project contexts is presented in Annex 1 of this report. This methodology describes steps for measuring resilience that enable projects to report against KPI4, and replaces the previous methodological guidance for KPI4. The methodology is based on the DFID Resilience Framework and the theory of change

represented respectively in Figures 1 and 2 of this report. It draws on the findings of the above review of existing methodologies for measuring resilience, and the survey of how resilience is addressed in ICF and BRACED project M&E plans. The methodology focuses on how to identify and measure context-specific indicators that represent key factors influencing people's resilience. It accommodates dimensions of resilience but does not require them, and it allows for analysis based on individual indicators, or on composite indices that might represent different dimensions of resilience. These indicators may be based on quantitative or qualitative information, and may also be used to measure the degree of improvement (or deterioration) in resilience associated with different factors or dimensions.

The methodology describes different levels of complexity in the measurement of resilience, described in terms of 'bronze', 'silver' and 'gold' standards, with bronze representing the minimum requirements for reporting against KPI4, and silver and gold representing more robust and complex, but optional, approaches that can be applied where appropriate and feasible.

The treatment of indicators in the revised KPI4 methodology is more straightforward than in the existing frameworks reviewed above. It does not propose representing resilience using a single, methodologically complex composite index that requires weightings to be applied to individual indicators, although such an approach is not precluded if it is deemed appropriate in a particular project context. Neither does it require the establishment of thresholds of cut-off points for indicators above or below which individuals or households are defined as 'resilient' or 'not resilient'. Complex statistical techniques are not required to construct or interpret indicators, which may be based on continuous variables, unitary scores (e.g. scores of 1 to 5 to represent levels of resilience), binary categorisation (i.e. 'yes' or 'no' answers), or subjective feedback from beneficiaries (e.g. perceptions of how well people would cope with a shock or stress).

A summary of the steps in the revised methodology for KPI4 is provided below. These are elaborated in more detail, with further supporting information, in Annex 1. The guidance in Annex 1 is expected to evolve over time as a result of learning generated by ICF and, in particular, BRACED projects.

Step 1: Identify beneficiaries, hazards and consequences

This step involves identifying the beneficiaries whose resilience is to be measured (resilience of whom?), the hazards (shocks and stresses) to which this resilience relates (resilience to what?), and the consequences of these hazards (resilience for what?). These correspond to Elements 1, 2 and 4 respectively of the resilience framework. The key systems, processes and livelihoods on which beneficiaries depend, and which mediate the consequences of hazards, should also be identified and described.

This scoping will enable projects to identify whose resilience is to be measured, in relation to what hazards, and with respect to what impacts (e.g. measure the resilience of pastoralists to drought in with respect to malnutrition, under-nutrition and mortality). Such scoping is vital for the identification not only of resilience indicators, but also of relevant project impact indicators, and indicators that can capture how relevant hazards change over time. Impact and hazard indicators do not feed into KPI4 directly, but are important as part of the wider M&E framework and for testing and validating the resilience indicators that will be used to report against KPI4. Identification of the beneficiaries is fundamental to the issue of how populations will be sampled in order to measure changes in resilience. Understanding who is exposed to what hazards, and the consequences of this exposure, is important for the identification of any control group(s).

This scoping of the resilience context, which should be highly participatory, should have been carried out during the project design phase, meaning that there is little left to do in this regard in the context of scoping for M&E. However, the above questions should be revisited when developing the M&E plan. Doing so may highlight gaps or deficiencies in project design or required knowledge, and provide a useful quality control mechanism. The development of an M&E plan should be undertaken during or soon after the project design phase, and before project implementation. Knowledge gaps should be addressed as soon as possible, for example through intensive participatory enquiry with key informants and beneficiaries.

Step 2: Define resilience in the project context

Factors that influence beneficiaries' ability to anticipate, plan for, cope with, recover from, and adapt to stresses and shocks associated with climate hazards should be identified using a variety of methods with a strong emphasis on participatory methods, guidance on which is included in the methodology in Annex 1. Special attention should be paid to the identification of factors that are important for short-term coping and longer-term adaptation, the latter over timescales that are relevant to the project and its stated goals and intended impacts. Factors important for resilience among different groups of beneficiaries (e.g. women, men, youth, very poor, remote etc.) should be identified at this stage.

Viewing resilience in terms of its various dimensions (section 6.1.4) is useful, as a review of these dimensions can be used as a way of checking that key factors influencing resilience have not been missed. While a project is likely to address only a subset of the dimensions of resilience it is useful to understand what factors might influence resilience that are outside of the project's influence. These may act as confounding factors that undermine or offset benefits from a project, so will be important in the interpretation of project performance.

Step 3: Develop resilience indicators

Quantitative or qualitative indicators can be identified or developed based on the factors identified in Step 2.

This will be an iterative process that involves addressing the following questions:

a. What have the local communities told us about the factors that contribute to their resilience?
b. What makes the logical link between intervention outputs and expected impacts?
c. What is likely to be attributable to the intervention?
d. What can be measured (qualitatively or quantitatively, objectively or subjectively) at reasonable cost and with reasonable rigour?

Projects should decide whether they will use (i) individual, disaggregated indicators that will be assessed individually, (ii) a set of composite indices each representing a dimension of resilience (e.g. assets, access to services, safety nets, adaptive capacity, etc.), or (iii) a single composite resilience index. Projects are free to use whichever approach is most appropriate, bearing in mind that (i) is probably the simplest, and that the construction of composite indicators will require decisions about how different indicators are weighted.

A single composite index has the advantage that, once constructed, using it to report against KPI4 is straightforward. Multiple disaggregated indicators are more straightforward to construct, but require a decision about how 'improved resilience' is defined (e.g. based on

improvement in one more indicators, in all indicators, or in a certain minimum proportion of indicators). Recommendations on how to address this issue are given in Step 7 below.

Decisions about the use of composite versus disaggregated indicators will be based on a variety of considerations. For example, some indicators may lend themselves to aggregation, while others may not. The former might include a set of quantitative indicators relating to a single, well-defined dimension of resilience, based on continuous variables that can be scaled from 0 to 1 and then combined using appropriate and readily agreed weights. The latter might encompass a mixture of continuous variables, binary indicators, and subjective indicators based on perceptions, which span several quite different dimensions of resilience.

In practice, projects are unlikely to target all dimensions of resilience that are relevant in any given context, and may target just a very small number of dimensions or even a single dimension. Where a project targets just one dimension of resilience it might use a single composite 'resilience index' that represents that single dimension, for reporting against KPI4. Such composite indices do not need to capture all dimensions or aspects of resilience, meaning that they are potentially much less problematic than 'universal' indicators of resilience and vulnerability such as those found in the academic literature.

Where composite indices are used, disaggregated data relating to their constituent indicators should be preserved so it can be used in analyses of how resilience is structured and distributed.

KPI4 only requires reporting of the numbers of people with improved resilience. Projects may decide to develop indicators that report only whether resilience has improved, or they may decide to develop more sophisticated indicators that seek to capture the extent to which resilience has improved (or indeed decreased). The latter approach might be achieved by scoring sampled individuals (e.g. from 1 to 5) according to their level of resilience as represented by each indicator. Guidance on how to do this is provided in the methodology in Annex 1.

A project might employ only indicators that capture aspects of resilience targeted by the project ('project-specific' indicators). However, a wider set of indicators that capture aspects of resilience that are not influenced by the project will enable M&E personnel to track changes in resilience that are outside the scope of the project and that might offset or undermine resilience gains resulting from the project. Such insights could be used to modify the project to address these other changes, or to make the case that the project has prevented a situation from worsening by improving certain aspects of resilience to compensate for deteriorations in others. The use of project-specific versus non project-specific indicators for reporting against KPI4 is discussed in Step 7 below.

Step 4: Theory of change

The identification of factors influencing resilience, and of resilience indicators, needs to be supported by a theory of change that links project activities and outputs with improved resilience outcomes and also with longer-term impacts in the form or improvements in human well-being and reduced losses and damages (relative to a no-project baseline). The project theory of change should be used to link the resilience factors identified in Step 2 and the indicators identified in Step 3 with project inputs and outputs (i.e. how the project will increase resilience by operating on these factors), and also with intended impacts (changes in well-being and reduced losses and damages compared to a no-project scenario). The theory of change should identify processes and mechanisms that link these outputs, outcomes and impacts. These mechanisms can be examined as part of the analysis of

attribution of measured changes in whole or in part to project activities. The project theory of change should be compatible with the generalised theory of change represented in Figure 2 above.

A theory of change should be developed early, during the development of the project or M&E plan. This theory of change should be constantly updated based on monitoring of resilience indicators and feedback from stakeholders/beneficiaries, and should be discussed with stakeholders and beneficiaries from an early stage and revised where appropriate. A 'predictive' theory of change developed early in the project might be compared with an 'explanatory' theory of change developed later in during the project (e.g. near the end of the project or as part of an ex-post evaluation) to facilitate learning. While a theory of change should be a fundamental aspect of a project's design, M&E, and in particular the regular monitoring of resilience indicators (for example annually during a project's lifetime) will play a key role in testing and improving the theory of change.

Step 5: Identify unexpected outcomes and confounding factors

The potential for projects to result in unexpected outcomes that might reduce resilience with respect to dimensions not directly targeted by the project should be considered. Where such risks exist they should be monitored. This might be done through beneficiary feedback, or by monitoring the dimensions in question using the procedure outlined in steps 1-3 above.

Similarly, risks of confounding factors operating on dimensions of resilience not targeted by the project should be evaluated and monitored in the same way where appropriate.

Step 6: Sampling methodology and measurement

Measurement of changes in resilience will be based on sampling of beneficiary populations using a variety of methods including surveys/questionnaires, participatory assessments and other methods. Sampling methods and sample sizes will need to be defined, and sampling intervals decided. Criteria for disaggregation will also need to be agreed. Results will need to be disaggregated by gender, and it may also be useful to disaggregate based on other criteria such as age, type of livelihood, membership of a marginalised group, or classification as in the most vulnerable/least resilient section(s) of society (e.g. based on initial resilience scores).

Effective sampling will require a clear plan and a dedicated budget. For monitoring purposes it will be useful to measure resilience indicators regularly, for example every 12 months, although this will depend on the expected rapidity of change in the indicators.

Step 7: Calculation of numbers with improved resilience

There are a number of ways of arriving at the final figure of '*number of people with improved resilience*'.

For projects using a single composite index of resilience, the number with improved resilience will be the number for whom the index shows a change in the direction of greater resilience.

For projects using multiple disaggregated indicators or multiple indices that each represents a dimension of resilience, it is recommended that the numbers with improved resilience are calculated as the numbers fulfilling the following criteria:

i. Improved resilience as represented by a minimum number of project-specific indicators, with this minimum number being appropriate for the project context (see below);
ii. Stability (i.e. no deterioration) in resilience as represented by the remaining project-specific indicators.

Here, project-specific indicators are those indicators that seek to capture aspects of resilience targeted by the project. Aspects of resilience that are outside the scope of a project's influence might be represented by other (non project-specific) indicators that are measured for contextual purposes. These indicators should not be included in the calculation of numbers with improved resilience, but any deterioration in such indicators should be reported alongside the numbers with increased resilience as a result of the project as used to report against KPI4.

Where a minimum number of indicators is required to demonstrate improved resilience, project M&E staff should consider the extent to which indicators represent aspects of resilience that are additive (i.e. changes in each indicator in a particular direction represent incremental, cumulative improvements in resilience), and the extent to which they represent more complex, interdependent aspects of resilience that act in concert rather than in isolation. For the latter case, it might be that improvements in a certain number of key indicators are required before overall resilience can be said to have increased (see the discussion in Section 6.1.5 above).

This guidance does not advocate the use of cut-offs above which people or systems are judged to be resilient. In other words resilience is viewed as a spectrum rather than in binary terms, with people being more or less resilient rather than resilient or not. Nonetheless, it is recognised that in some contexts it might be appropriate to define indicator thresholds that need to be exceeded in order for resilience to be improved in any meaningful way. For example, in order to enable crops to withstand a drought of a certain magnitude or duration, smallholders might need access to a minimum amount of water as supplied by new irrigation. Indicators of water access might show an 'improvement' in access, but if this improvement is insufficient to supply minimum needs during periods of drought it cannot be said to have increased resilience to drought.

As resilience indicators will be highly context specific, the use of thresholds and the appropriate minimum number of disaggregated indicators will need to be decided on a project-by-project basis.

Step 8. Address attribution

The extent to which measured improvements in resilience can be attributed to a project can be assessed using comparisons with control groups, key stakeholder narratives, or (continuous) feedback from beneficiaries. Qualitative attribution should pay particular attention to how and why the project resulted in improved resilience, and how this fits with the theory of change.

6.3 Delivering value-for-money in project M&E

Value for money in adaptation projects is strongly related to the extent to which projects deliver robust 'win-win' or no/low regrets adaptation benefits that are robust under uncertainty and deliver a high ratio of benefits to costs. Value for money involves adaptation options that generate development benefits even in the event that anticipated changes in climate do not materialise. It also means delivering benefits in the short term that are not potentially 'maladaptive', increasing risks associated with climate change in the longer term.

Project M&E systems need to deliver value for money, striking a balance between cost and resource intensiveness on the one hand, and learning benefits that improve project performance and help to build knowledge of 'what works' in resilience on the other. Minimum requirements for reporting against ICF KPI4 (numbers with improved resilience as a result of ICF projects) are detailed in Annex 1. These represent a 'bronze' standard for resilience reporting. Projects might demonstrate that they are providing additional value for money by going beyond this 'bronze' standard and meeting 'silver' or 'gold' standards, for which guidance is also provided in Annex 1.

Therefore, as well as the delivery of improved resilience over the short term, Given our current poor understanding of resilience and how it links 'backwards' to development interventions and 'forwards' to human well-being, projects should seek to enhance and facilitate learning as well as delivering improved resilience on the ground. The extent to which projects deliver such learning will be a key criterion in assessments of value for money. Projects might demonstrate additional value for money - over and above the minimum required bronze standard - in a number of ways, as discussed below.

1. Development of new indicator methodologies

As discussed above in Section 6.2, there are a variety of ways in which indicators might be constructed and analysed to measure the resilience of project beneficiaries. Projects might contribute to learning by developing novel methodologies for indicator identification, construction, and aggregation, and for identifying thresholds or cut-offs associated with transitions to resilience in the context of specific hazards.

2. Empirical validation of resilience indicators using impact indicators

A minimum requirement for reporting against KPI4 is the use of contextually appropriate resilience indicators grounded in evidence such as that provided by participatory assessment. Additional value for money in terms of delivering learning might be demonstrated where projects test or validate resilience indicators (measured before a shock or stress) by examining the extent to which they correlate with impact indicators (measured after a shock or stress). Impact indicators will need to be scaled or adjusted to account for variations in the level of stress or shock (magnitude, frequency, etc.), which may be as important or more important than changes in resilience in determining climate-related losses, damages, and changes in well-being over any given period. Good correlations between resilience indicators and adjusted impact indicators can help to identify which resilience indicators are most important (i.e. have greatest predictive power), helping us to understand resilience better and building the evidence base to inform future interventions.

3. Establishing meteorological stations and networks

The DFID Resilience Framework explicitly relates the building of resilience to specific stresses and shocks, and strategies to build resilience and deliver adaptation to stresses and shocks associated with climate change will need to be informed by an understanding of how these stresses and shocks are evolving. The monitoring of climatic and meteorological variables thus provides vital contextual for adaptation. This is particularly important in locations such as the Sahel, where observational networks are patchy and there is high uncertainty about how climate may change in the future. Of more direct relevance in project contexts is the potential for using quantitative data on climate trends and variations to interpret project impact indicators in the light of dynamic stresses and shock. Project impacts cannot be assessed simply by measuring how climate-sensitive well-being variables, and losses from climate stresses and shocks, change over time: the relative roles of varying exposure (e.g. variation in number of shocks from year to year) and changes in resilience

need to be considered, and this requires data on how climate hazards are changing over time.

Where climate data do not already exist, projects that help to generate such data will be in a stronger position when it comes to interpreting impact indicators, and using impact indicators (adjusted to take account of climate-driven changes in exposure) to test and validate resilience indicators (i.e. assessing the extent to which the latter are good predictors of the former). The establishment of observational stations or networks that persist beyond the lifetime of a project will also provide contextual data for future studies and initiatives. Data from these stations or networks can feed into regional forecasts and global climate models, directly contributing to resilience and enhancing our understanding of climate change processes.

Projects that help to establish observing stations or networks (e.g. through the installation of relatively inexpensive automatic weather stations) therefore can provide additional value for money in terms of learning and capacity building. While it may be difficult to calculate the benefit to cost ratio in financial terms, this ratio is potentially very large.

4. Catalysing transformational change through learning

ICF KPI 15 addresses the "Extent to which [an] ICF intervention is likely to have a transformational impact", where "Transformational change is defined … as change which catalyses further changes, enabling either a shift from one state to another (e.g. from conventional to lower carbon or more climate-resilient patterns of development) or faster change (e.g. speeding progress on cutting the rate of deforestation)." Projects are not required to report against KPI15, but those that are able to do so and convincingly demonstrate that they are likely to contribute to transformational change might be seen as providing additional value for money on account of their potential to influence processes and practices well outside the immediate project context. One indication that a project might be likely to deliver transformational change is the successful emulation of project activities or measures by people who are not directly targeted by the project. This might be measurable within the lifetime of a project. Other guidance on assessing KPI15 is provided in the relevant methodological note.

The above considerations can be combined with considerations of how well a project delivers on the steps outlined in Section 6.2, and with more general considerations relating to the dissemination of learning, to produce the following (non-exhaustive) list of criteria that might be examined in any assessment of value for money.

i. Enhances understanding of the factors influencing resilience in specific contexts and in a more general sense;
ii. Identifies (or includes a mechanism to identify) unexpected outcomes so that maladaptation is avoided;
iii. Delivers learning on how changes in resilience are linked with changes in well-being (including in losses and damages from climate stresses and shocks);
iv. Disseminates learning to project beneficiaries, governments, and internationally;
v. Results in uptake of successful adaptation/resilience building measures outside its target area/population (scaling up through learning/emulation);
vi. Improves the availability of data on climate hazards (trends, frequency, severity), through the collation of existing data or the generation of new data (e.g. through the establishment of meteorological observing stations[16]);

[16] These can be small in scale and low in cost.

vii. Results in the enhanced awareness of climate risks and better climate risk management by governments and institutions;[17]
viii. Leaves a sustained legacy of improved resilience and data availability after the project has ended.
ix. Reports against ICF KPIs other than those that are mandatory.

Any assessment of value for money must take into account that it will be easier for some projects to meet certain criteria than it will for others. This will depend on factors such as the strength of existing governance institutions, government buy-in, the nature of formal and informal communications networks and the isolation/connectivity of target communities, political stability and conflict, and the availability of climate data. The extent to which resilience indicators can be correlated with impact indicators measured after a shock or stress has occurred will depend on whether a shock or stress occurs during the period over which M&E systems are operational. Projects therefore should not necessarily be penalised or seen as delivering 'poor' valued for money because they do not meet certain criteria.

Finally, the process of reporting against KPI4 might be used to evaluate value for money in terms of the cost per person *with improved resilience* (perhaps expressed as the proportion of beneficiaries or associated spend associated with improved resilience). This represents a measure of value for money in terms of effectiveness that might complement the 'efficiency' measure of cost per beneficiary/person supported. However, caution should be exercised here. Some projects will need to spend more per beneficiary than others in order to achieve a comparable result, simply because the contexts in which they are operating are more challenging. Similarly, some projects may be more risky than others in terms of their likely success. Value for money metrics should not penalise projects that operate in challenging circumstances where the chances of success may be low when compared with other projects. Nor should they drive projects to pursue 'easy wins' that might ignore difficult but important resilience challenges or exclude more vulnerable groups.

[17] This can be assessed using the TAMD Track 1 Climate Risk Management Indicators described in Brooks et al. (2013).

SECTION 7

Recommendations and next steps

This report details the results of a review of existing methodologies for measuring resilience and concludes that none of these is directly applicable in its existing form to the measurement of resilience as a means of assessing the effectiveness of ICF or BRACED projects. Nonetheless, some general guidance on how to measure resilience as part of ICF/BRACED project M&E is highly desirable, as indicated by the review of project M&E plans conducted as part of this study. Even when project indicators are combined into more generic indicators, the number of such generic indicators used across projects exceeds 70. Where similar indicators are defined for different projects, these might be defined at the output, outcome or impact level indicating not only a high degree of variation in indicator definition, but also in how indicators are mapped to project log-frames.

The report presents a novel theory of change in which improved resilience is defined at the outcome level. Resilience outcomes are viewed as predictors of longer-term project impacts involving reductions in mortality and assets lost as a result of climate stresses and shocks, and increased human well-being (relative to a no-intervention scenario). The report details a methodology for measuring resilience (Annex 1) as a means of monitoring and evaluating the performance of projects funded under the ICF and BRACED programmes, in relation to ICF Key Performance Indicator No. 4
(KPI4). This involves the identification of context-specific indicators of resilience, which can (if appropriate) be guided by a framework that decomposes resilience into a number of dimensions that are defined across contexts. Guidance is provided on the identification of these indicators, for example using participatory methods. This is part of a step-by-step guidance on the measurement of resilience to report against KPI4.

The next step in the development of capacity to measure resilience will be to pilot this methodology in the context of the DFID BRACED programme, whose implementation phase will begin in mid-late 2014. This will provide opportunities to test and refine the methodology, and for learning in relation to the measurement of resilience.

While the methodology presented in this report focuses on the measurement of resilience outcomes, a key step in developing our understanding of resilience will be the validation of predictive resilience indicators against measured impacts on well-being and the adverse effects of climate-related stresses and shocks. This will require the further refinement and piloting of the methodological framework for M&E of outcomes and impacts described in Annex 2 of this report. The examination of links between resilience outcomes and well-being impacts through empirical studies in project contexts represents a means of testing project-level and more general theories of change.

It is recommended that projects are encouraged to monitor climate and other hazards associated with the shocks and stresses to which project beneficiaries are intended to become (more) resilient. These will need to be identified during the scoping phase of the project or M&E plan, so that appropriate resilience-building measures can be identified and supported. While resilience indicators may be measured without reference to specific variations in the frequency and severity of hazards, an understanding of how hazards are changing over time is vital for the interpretation of project impact indicators associated with measures of losses, damages and well-being (section 3.3). The establishment of records of

hazards is essential for the longer-term monitoring of impacts, and for the identification and implementation of adaptation and resilience-building measures. Quantitative records of variations in climate hazards may be complemented by additional qualitative reports from communities on the perceived relative severity of climate events in relation to remembered history.

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Annex 1 Methodology for collecting KPI 4 – Number of people whose resilience has been improved as a result of project support

Background

KPI4 is a Key Performance Indicator (KPI) in the DFID-funded International Climate Fund (ICF). However, the indicator can be used for any project for which increased resilience is an objective. It is an outcome indicator in DFID's BRACED portfolio log-frame.

This guidance outlines a step-by-step methodology to help ICF and BRACED projects identify context-specific resilience indicators, and to use these indicators to track changes in resilience resulting from project activities, and report against ICF KPI4. Some of these steps are associated with a range of methods and approaches that involve varying levels of complexity and rigour. For each of these steps, a table is provided illustrating what is required for three different standards: bronze, silver and gold. The bronze standard describes minimum standards for measurement, analysis and reporting as required by DFID. The silver and gold standards describe optional additional measures that enhance the rigour of resilience monitoring and evaluation (M&E), that can be taken where circumstances allow and where this will add value to a project M&E system in terms of reporting and learning. Where a step is not associated with a table of criteria for bronze, silver and gold standards a project is expected to follow all the recommendations in that step. This does not necessarily mean that all the techniques described under a step need to be employed by a project; rather that a project must demonstrate that it has considered which of these techniques (if any) are required, and is employing those that are appropriate to its context (e.g. incorporating indicators to track potential unintended consequences of a project if the possibility of such consequences is identified, under Step 5).

KPI 4 specifically measures the number of people with **improved resilience due to a specific project intervention. It is not a measure of overall resilience, or of a change in overall resilience.**

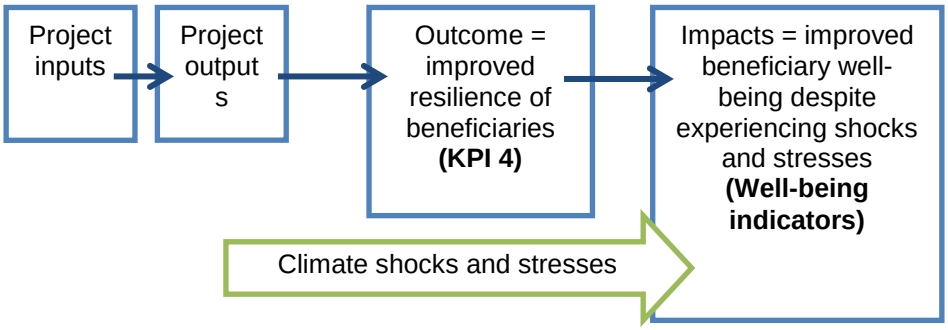
In the context of KPI4, resilience to climate shocks and stresses (that may be intensifying as a result of climate change) is considered to be a composite attribute possessed by each individual - KPI4 measures how many people have experienced improvements in their ability to cope with climate related shocks and stresses as a result of project activity. Improved resilience means that the individual, when experiencing a shock or stress, is better able to maintain or improve their well-being.

KPI 4 is most applicable to projects that target (directly or indirectly) individuals and households. In these contexts KPI4 will be derived from context-specific indicators of resilience at the individual or household level. However, it is also possible to apply KPI4 to resilience projects aimed at institutional capacity building or policy change. This means answering the question 'How many people have had their resilience improved through this increased institutional capacity' or 'how many people have had their resilience improved through this change in policy?' This may be based on the measurement of context-specific indicators representing individuals or households, or on other measures of numbers benefiting from capacity building or policy change.

At what level in the logframe/theory of change should you put KPI 4?

KPI 4 will normally be an **Outcome Indicator.** This is because resilience to climate shocks and stresses is not usually a direct output of a project activity, but an outcome of one or more outputs. Increased resilience should mean that people are less likely to suffer losses, damages, and declines in their well-being when they encounter a shock or stress. This is illustrated in Figure 1.

Figure 1 General theory of change for resilience



Theory of change (ToC): without the programme beneficiaries would have been less resilient to climate related shocks and stresses and therefore performance of well-being indicators (e.g. income, deaths) would be worse than in the with programme scenario

Normally, at the start of a project, the context-specific indicators from which KPI4 is to be derived are indicators representing certain attributes that the project's Theory of Change suggests will make individuals less vulnerable to climate related shocks and stresses. Later, if the project monitoring system is sufficiently robust, it should be possible, after the project's outputs have affected a sufficient number of people and if climate related shocks and stresses have occurred, to correlate KPI4 components with actual well-being impacts. At this stage KPI 4 can be adjusted to be closer to a proven indicator of resilience. This is an important learning process. Good resilience indicators – measured before a shock or stress occurs - should be significantly correlated with indicators that capture losses, damages and changes in well-being associated with that shock or stress, measured after it has occurred. In other words, resilience indicators should be predictive of future changes in well-being resulting from shocks and stresses.

KPI 4 measures the resilience of INDIVIDUALS

Resilience as a concept can apply to individuals, households, communities, systems, ecosystems etc. **KPI 4 specifically measures the resilience of individuals.** However it is recognised that the resilience of the individual being measured is a function of the resilience of the household, community, systems and ecosystems in which they live – therefore the context in which the individual lives is very much part of the resilience story we are trying to understand and to measure.

KPI 4 measures the resilience of individuals because there are large differences even within the same household in how individuals are affected by a shock or a stress. We are very interested in these differences and also the differential impact of any project intervention on different categories of individual. As a result of these intra-household differences in resilience and project impacts, KPI4 should always be disaggregated by gender. Disaggregation based on other categories of beneficiary may also be desirable.

KPI 4 units, attribution, and dealing with a changing context

There are no agreed units in which 'resilience' is measured. This is because resilience is extremely context specific. Therefore resilience is dealt with as a relative attribute in each specific local context. Individuals can be considered 'more' or 'less' resilient to climate related shocks and stresses as a result of the context in which they live, and of their gender, age, poverty level, type of livelihood, geographical location etc.
A project intervention may make individuals more or less resilient to shocks and stresses. KPI 4 is defined in such a way as to take into account the change specifically due to a project intervention:

KPI 4 - Number of people whose resilience has been improved as a result of project support

Therefore we are not measuring the absolute level of resilience – but rather the relative change in resilience due to the project intervention – and specifically the number for whom this change is positive. This means the measurer can (temporally)[18] ignore the overall trend in resilience (whether it is getting better or worse) – and focus on the change that reasonably can be attributed to the project. It also means that in order to be counted, the measurer must be able to make a reasonable estimate of the contribution of the project. This is often done by choosing to measure specific aspects of resilience that the project targets or is known to have affected (see example in Box 1).

Box 1 Example – choosing aspects of resilience that reflect the project intervention

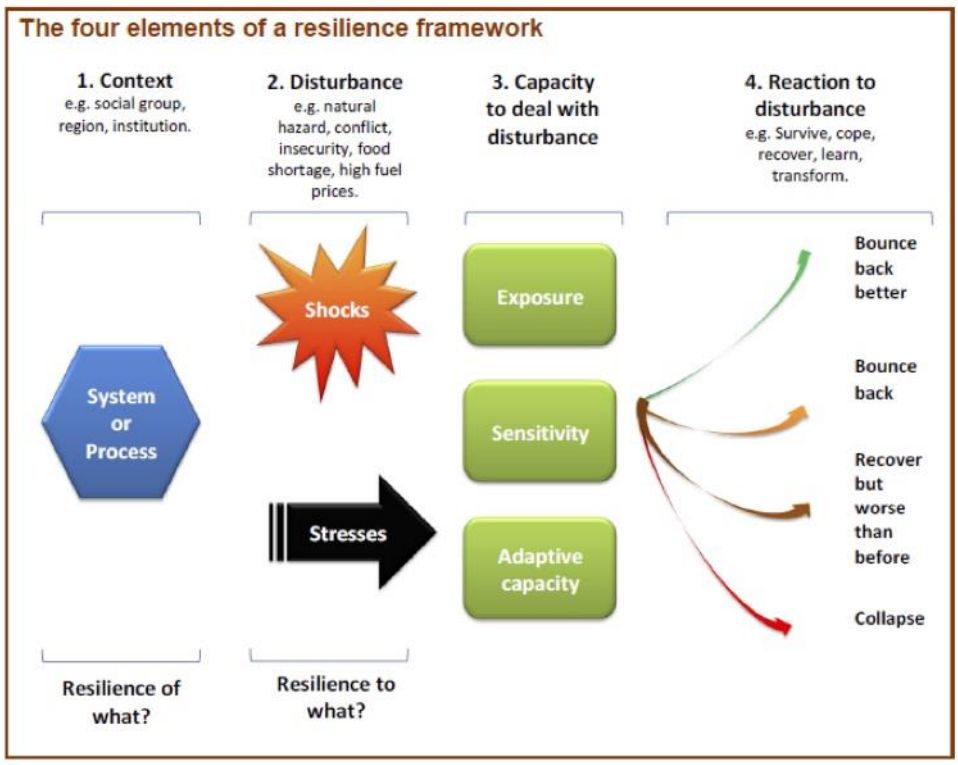
Project intervention	Possible aspect of resilience to measure
Improve flood early warning systems	Number of people able to receive and respond beneficially to the improved flood warning system
Labour based safety net	Number of people covered by and eligible for the new safety net system (before) or number of people actually participating in new safety net programme – and who is not able to participate (after)
Drought resistant agricultural techniques	Number of people permanently adopting the techniques promoted by the project

STEP BY STEP GUIDE TO DEFINING AND MEASURING KPI 4 IN A PROJECT CONTEXT

1. Identify beneficiaries, shocks and stresses, and their consequences

Describe the resilience context using the DFID Resilience Framework (see fig). This is usually done as part of the project design, and should involve a combination of methods including participatory assessments.

18 Of course the overall trend is very important in the overall project design, and is an important part of the context against which KPI 4 should be reported (e.g. overall the level of resilience deteriorated, but for project participants the level of deterioration was 50% less than for non-participants).



a. Identify key climate shocks and stresses to which people need to be more resilient (Element 2). This should include existing shocks and stresses and potential future shocks and stresses over timescales relevant to the project.

b. Identify key consequences of climate shocks and stresses such as losses, damages and negative effects on human well-being (e.g. increased poverty, worse health outcomes, etc.) (Element 4). The long-term impacts to which the project contributes will be the amelioration of these consequences.

c. Identify the key systems and processes (Element 1) on which individuals and households depend, and that influence their resilience to climate related shocks and stresses.

2. Define resilience in the project context

Identify key factors that are important for influencing people's resilience (Element 3 of the resilience framework). These will be factors that affect people's ability to anticipate, avoid, plan for, cope with, recover from, and adapt to climate shocks and stresses:

a. Use a combination of methods to identify these factors including surveys, questionnaires, interviews, and participatory assessment (see additional guidance below).

b. Consider the factors that influence people's ability to cope in the short term and those that influence their capacity to adapt in the longer term, informed by considerations of the timescales and shocks and stresses that the project seeks to address.

c. Consider how the project is likely to affect these factors. This can be illustrated in a simple **Theory of Change** (Step 3)

During this step, reference can be made to the different **dimensions of resilience** identified from a review of resilience methodologies (Box 3). This is a way of checking whether all the relevant dimensions of resilience that might link project outputs to intended project impacts have been considered (not all of these dimensions will be relevant in a project context, and this procedure is intended to provide some light-touch quality control rather than to be at all prescriptive).

Box 3 Broadly defined dimensions of resilience, based on a review of methodologies for measuring resilience[19]

1. **Assets,** including physical and financial assets, food and seed reserves, and other assets that can be deployed or realised during times of hardship to help people absorb losses, and recover from stresses and shocks.
2. **Access to services**, including water, electricity, early warning systems, public transport, & knowledge and information that helps people plan for, cope with and recover from stresses and shocks.
3. **Adaptive capacity**, including factors that specifically enable people to anticipate, plan for and respond to longer-term changes (for example by modifying or changing current practices and investing in new livelihood strategies), that are not represented by the other dimensions.
4. **Income and food access**, indicative of the extent to which people may be poor or food insecure *before* the occurrence of a stress or shock.
5. **Safety nets**, including access to formal and informal support networks, emergency relief, and financial mechanisms such as insurance.
6. **Livelihood viability**, in terms of the extent to which an individual's livelihood can be sustained in the face of a shock or stress, or the magnitude of shock or stress that can be accommodated before a livelihood ceases to be viable.
7. **Institutional and governance contexts**, including extent to which governance processes, institutional mechanisms, policy environments, conflict, and insecurity constrain or enable coping and adaptation.
8. **Natural and built infrastructural contexts**, including extent to which coping and adaptation is facilitated or constrained by the quality of built infrastructure (e.g. roads), the quality/functioning of environmental systems/natural resources (e.g. health of ecosystems providing livelihoods), and geographical factors (e.g. remoteness).
9. **Personal circumstances**, including any factors not covered by other dimensions that might make an individual more or less able to anticipate, plan for, cope with, recover from, or adapt to changes in stresses and shocks. These might include health, debt, low socio-economic status, etc.

3. Develop resilience indicators

a. Develop indicators that capture the aspects of resilience identified in Step 2 **that the project will seek to address**. These indicators need to link project outputs with intended project impacts in a way consistent with a project's theory of change and with the overall resilience theory of change (Figure 1). Beneficiaries should have a role in the selection and verification of indicators, which will be highly context-specific, and this can be via an extension of the participatory processes associated with Step 2 above. Resilience indicators should clearly link project outputs (the mechanisms through which the project seeks to increase resilience/reduce vulnerability) with the factors that make people resilient. Box 2 provides an example of indicator development in a

[19] Brooks, N., Aure, E. and Whiteside, M. 2014. Assessing the impact of ICF programmes on household and community resilience to climate variability and climate change. Evidence on Demand for DFID.

project context. The development of resilience indicators should consider the following issues:

b. Identify a set of quantitative and/or qualitative resilience indicators (a project can use both). Quantitative indicators might be based on continuous variables, categorical scores (e.g. 1 to 5 depending on criteria fulfilled), or be binary in nature (e.g. yes/no). Qualitative indicators might be based on stakeholder perceptions (e.g. of their capacity to cope with a drought). Indicators based on perceptions might be recorded on an H-form and converted to quantitative form (e.g. based on scores). *For the purposes of reporting against KPI4 the indicators need only represent those aspects of resilience targeted by the project, and not all the factors that might influence resilience.* However, indicators of aspects or dimensions of resilience not directly targeted by the project might be useful for understanding unexpected results (Step 5).

c. Establish whether the same indicators are to be applied to all beneficiaries, or whether different indicators are required to measure changes in resilience for different groups of beneficiaries (e.g. by location, livelihood, etc.).

d. Decide whether to use individual, disaggregated indicators, one or more composite indices (e.g. a single resilience index or one or more indices representing particular dimensions of resilience as in Box 3).

e. Determine how indicators might be weighted based on their relevant importance. This is less relevant for disaggregated indicators than for indicators that will be used to construct composite indices. However, it is useful to have an idea about which indicators are likely to be most important even where they are disaggregated, as this may inform how KPI4 is measured (see below).

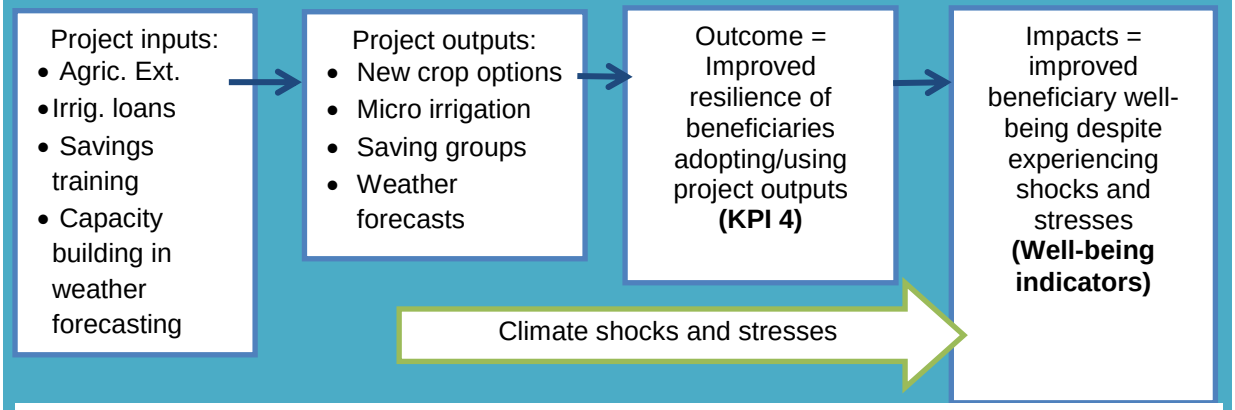
f. Identify whether indicators are (i) additive, i.e. improvements in individual indicators may be assumed to reflect incremental improvements in resilience, or (ii) whether they exhibit a more complex interdependence, meaning that for resilience to improve, improvements must be seen across multiple indicators.

g. For each (non-binary) indicator, establish whether resilience can be said to have improved on the basis of *any* change in the desired direction, or whether change as measured by the indicator needs to exceed a certain threshold for resilience to be said to have increased in any meaningful way (e.g. does water availability need to increase beyond a certain threshold to enhance resilience of subsistence systems?).

h. Decide on how the indicators will be measured and the standard (bronze, silver, gold) to be met (Table 1). The most basic requirement is that indicators establish whether resilience has improved in order to report against KPI4 (bronze standard). However, a project might decide to track the degree of change in resilience over time, or the extent to which people move from one category of resilience (e.g. very low) to another (e.g. moderate).

Box 2 Example of the use of KPI4 in a project context

Project X has used existing experience and a series of structured qualitative enquiries to identify a Theory of Change. They have identified increasing unpredictability of rain as a major cause of shock and stress. A combination of project inputs have been designed to address this :



Theory of change (ToC): a combination of adopting a drought resilient crop, access to micro-irrigation, family membership of a saving group and making use of weather forecasting for deciding when to plant constitutes improved resilience due to the project, which will enable well-being to be maintained in a drought year.

Building on focus group discussions and experience from similar areas the project decides to construct a composite index of **'improved resilience due to project support'** that can be used to track changes in key factors addressed by the project that are thought to confer increased resilience, and that can be used to report against **KPI 4.** This composite index is based on a number of binary indicators that identify whether an individual/household meets certain criteria, with an answer of 'yes' resulting in a score of 1, and an answer of 'no' resulting in a score of zero. The composite index is the sum of these scores. The index is an index of predicted resilience, based on assumptions derived from the focus group discussion and theory of change.

Attribute	Yes	No
Adopted one drought resistant crop on > ¼ ha	1	0
Access to micro-irrigation > 1/10 ha	1	0
A family member in a savings group	1	0
Current savings > $20	1	0
Have used a weather forecast in last 2 years to decide when to plant	1	0
Total project attributable resilience score	**0-5**	

The project decides to do a baseline (Yr 0), mid (Yr 2), end (Yr 4) and ex-post (Yr 6) survey. It receives statistical advice and is told a sample size of 600 HHs would be suitable. It decides to do a full household survey in Yr 0 and Yr 6, which will include questions and measurements to measure well-being (e.g. nutrition survey). In Yrs 2 & 4 a simpler survey is planned just to track the five KPI 4 components. Although the sample will be for households, the results for KPI 4 will be reported in terms of number of individuals.

Project X is therefore able to report to its funder the number of people with improved resilience (as represented/predicted by the composite index) due to the project in Yrs 2, 4 & 6 (KPI 4).

However, it also plans to compare the change in resilience (as represented by the index) between Yrs 0 & 6 with the change in well-being indicators over the same period. It plans to use multiple regression to (i) examine the strength of the correlation between the composite resilience and its individual components and thus test the appropriateness of the index, and (ii) identify the factors/components of the index that are most important in explaining measured changes in well-being indicators. The project

thus hopes to deliver learning on what factors are the most important contributors to resilience that can be used for future project design.

Table 1 outlines the criteria that should be met for the construction of indicators to different standards. It should be stressed that the gold standard might not be appropriate in all contexts, depending on the aspects of resilience to be measured and the nature of the associated indicators, and projects should use whatever standard is appropriate.

Table 1 Different standards for the construction of resilience indicators

Bronze	Silver	Gold
Qualitative measurement: • Establishment of increase or decrease in one or more indicators or composite index.	Simple scoring system: • Composite indices based on several elements with 0/1 scoring that can be added for overall index score (Project X in Box 2 example). • Scoring based on appropriate scale (e.g. 1-5) depending on location of household or individual within the range of a continuous variable (e.g. lowest, highest fifth of range).	Use of composite indices or scoring based on continuous variables plus one or more of: • Conversion of indicators into variables scaled to be comparable and allowing measurement beyond a small number of categories (e.g. each indicator represented by a score from 0 to 1) • Use of different weightings in construction of composite indices, with clear justification for weightings chosen • Explicit consideration and, where appropriate, identification of minimum criteria for 'improved resilience' such as coherent improvement across a suite of related indicators and/or exceeding of specific thresholds within an indicator (See Step 2e,f)

4. Develop/refine theory of change

A theory of change should have been developed to inform and guide the project design, and to link project outputs, outcomes and impacts (see Figure 1 above). This theory of change should identify factors thought to contribute to resilience that the project expects to address/improve.

As part of the process of measuring resilience to report against KPI4, project M&E staff should check that a clear, credible theory of change exists, and that it links project activities and outputs to each of the elements to be monitored and represented by indicators. The development of resilience indicators as part of a project M&E system represents an opportunity to review, test and, where appropriate, revise the project theory of change based on information generated during Steps 1 to 3 above.

A project theory of change should be constantly reviewed and updated in the light of new information, and the development and measurement of resilience indicators provides opportunities to do so (see also Step 6). It is recommended that an 'explanatory' narrative describing how a project has affected resilience (and if possible how this has mediated the

effects of stresses and shocks on human well-being) is developed at/near the end of a project, or at a point where sufficient information is available to address these questions. This explanatory narrative should be compared with the theory of change developed during the project design phase, in order to test the validity of the project's initial assumptions and to deliver learning about resilience and how it can be influenced through project interventions.

The indicators developed in Step 3 should be consistent with the theory of change, with changes in resilience measured at the outcome level. Indicators of resilience should, as far as possible, be based on factors and characteristics that can be measured at any time, not just during or after a climate shock or stress. These resilience indicators should represent factors and characteristics that, as far as can be ascertained given the available evidence (e.g. from past shocks and stresses, participatory assessments, etc.), are predictive of how well people will cope with, recover from and adapt to (evolving) stresses and shocks, and thus of *impact indicators* measured after/in relation to those stresses and shocks.

5. Establish how to identify unexpected outcomes and confounding factors

Project M&E systems should include mechanisms for identifying and tracking potential 'unintended consequences' of the project on resilience (Box 4). At the very least these should include provision for open-ended qualitative questioning of beneficiaries at regular intervals, e.g. using key informants to ask if any unintended consequences have been noticed.

If some **potential unintended consequences** are identified in advance these might be tracked using additional indicators to those intended to capture changes in the aspects of resilience targeted by the project (see Step 3). For a project to demonstrate increased resilience as required by KPI4, improvements in indicators associated with targeted aspects of resilience would need to be accompanied by evidence that the project had not resulted in deterioration in other aspects of resilience not directly targeted, as represented by the additional indicators. Where a project employs composite indices, these additional indicators might be incorporated into these indices.

Box 4 Example – potential unintended consequence of Project X

A concern was identified in project planning that households might sell small amounts of stored crops on a fortnightly basis in order to meet the savings requirements of the savings groups, leading to a reduction in level of crop stored. Therefore Project X introduced an additional factor into its composite KPI 4 – 'Amount of crop storage in March each year > 2 bags cereals'. This enables it to track and factor in this potential unintended consequence

A similar approach to that outlined above for unintended consequences might be taken to track any **potential confounding factors outside of a project's control or influence** that have the potential to reduce aspects of resilience that may or may not be targeted by the project. Such factors could mean that a project does not achieve the improvements in resilience that it would in their absence, or that improvements in aspects of resilience targeted by the project are offset by declines in other aspects of resilience. In the latter case a project might report improvements in resilience, but these might not deliver the improvements in well-being in the face of evolving stresses and shocks that they would if other factors were not acting to offset project gains. Indicators might be developed to track these confounding factors and their effects on aspects of resilience that are not directly targeted by the project. However, these indicators would not be incorporated into composite resilience indices, and would not affect the reporting of improvements in resilience based on aspects of resilience targeted by the project. Instead they would provide contextual information to be used in the interpretation of project impact data.

Treatment of unintended consequences and confounding factors for bronze, silver and gold standards is summarised in Table 2.

	Bronze	Silver	Gold
Unintended consequences / confounding factors	Evidence that unintended consequences and confounding factors have been considered, e.g. at start of project with follow up qualitative assessments.	Clear mechanism for tracking unintended consequences and confounding factors with regular review	Tracking unintended consequences or confounding factors using quantitative indicators developed for this purpose

Table 2 Different standards for addressing unexpected consequences and confounding factors

6. Develop a sampling methodology

Projects will need to identify how frequently they will sample beneficiaries to measure changes in resilience using the indicators developed under Step 3. At the very least, projects will need to gather baseline data before or very close to the start of the project, and a further set of data at the end of the project for comparison with the baseline data. However, more frequent sampling during a project's lifetime may be desirable, where resilience indicators are expected to exhibit changes on sufficiently rapid timescales. Such sampling might be done annually. In addition, ex-post sampling of beneficiary populations are useful to test whether any improvements in resilience have been sustained, and to examine the longer-term impacts of a project. It is conceivable that some changes in resilience may not be apparent until after a project has ended, making ex-post evaluations essential. Where resilience indicators are to be compared with impact indicators, the latter might need to be measured after a project has ended because of the timescales associated with the evolution and return periods of some climate stresses and shocks (i.e. it might be unlikely that such stresses and shocks will occur during a project's lifetime, making the measurement of impact indicators against stresses and shocks impossible on project timescales). Table 2 provides guidance on sampling intervals for different measurement standards.

Where a project is implemented in phases, sampling of different beneficiary groups might take place at different times.

Whatever timescale is chosen, projects should seek statistical advice on sample frames and sample numbers, as well as on the use of different sampling approaches such as large-scale household surveys, group participatory assessment, and panel surveys that track the same individuals over time.

Measurement of resilience indicators should ensure that data can be disaggregated so that results may be examined for different beneficiary categories. At the very least data should be disaggregated by gender. However, there may be systematic differences in resilience, and in the extent to which a project improves resilience, between other categories of beneficiary. These categories might be based on age, location, livelihood, or other social, economic or cultural differences (Table 3).

	Bronze	Silver	Gold
Timing	Baseline and end	Include an ex-post measurement	Include one or more ex-post measurements
Disaggregation	Gender	Gender + other pre-determined classes.	A range treated as independent explanatory variables

Table 3 Different standards for sampling methods

7. Calculate numbers with improved resilience due to project

To report against KPI4 a project needs to estimate the **number of people whose resilience has been improved as a result of project support.** The following points should be emphasised in relation to reporting against KPI4:

i. The quantity to be reported is number of people;
ii. KPI4 is based on the reporting of relative improvement, i.e. the number of people for whom the indicators (Step 3) show improved resilience due to project activities, relative to the situation that would pertain had they not been targeted by the project (see Step 8);
iii. The calculation of KPI4 is not affected by wider issues outside a project's influence – the population at large may be becoming more or less resilient as a result of factors such as those related to the cumulative impact of increasingly frequent or severe shocks, or changes in the external economic environment. Changes in resilience due to factors outside of the project's control or influence do not count in the calculation of KPI4. However, the reporting of KPI4 should be accompanied by contextual information on broader trends in factors influencing resilience.
iv. The number reported is the number with improved resilience linked to the project minus the number with reduced resilience linked to the project as a result of unintended consequences (Step 5).

The way in which the number of people with improved resilience is calculated will depend on the type of indicators used:

a. Where a single composite index is used, the number with improved resilience will be simply the number with an improved score in the composite index.
b. Where multiple composite indices are used to represent different dimensions of resilience, the number with improved resilience will be the number with an improved score in at least one of these indices and no deterioration in the remaining indices.
c. Where multiple disaggregated indicators are used, the number with improved resilience will be one of the following, depending on the relationship between the indicators as discussed in Step 3 (d-f):

    i. Number with improved resilience as represented by one or more indicators, and with no deterioration in resilience based on the remaining indicators, for *additive indicators* representing incremental improvements in resilience as in (see Step 3e).
    ii. Number with improved resilience in all 'core' indicators that must all indicate an improvement for resilience to be said to have improved as a result of the project, where indicators are not simply additive (see Step 3e).
    iii. Number with improved resilience as in (i) or (ii) above, taking into account any resilience thresholds that need to be exceeded for specific indicators (see Step 3f).

All reporting of numbers with improved resilience as a result of project interventions needs to be accompanied by evidence that the improvements in resilience in question can be attributed in whole or in part to the project (see Step 8 below).

While KPI4 only requires reporting of 'numbers with improved resilience', some projects might be in a position to report the extent to which resilience has been improved, or the numbers for whom resilience has remained the same and the numbers for whom it has deteriorated (Step 3g, Table 1). KPI4 should be disaggregated by gender and might also be

disaggregated by other categories. A description might be given of those in the target area who were excluded from benefiting from the project. Reporting of KPI4 should be accompanied by some contextual information detailing how factors driving resilience that are not related to the project are changing. The way these issues should be reported for bronze, silver and gold standards is summarised in Table 4.

	Bronze	Silver	Gold
Headline indicator	Number	Number	Number
Categories of resilience	Improved, same, deteriorated	A simple scale	A more complex scale with the ability to divide into explanatory variables.
Disaggregation	Gender	Gender + number of pre-determined categories	Gender + other categories that have been found to be associated with, systematic, statistically significant differences in indicators/ scores, based on quantitative assessment of indicator data.
Those excluded	Not required	Identify those unable to benefit from the project in area housing target population.	Quantify those unable to benefit from the project (i.e. how many people); how has their resilience changed (qualitative description or tracking using equivalent/ comparable indicators to those used for beneficiaries).
Contextual narrative	Simple description by project staff of process and trends influencing resilience at large (i.e. outside of project context)	Estimate direction of change for processes and trends influencing resilience at large (i.e. outside project context)	Quantitative description of processes and trends influencing resilience at large (i.e. outside project context) with narrative of how beneficiaries' experiences differ from wider context.

Table 4 Different standards for reporting against KPI4

8. Address attribution

Evidence needs to be provided to establish the extent to which improvements in resilience can be attributed directly or indirectly to a project. At the very least this should consist of a convincing narrative that links measured changes in resilience to a project's theory of change. This should be based at least in part on participatory methods/beneficiary perceptions/feedback that address why measured changes in resilience as represented the indicators developed under Step 3 did or did not occur (and, where feasible, how and why they did or did contribute to improved well-being).

A counterfactual should be presented describing the situation that would be expected to pertain if the project had not been implemented. This might simply compare the situation before and after project intervention(s), with the situation before the project representing the counterfactual. In such a case, an argument should be presented that resilience would not have improved anyway, for example due to other factors or processes outside of the project context (e.g. government investment, changes in the wider economic context, and improvement in climatic conditions, etc.).

More sophisticated counterfactuals might compare the resilience of different groups of beneficiaries at different times for a phased intervention, or use control groups. Control groups should have similar characteristics to beneficiaries and be exposed to the same

stresses and shocks. Assessment of the resilience of control groups might involve qualitative narratives bolstered by secondary data/evidence, or the tracking of resilience among control groups using similar indicators to those applied to the beneficiaries (although this might present practical and ethical challenges). The instances in which rigorous comparisons based on randomised control trial methodologies are applicable are expected to be rare. Panel surveys might also be employed, but specialised advice should be sought on how to conduct these for such a purpose.

Going beyond the attribution of improved resilience to project activities, projects might also seek to attribute changes in well-being at the impact level to changes in resilience at the outcome level. This might include consideration of variations in the frequency and severity of shocks and stresses, so that impact indicators can be interpreted in the context of these variations.

Table 5 summarises how attribution should be addressed for the bronze, silver and gold standards.

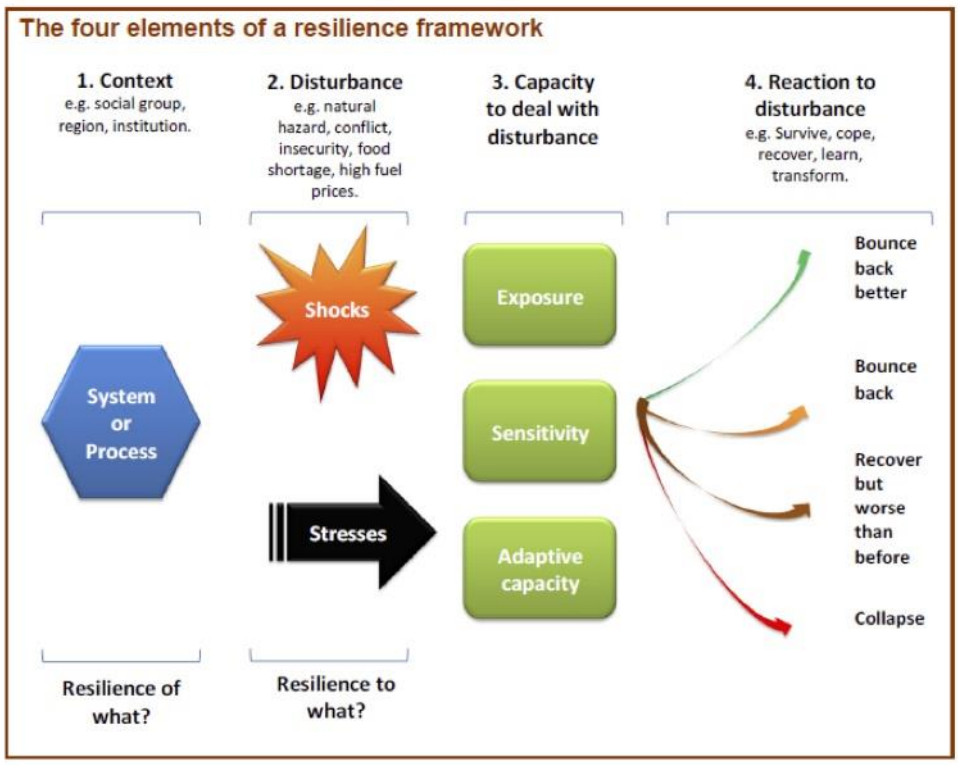
	Bronze	Silver	Gold
Attribution narrative	Simple explanation of how & why resilience has changed by project staff	Participatory enquiry based explanation of how and why resilience has changed. Include those 'excluded' from benefit.	Participatory enquiry based explanation complemented by other evidence, e.g. timing of changes in factors/processes represented by indicators in relation to project activities/ outputs. Include those 'excluded' from benefit
Counterfactual	Before/after	Use of phased intervention approach to examine differences in resilience (and if possible impacts) across groups at different levels of intervention for different sampling periods.	Some experimental or quasi-experimental design (e.g. use of control groups, areas or populations).
Compare KPI 4 with well-being impact indicators	Not required	Semi-quantitative comparison – have those with increased resilience experienced better well-being outcomes than those without?	Quantitative analysis – statistical correlation of resilience indicators measured before shock with impact indicator measured after shock, or of resilience indicators with time-lagged impact indicators.
Factor 'level of shock and stress' into the comparison	Not required	Qualitative consideration of level of shock and stress, e.g. how do results compare with expectations given variation in frequency & severity of shocks & stresses.	Quantitative comparisons of impact indicators with relevant climate indices (e.g. statistical modelling or plotting of time series data), complemented by qualitative assessment/ narratives.

Tables 5 Different standards for addressing attribution

Annex 2 Outline of a possible methodology for project-level M&E

The DFID Resilience Framework (Figure A1) provides a useful template for mapping out a project monitoring and evaluation framework that links the measurement of resilience, as discussed in this report and Annex 2, with the measurement of losses, damages, and changes in human well-being associated with climate (change) hazards. Using the resilience framework as a starting point, and drawing on the general discussion of links between output, outcome and impact indicators, as well as the contextualisation of impact indicators using indicators or indices of climate hazards, this annex outlines a provisional methodology for project-level M&E based on nine steps. These steps have been constructed to map closely onto the resilience framework, and with attention to programmatic reporting requirements against KPI4. The emphasis on KPI4 means that the methodology needs to focus heavily on the measurement of resilience at the individual level.

Figure A1 The DFID Resilience Framework



The draft methodology described here should be regarded as a work in progress and a starting point for further discussion and development.

The steps are outlined below.

Step 1. Characterise the resilience context (Element 1 of the resilience framework)

This step overlaps with the project scoping phase, during which beneficiaries are identified, project goals and objectives set, and outcomes and impacts defined. During this step, M&E planners should:

i. Identify the **beneficiaries** of the project whose individual resilience will be tracked.
ii. Identify the **systems, processes and resources accessed by the beneficiaries**, so the resilience of these systems and processes (i.e. resources) can be tracked.

To a large extent, the above should be achieved during general project scoping/development. However, the links between individual beneficiaries and the systems, processes and resources on which they depend, and on which their individual resilience is founded, is particularly important. The resilience of individuals is a function of their individual characteristics and capacities, but also of their access to key systems, processes and resources (SPRs), and of the resilience of these SPRs. These factors need to be identified at the outset of M&E design, so that appropriate indicators of individual capacities, access to SPRs, and resilience of SPRs, can be identified.

Where a project is concerned with the resilience or well-being of disadvantaged or highly climate-vulnerable groups, participatory methods should be used to identify these groups and the systems and processes through which shocks and stresses result in adverse impacts.

Step 2. Identify key stresses and shocks (Element 2 of the resilience framework)

The identification of *hazards* is important for two key reasons. First, once these have been identified, the consequences and impacts associated with them may be more readily identified and interrogated. Second, an understanding of how these hazards have changed/are changing over time is crucial to the interpretation of impact indicators (e.g. through contextualisation or normalisation as described in Section 3.4 above).

i. Identify the principle **existing climate-related *hazards*** (droughts, floods, storms, increase rainfall variability, long-term sea-level rise or aridification, etc.), based on general knowledge of context, meteorological/climate data, data on climate-related disasters/losses, and participatory surveys in which people identify a range of stresses and hazards, which will include, but not be limited to, climate-related hazards.
ii. Identify any **observed changes/trends in climate-related hazards**, to establish baseline information and identify any hazards that are already intensifying and have the potential to become more problematic in the future.
iii. Identify, as far as possible, **how hazards may evolve in the future**: what are the plausible ranges for changes in the frequency and intensity of existing hazards; what new hazards may emerge? Use expert judgment informed by climate data (models, projections).
iv. Develop **climate hazard indicators/indices** to track frequency and intensity of hazard, and to provide context for the interpretation of impact indicators (Step 3). Hazard indicators may be developed using a range of methods, from participatory surveys that seek to identify the number of 'problematic' hazards occurring over a given period, to the development of composite climate indices based on meteorological/climate data (see Section 3.4 above for further guidance).

It is recognised that the acquisition, and particularly the primary collection, of meteorological/climatological data may pose particular challenges, as might the construction of indices and the analysis and interpretation of climatological data. Therefore, it is not recommended that detailed analysis of such data, and quantitative normalisation of impact indicators using these data, is a reporting requirement. Instead, it is recommended that projects make *some* attempt to describe how hazards are evolving and what the implications of changes in hazards are for the interpretation of impact indicators. This might be at a very basic level, based on qualitative, subjective data from beneficiaries. More detailed and complex analyses may be carried out if data and resources permit.

Step 3. Identify key consequences of stresses and shocks (Element 4 of the resilience framework)

It is important that the key consequences of the hazards identified in Step 2 are identified, as these this will enable project staff to identify appropriate project impact indicators. These will seek to track improvements in human well-being in the face of evolving climate hazards that might act to reduce well-being, and to test the extent to which these improvements can be attributed (partially or wholly) to project activities.

i. Identify the **principle adverse consequences associated with the hazards** identified in Step 2, based on general knowledge of context, economic data, disaster data, and participatory surveys with stakeholders/project beneficiaries.
ii. Identify/develop indicators of to represent the **impacts of climate hazards on human well-being**, e.g. in terms of mortality, economic impacts, etc.

*These indicators measure the impacts of climate and other hazards on human well-being, but can also be used as **project impact indicators**. Improvements in these indicators relative to a no-project scenario, or improvements in normalized versions of these indicators over time (Step 5), might be linked with project activities and represent the ultimate impacts of the project on human well-being. These indicators measure changes in well-being, and changes in the impacts of climate hazards, after hazards have occurred.*

Step 4. Identify determinants of resilience (Element 3 of the resilience framework)

People's resilience to evolving hazards and related stresses will depend on (i) a suite of characteristics related to their personal or individual capacity to anticipate, plan for, cope with, recover from and adapt to those hazards and stresses, (ii) their access to systems, processes and resources (SPRs) that help them anticipate, plan, cope, recover and adapt, and (iii) the resilience of those resources themselves. These three aspects of resilience will interact in a complex manner. Using a combination of contextual knowledge, literature review, interviews with key stakeholders, and wider participatory assessment, project staff should identify:

i. The factors that affect the **functioning/viability/availability** of SPRs on which the intended project beneficiaries depend, and that determine the extent to which these resources are resilient *to the hazards that are likely to be encountered over the period relevant to the project (including project impacts long after it has ended).*
ii. The factors that affect people's **access** to these resources.
iii. Other factors that affect people's **individual capacity** to anticipate, plan for, cope with, recover from and adapt to the same hazards.

These factors might be identified through participatory assessments that ask questions about:

- The underlying factors that determine who is worst affected and why, i.e. the factors that make these people sensitive or vulnerable;
- The underlying factors that help people cope with and recover from the hazards and their impacts, i.e. the factors that make people resilient;
- What needs to be done in order to ensure that people can anticipate, plan for, cope with, recover from and adapt to evolving climate hazards? Asking people what changes would help them cope better with climate hazards and other stresses helps to ensure that project outputs are relevant. Identifying the changes required for

people to cope better with climate hazards enables indicators to be developed that can track whether these changes have occurred, and to what extent.

Based on the identification of the above factors, and in partnership with stakeholders, project staff should identify/develop **context-specific indicators** representing resource resilience (i above), degree of access to those resources (ii above), and individual capacities (iii above). These indicators should be validated using participatory methods.

Resilience indicators might be grouped into those representing the three dimensions of resilience in the resilience framework, namely:

i. **Exposure:** the factors that determine the extent to which people or locations within an area subject to a hazard are likely to experience the immediate physical impacts that hazard, for example elevation or proximity to shoreline in the case of flooding.
ii. **Sensitivity:** the factors that make people more or less likely to experience adverse consequences when they are exposed to a hazard, including their ability to cope with the hazard while it is occurring and to recover after it has occurred.
iii. **Adaptive capacity:** the factors that allow people (and relevant institutions) to anticipate and plan effectively for change, to learn from experiences of previous hazards, and to act on the lessons of that experience.

These dimensions might be broken down into sub-dimensions, or a different set of resilience dimensions might be used depending on what is appropriate in the context in question (see discussion in main text of report and Annex 2).

A project may not be able to address all the factors that influence resilience, and staff may wish to focus on indicators representing factors that it can address. However, it may also be useful to develop indicators representing factors that the project cannot affect but that themselves influence resilience. These factors may change in a way that makes the securing of enhanced resilience and well-being more difficult, and it will be important to account for such 'confounding factors) in the evaluation of project success.

A straightforward alternative to the construction of quantitative indicators is the use of participatory community assessments to establish whether resilience has improved. This might be based on questions around specific factors identified as important influences on resilience (points i-iii above in this step). Alternatively, it might be based on more general questions related to whether people feel that they are better able to cope with or adapt to the hazards identified in Step 1.

*Changes in key resilience indicators that can be linked to project activities can be used as measures of project **outcomes** (Annex 3), and as a means of monitoring project effectiveness over the project implementation phase (i.e. in terms of enhancing resilience). These indicators measure the characteristics of people and systems that determine how they will be affected if they encounter a hazard, and are effectively **predictive indicators.***

Step 5. Establish how impact indicators will be contextualised

To get a true picture of project impacts on human well-being, it is necessary to establish how impact indicators (Step 3) would have varied without the project. This may be done through:

i. The establishment of a 'no intervention' baseline or counterfactuals involving a projection of well-being indicators and/or indicators that measure the impacts of climate hazards from a point prior to the implementation of the project. This will only be possible where there are robust, established statistical relationships between

hazard indicators and well-being/impact indicators, representing the period prior to project implementation. These relationships may be used to model how and well-being would have changed in the absence of the project, using the hazard indices described in Step 2. Other trends, e.g. in population and the value of assets, may also need to be taken into account. Modelled changes in well-being and the impacts of climate hazards/disasters may then be compared with recorded changes.

ii. The 'standardisation' of well-being/impact indicators with respect to population (e.g. for mortality data), value of assets exposed (e.g. for economic loss data) and hazard frequency and severity (all data, using indicators developed in Step 2).

iii. Qualitative and participatory approaches, either as a 'stand-alone' where data availability does not permit either of the above approaches, or as a 'reality-check' to complement quantitative approaches. Carefully sampled opinions from participants asking something as straightforward as whether the interventions from the project 'helped',' hindered' or 'made no difference' in a recent shock and why (or why-not) can be valid and should not be disregarded even when quantitative data is also being used. This can also be an important way of discovering unexpected outcomes or processes.

Step 6. Decide whether to use composite indices or disaggregated indicators

Composite indices might be constructed to represent hazards, resilience outcomes, and impacts on well-being. Hazard, resilience and well-being might each be represented by a single composite index. Alternatively, each of these elements might be represented by multiple composite indices (e.g. separate hazard indices for drought and flooding; separate indices for different dimensions of resilience).

When using composite indices, it is important to ensure that:

i. Separate indices are used to represent the hazard, resilience/capacity (outcome), and well-being/response (impact) elements of the resilience framework.

ii. Disaggregated indicator data are readily accessible alongside composite indicators, so that the roles of different factors in driving changes in the composite indicators can be identified (for learning, identification of confounding factors, and explanation of unexpected results).

Step 7. Reporting against KPI4 (no. of people with increased resilience)

One of DFID's Key Performance Indicators (KPI4) is 'Number of people whose resilience has been improved as a result of ICF support'. At the project level, this can be estimated by identifying how many individuals have (enhanced) access to resources with improved resilience, or experienced improvements in other factors that make them individually resilient (Step 4). These project level estimates may be aggregated across a programme such as BRACED.

At the project level, estimates of numbers of people whose resilience has been improved can be made using indicators of individual resilience and indicators of access to SPRs whose resilience has been maintained or enhanced. Individuals may be surveyed directly, or the unit of analysis might be the household, provided the links between household and individual resilience are understood and differential resilience and vulnerability within households is accounted for.

Numbers of people with improved resilience might be estimated using participatory community assessments in which participants are asked how many people (and who) are better able to cope with or adapt to certain hazards and stresses. Where M&E employs

indicators of resilience (Step 4), numbers of people reporting an improvement in N indicators might be estimated, where N is a threshold that recognises the multidimensional nature of resilience, requiring improvement in a number of key indicators before 'overall resilience' can be said to have improved.

A more complex methodology might be employed to estimate the degree to which resilience has been enhanced at the project level, based on the conversion of indicator data to scores. A methodology is described for KPI4, which involves the following steps:

i. For any given resilience indicator or index, disaggregated to the individual level[20], a score of 1 to 5 (representing low to high resilience) is assigned to an individual on the basis of their quintile position in the range of values of that indicator.
ii. Indicators are measured at regular intervals (e.g. every 6 months or every year), and scores recalculated based on the original quintile divisions, which constitute the baseline.
iii. Changes in scores are calculated at the individual level.
iv. Numbers of people exhibiting increases in resilience as represented by increased scores are calculated for each indicator or index.
v. Performance is judged on the basis of some combination of numbers of people with increased resilience, the number of indicators/indices exhibiting an increase, and the magnitude of the changes in scores.
vi. Programme performance can be judged by aggregating the numbers of people with increased scores in a minimum number or percentage of indicators.
vii. Project might be compared on the basis of these scores, but the diverse nature of the contexts, challenges and goals needs to be acknowledged in any such exercise.

The use of scores to represent changes in resilience as measured by a particular index or indicator delivers some consistency and comparability across different project contexts. Standardised scores enable reporting not just of numbers of people with increased resilience, but of numbers of people improving their resilience scores by different amounts.

Step 8. Address issue of attribution/contribution

Attribution of enhanced resilience to a project can be addressed through the following complementary actions.

i. Comparison of groups or locations targeted by a project with other groups or locations that are not targeted by the project but which otherwise experience very similar development conditions and challenges (i.e. randomized control trial type comparisons). This approach requires an investment in monitoring of the same indicators outside of the target group or location, and may raise ethical issues, even if an appropriate control population or location can be identified.
ii. Continual stakeholder engagement and feedback to develop stakeholder narratives[21], built around questions that address the extent to which

[20] An indicator may be measured at the level of a system or process, such as an agricultural system or household. Changes in that indicator can then be used as indicators of individual resilience for those who access that system or process and who will thus benefit from increased system/process resilience. Any resilience gains due to increased resource/system resilience might be offset by changes in individual access to that resource (resources may become more resilient due to changes in management regimes, but these changes might exclude certain groups who depend on those resources).

[21] These narratives may be developed into an explanatory theory of change that can be used to test the assumptions behind the project as articulated in the initial or predictive theory of

desirable/intended and undesirable/unintended changes have been experienced by stakeholders, and elicitation of stakeholder explanations of how and why these changes occurred. Stakeholders may also be asked directly about how they view the project in terms of its success in delivering the intended changes, in enhancing resilience, and in terms of its wider impacts on well-being.

Step 9. Address resilience-well-being links

The ultimate purpose of adaptation and resilience building is to **secure human well-being in the face of climate change**. Measuring improvements in resilience indicators is meaningless if these cannot be linked with enhanced well-being. In this sense, resilience may be viewed as an **outcome** of projects and programmes that contributes to longer term project or programme **impacts** involving improved well-being. The extent to which enhanced resilience is associated with positive impacts on well-being can be examined by assessing the relationship between resilience (outcome) indicators (Step 4) and well-being (impact) indicators (Step 3). Such analyses can reveal whether improvements in the former are robustly linked with improvements in the latter, through:

i. Regression or other statistical analyses to reveal robust correlations between resilience (outcome) indicators and well-being (impact) indicators (taking account of any built-in co-variance resulting from the use of similar indicators in composite indices).
ii. Qualitative and participatory comparisons that ask whether improvements in resilience indicators are accompanied by improvements in well-being indicators and that seek to develop explanatory narratives of whether and how these improvements are linked.

Step 10. Use theories of change for learning

The above steps should generate important lessons about a variety of issues including the nature of resilience; how it can be represented (e.g. by indicators); the causal pathways linking hazards to deteriorations in human well-being; and the pathways linking project outputs, outcomes and impacts. These lessons may be synthesised in an explanatory theory of change (ToC) developed retrospectively, based on the evidence gathered during project implementation and M&E. A key learning opportunity is to compare such explanatory ToC with predictive ToC developed during the project scoping and design phases. The development of a ToC at the beginning of a project is a powerful way of making explicit the assumptions behind project design so that they may be interrogated and challenged. The comparison of predictive and retrospective ToC enable the assumptions in the former to be tested against experience. Where such assumptions are not validated by experience, an explanatory ToC can investigate why, providing new, more evidence-based narratives that can inform future interventions and reduce the risk of poor project design based on false assumptions.

change, and are thus a key element of the adaptation and resilience-building learning process.

Annex 3 Resilience, risk, and vulnerability

The DFID resilience framework has much in common with risk and vulnerability frameworks that are used widely in the fields of climate change adaptation and natural hazards/disaster risk reduction (DRR).

Risk frameworks

Risk frameworks address the risk that a system will experience an adverse consequence when it is exposed to a disturbance or hazard. In these frameworks, risk tends be viewed as arising from the interaction of 'external' hazards with the 'internal' properties or characteristics that make that system sensitive or vulnerable to hazards. In other words, risk is a function of hazard and vulnerability, where vulnerability describes the set of characteristics of a system that make it sensitive or susceptible to harm when it is exposed to a hazard. In other words, vulnerability represents the 'detrimental part of sensitivity' (Smit et al. 2001). The 'harm' in question depends on the nature of the system. For example, if we are concerned with a human population this will be measured in terms of negative changes in well-being. If we are concerned with an ecosystem the harm in question might be measured in terms of biodiversity loss or disruption of food webs (where an ecosystem is sensitive to hazards it might suffer a reduction in resilience that represents a positive feedback). In agricultural systems, harm might be measured in terms of loss of productivity

The 'hazard' component of risk as defined above maps to the 'disturbance' column of the resilience framework, and the vulnerability component effectively maps to the 'capacity' column. The consequences of the interaction of hazard and vulnerability (i.e. the risk itself) map to the 'reaction column of the resilience framework'. The greater the risk, the more likely it is that the system ('context' column of the resilience framework) will recover but be in a worse condition than it was before it encountered the hazard, or that the system will collapse.

Vulnerability frameworks

In the literature related to climate change adaptation, vulnerability-based frameworks tend to fall into two broad categories. One category focuses on the consequences of exposure to stresses/hazards, for example through measurement of losses or damages (Adger 2006). O'Brien et al. (2007) describe this as the 'outcome vulnerability' approach, linked to a framing of vulnerability grounded in the physical sciences. The IPCC definition of vulnerability is an example of such a framework, viewing vulnerability in terms of susceptibility to harm, and as a function of exposure, sensitivity and adaptive capacity (IPCC 2001, 2007). This framework has been used widely since it first appeared in the IPCC Third Assessment Report (TAR) in 2001 (e.g. Allison et al. 2009; Pandey and Jha 2011, Notenbaert et al. 2012, Sonwa et al. 2012), and is reflected in the dimensions identified in the 'capacity' column of the DFID resilience framework.

The second category of framework views vulnerability in terms of social conditions, and draws heavily on the literature on livelihoods and poverty. O'Brien et al. (2007) refer to this as the 'contextual vulnerability' approach and locate this within what they call a 'human security' framing of vulnerability. This category is less concerned with outcomes themselves, and more with the socio-economic conditions and governance contexts that make negative outcomes more or less likely. In this framing, vulnerability is often viewed in terms of absence of entitlements or access to resources, broadly defined to include physical resources, support networks, governance processes, and various types of 'capital' (social, human, education, financial, etc.) (Adger 2006).

The key difference between these two ways of framing vulnerability is in the treatment of exposure. Frameworks that view vulnerability as a function of exposure, sensitivity and adaptive capacity explicitly relate vulnerability to the extent to which people and systems are exposed to hazards. In the IPCC definition of vulnerability, exposure is described in terms of "the character, magnitude, and rate of climate change and variation to which a system is exposed" (IPCC 2007, p.883). The definition of vulnerability in these frameworks is similar to the way risk is defined in much of the natural hazards literature, with the addition of adaptive capacity, a result of the explicit consideration of changes in climate that will unfold over timescales longer than those historically considered in the field of DRR.

In frameworks that view vulnerability in terms of social conditions, the concept of vulnerability echoes that of sensitivity, and vulnerability may be seen as either equivalent to sensitivity or as a component of it (i.e. the detrimental part). In such frameworks, which echo natural hazards/DRR risk frameworks, vulnerability may also be viewed as a measure of resilience (Adger 2006).

While the definition of vulnerability used in the 2001 TAR was retained in the 2007 Fourth Assessment Report (AR4), the more recent IPCC SREX report (IPCC, 2011) employed risk-based language and concepts that reflect the natural hazards view of risk as a function of hazard and vulnerability. It appears likely that the next IPCC report (AR5) will continue the emphasis on risk frameworks, and move away from the idea of vulnerability as a function of exposure, sensitivity and adaptive capacity.

Large-scale versus differential exposure

The concept of exposure can be problematic. On the one hand it can describe the extent to which a geographic area or population at large is exposed to hazards as a function of hazard frequency and severity (large-scale exposure). On the other hand it can refer to the varying extent to which locations and people within a region or population experience the same hazard and its primary impacts (differential exposure).

Distinguishing large-scale exposure from differential exposure is particularly helpful in frameworks that include elements explicitly relating to disturbances or hazards, such as the DFID resilience framework. On the one hand this allows hazards themselves to be represented in terms of large-scale exposure, for example through climatological indices that represent factors such as hazard frequency, intensity, duration and spatial extent. On the other it allows the differential physical exposure of people and places to any given hazard to be represented by indicators such as elevation above sea-level or flood-plain level, proximity to coast, topography (e.g. in relation to risks from land-slides), etc.

For practical purposes, differential exposure might be treated as part of sensitivity. This also avoids the problem of deciding whether exposure should also include factors such as nature of livelihood (e.g. a livelihood for which a particular hazard is relevant) or dependence on marginal resources, or whether such factors instead should be treated as contributors to sensitivity.

Relationships between resilience and vulnerability

The concepts of resilience and vulnerability are closely related and have common elements such as the shocks and stresses experienced by a (socio-ecological) system, the response of the system, and the capacity of the system to act in an adaptive way (Adger 2006). Put another way, and in a more human context, both are concerned with the factors that influence people's ability to cope with and respond to change.

As a result, the factors that influence resilience will be strongly related to those that influence vulnerability, and there is a sense in which resilience might be viewed as the inverse of vulnerability. Nonetheless, there are important differences in way the concepts of resilience and vulnerability are framed. Resilience emphasises capacity to withstand and recover from disturbance, with a focus on socio-ecological systems, while vulnerability emphasises susceptibility to harm as a result of exposure to a disturbance, and (at least in one tradition) tends to focus on people, livelihoods and entitlement.

The choice of whether to frame responses to climate variability and change in terms of resilience or vulnerability can have important implications for development and adaptation pathways and outcomes. A focus on resilience rather than vulnerability can result in adaptation actions benefiting those best placed to take advantage of governance institutions while excluding the most vulnerable, entrenching and/or exacerbating inequality and poverty (Adger 2006). Resilience narratives can also underestimate the magnitude of the climate change challenge, for example by failing to recognise limits to adaptation that mean the most appropriate adaptation responses might involve abandoning or replacing existing systems rather than seeking to sustain them through enhanced resilience. Such approaches might result in resilient but undesirable states (e.g. poverty traps), and might be maladaptive, increasing resilience to specific existing stresses while preventing systems from evolving in response to longer-term changes, and even increasing the risk of abrupt and catastrophic collapse when thresholds of change beyond which systems cannot be made resilient are breached (Dow et al. 2013; Maru et al. 2014). These risks need to be addressed in the context of resilience interventions, for example by screening projects for risks of maladaptation.

A focus on vulnerability can address the problem of exclusion by explicitly identifying the most vulnerable and ensuring that adaptation actions are targeted to reduce their vulnerability. However, vulnerability-based frameworks have been criticised for their potential to treat people as passive recipients rather than active participants in the adaptation process, and for ignoring the resilience that often resides in remote and often marginalised populations (Maru et al. 2014). In many instances, the vulnerability of such groups is closely related to policy contexts that drive marginalisation, for example by restricting access to key resources. This is the case throughout most of the Sahel, where the potentially high adaptive capacity – and high resilience - of mobile pastoralists is undermined by policies that discriminate against mobile pastoralists in favour of sedentary agriculture (Bloch and Foltz 1999; Brooks 2012).

In recognition of the problems associated with a focus solely on either vulnerability or resilience, recent studies have emphasised the need to combine these approaches (e.g. Maru et al. 2014). Attention to vulnerability can ensure that resilience does not simply reinforce existing patterns of inequality, while a focus on resilience might result in much broader ‘buy-in’ from a range of stakeholders than a (perceived) more narrow focus on vulnerable and marginalised groups.

Annex 4 Techniques and methods used for measuring resilience

A variety of techniques are employed by the methodologies for measuring resilience reviewed in this report. These are discussed below.

Statistical techniques

These may include time series, panel, and/or any linear modelling analysis using large sample sizes that can provide statistical power to make the analysis possible. Statistical models normally assume a linear relationship between the dependent and independent variables and a unidirectional causal relationship, which can be quite problematic in resilience measurement. For example, socio-economic indicators and resilience may be conceptualised or used in the resilience literature as having a bi-directional relationship (hence sometimes one is the determinant of the other and vice versa).

Statistical techniques can avoid double counting (outcomes may be counted as common to two or more independent variables due to high correlation between them (explaining the same thing). Therefore, the problem of including too many indicators that can potentially explain (and which may be potentially explaining the same thing about) the latent variable that is resilience may be avoided.

However, as in most modelling exercises, the type of data available for important qualitative characteristics such as sex (male or female), age, education level, etc., being either nominal or ordinal variables, can be included in the model as dummy variables (0,1) only. While it can be argued that there is not much information lost in collapsing them into dichotomous variables (e.g. unlike income which is best used in its continuous form), the problem arises in the model specification because of the tendency to include a large number of dummy variables which may be insignificant ("dummy variable trap") and therefore will only make the model unreliable.

Multivariate techniques

These normally represent a preliminary step used to analyse the underlying structure of data but on their own can also be used to (i) test dimensionality of a construct and (ii) generate weights ("factor loadings") for indicators which can be aggregated to (ii.a) generate composite scores for each dimension (e.g. Tulane University) and then (ii.b) construct a composite index (e.g. FAO). There is no need for studies to construct the overall index from the composite scores. The composite scores are (and can be) used as a continuous variable in a statistical model (e.g. Tulane University).

The assumption is that the concept to be assessed is unobservable ergo the observed variables are "characteristics" of the latent concept. In this case, resilience" is conceptualised as a latent variable which can be explained or modelled through observed variables or characteristics postulated to be linear functions of unobserved latent variables called factors. The most commonly used techniques are principal component analysis, cluster analysis, and factor analysis (can be exploratory or confirmatory). Tulane University used principal component analysis, University of Florence used factor analysis, and FAO used a combination of cluster analysis (step 1) and confirmatory factor analysis (step 2).

The advantage of using multivariate techniques is that they minimise the arbitrariness in the (i) inclusion of indicators (since it identifies indicators that have the largest variation across the distribution through "factor loadings") and (ii) assignment of weights to these indicators (as weights are derived from the variance of the indicators). It can also provide an analysis of the adequacy of a set of indicators in explaining the construct in question. At the same

time, it can also yield a more parsimonious calculation and reduce double counting of highly similar attributes by including only the indicators that explain the greatest proportion of variance in the observed variables. The downside of this, however, is that the same weights are purely data-driven and therefore do not really carry any real meaning that resembles people's "valuation" of these indicators in real life (i.e. external validity). In addition, the weights are very much data dependent and therefore are variable.

There is also a question on the incorporation of qualitative characteristics and other possible explanatory variables that may be of nominal or ordinal nature. There are a number of caveats that must be considered and factor loadings have to be interpreted very carefully. This is because categorical values are interpreted in the cardinal sense. For example, in the FAO study, it will be interesting to know how the indicators within the Access to basic services dimension have been used, e.g. how they were scaled, whether distance has been used (hence a continuous variable), or how the factor loadings have been interpreted with ordinal indicators such as level of education, quality of assistance, etc.

List of indicators used by FAO (in TANGO International)

Assets: housing, durable index, tropical livestock units (TLU), land owned
Income and food access: income/expenditures, Household Food Insecurity Access Score (HFIAS), Dietary Diversity Score (DDS)
Access to basic services: physical access to/quality of health services, education, security, mobility/transportation, water, electricity and phone networks
Social safety nets: cash/in-kind assistance, quality of assistance, job assistance, frequency of assistance
Adaptive capacity: income diversity, level of education, employment ratio, coping strategies, food consumption ratio
Stability: household jobs lost, changes to income/expenditures, safety net dependency, stability of education system, capacity to maintain stability in future

The University of Florence made use of 11 indicators. Most if the indicators are continuous variables, e.g. per capita income, values of house and other assets and capital, transfers received, etc. Similar to FAO, the study made use of categorical variables mostly to measure adaptive capacity.

Income and food access: per capita income
Access to basic services: distance to the nearest health facility, school, water source, and access to a safe sanitation system, electricity
Agricultural assets: value of land, livestock (TLU), machinery and other capital assets owned
Non-agricultural assets: value of the house in which the family lives, and durables owned
Household technological level: value of all agricultural and non-agricultural capital and installations owned, hired and shared by the household
Social Safety nets: transfers received from public institutions
Social Safety Nets: transfers received from other households, NGOs, religious organizations, etc.
Adaptive Capacity: number of household members who are income earners, number of sectors of employment earned by household members, educational attainment of all household members/household head, employment ratio, food share, health insurance)
Physical Connectivity: household owns at least one TV, whether paved/maintained roads reach household, household owns at least one motorized means of transportation
Household Structure: dependency ratio
Economic Connectivity: share of food to total household expenses, access to credit, ownership of financial assets

Tulane University included seven dimensions to construct its resilience measure:

Wealth: This dimension includes financial and physical capital, income expenditures and food security/consumption measures.
Debt and Credit: This dimension includes information on the use of credit to access food and non-food items necessary for survival. Although access to credit can increase household resilience, use of credit (i.e., accumulation of debt) for survival is an indication of vulnerability.
Coping Behaviours: This dimension includes household behaviours used to respond to shocks as well as those they might use to respond to future shocks. This dimension does not focus on the ability of households to respond, but rather on the consequences of certain coping strategies (i.e., negative) that can lead to loss of household resources.
Human Capital: Human capital involves the skills and abilities that enable households/individuals to generate income and have access to food and goods and services. For the purposes of the Humanitarian Assistance Evaluation, this is represented by level of education and workforce capacity within the household.
Protection and Security: Protection and security were measured in terms of self-reported experiences, perceptions and opinions of household members related to their personal sense of security and their reported exposure to personal and property crime.
Community Networks: Related to the concept of social capital, this dimension reflects the connectedness of households to groups—particularly those related to livelihoods, income or decision-making within the community— and community decision processes.
Psychosocial Status: Psychological status and well-being of household heads is a dimension of resilience not often measured but that can affect how individuals and households manage risks, and respond and adapt – or fail to adapt – to shocks and stresses. The composite psychosocial score used here was created using two composite scales based on household survey data. The General Health Questionnaire – 12 (GHQ-12) measures acute psychological stress resulting from loss of sleep from worrying, loss of concentration, difficulty making decisions, depression, etc. The Well-Being Index (WBI) rates respondent perceptions regarding their personal satisfaction in eight life categories, including standard of living, health, relationships, safety, community-connectedness, etc.

Composite Indices

These provide the simplest and most transparent measure of resilience. They are however not immune to criticisms especially on the selection of indicators (what constitutes resilience, comprehensiveness-comprehensibility trade-off), weighting decisions (arbitrary or data-driven?), setting the thresholds (who is resilient, at what level do we say that a household or community is resilient?), and aggregation techniques (across indicators and across dimensions). Examples of studies that used composite indices in the papers reviewed include the University of Florence (Agriculture Resilience Index as above) and Oxfam GB (Alkire-Foster Index).

The Alkire-Foster Index is a modified Foster, Greer, and Thorbecke family of poverty measures (FGT) which include the headcount ratio (poverty count), poverty gap (breadth), and squared poverty gap (depth). It was originally formulated as a measure of multidimensional poverty within the Senian Capability Approach and therefore conceptualises development as expansion of freedoms (Development as Freedom, 1999).

McGillivray and Noorbaksh (2004) provide a useful summary of composite indices and critique in the context of human development and poverty measurement. Their critique resonates on the resilience measurement using composite indices as well. This includes (i) indicator selection is by and large ad hoc; (ii) universalism or the assumption of uniform needs and contexts; (iii) combining measures of means (e.g. income, assets) and measures of outcomes/results (well-being, health, psychosocial measures); (iv) equivalence scales- we cannot assume that transformations over time are comparable; (v) correlation between

indicators- not immune to double counting; (vi) weighting- if correlation is high then there's no point weighting.

Indicators and dimensions included in the measurement must reflect the priorities and contexts in different geographical space and over time, reflecting as well the achieved levels of well-being, cultural specificities, etc. To a certain extent, it can be argued that there is some level of subjectivity in this exercise. But a contextualised measure in my opinion is always better than an entirely data-driven exercise which bears little meaning in the real world.

On the equivalence scales point, this seems relevant to intra-household distribution for there will be a different distribution pattern within households and it is important for differences in age, sex, etc. which are normally assumed to determine the needs and ability to transform resources to achievements (such as well-being or could also be resilience). In income-based poverty measurement (unidimensional poverty), there are various techniques to assign weights to every household member (first adult, child,…) to come up with a representative income. However this is lost in most multidimensional measures partly because some of the indicators used are actually at the household level already (e.g. motorised vehicles or TV set as in FAO), while other indicators such as level of educational attainment are only asked of the household head but are assumed to apply to the whole household.[22]

In addition to the needs which are mostly reflected by equivalence scales, most multidimensional measures do not reflect the rate of conversion of resources such as assets by each individual member of households or communities. This makes it less appealing to assume that the more resources a household has, the more resilient it is to climate risks and climate change. More to the point, the distribution of benefits from these assets within households will differ depending on power dynamics, cultural specificities, etc.

Similarly, there is a distribution issue in any intervention that targets the community level in that not every member of the community can reap the gains equally. In most cases, we try to stick with mean-based measures and assume an even distribution. The notion of "community" needs to be interrogated and validated.

Regarding weighting issues, lessons can be learned from the development of multidimensional poverty measure. Weights must demonstrate the trade-offs between dimensions; they reflect the importance of one indicator relative to the other/s within a dimension and of one dimension relative to the other/s (see Decanq and Lugo 2008, pp. 15-18 for a detailed discussion). Decanq and Lugo (2008) provide the following discussion on the different weights used by most multidimensional poverty measure, which are likely to be relevant to resilience measurement (note that all the cited works below were also in Decanq and Lugo 2008 which was used by this review as main source):

Equal weighting - convenient but "universally wrong" (Chowdhury and Squire, 2006, p. 762). Ravallion (1997, p. 663) for example noted that in the case of HDI, it is assumed that a unit decrease in life expectancy is substituted by a unit increase in income or education.

Data-driven

Frequency-based: the smaller the proportion of individuals with certain shortfall, the higher the weight (hardship shared by a few has more impact than one shared by many) (Desai and Shah 1988 and Cerioli and Zani 1990)

[22] This may be combining two different issues - on equivalence scales and combining individual and household level measures which is quite common in social research is not widely acceptable amongst statisticians.

Quality of data: less weight to variables where data problems exist (Jacobs et. al. 2004), hence more weight can be given to indicators with good data. But why should the relative importance of components and the implied trade-offs be decided by data quality?

Regression-based weights

If constructs can be measured by a linear approximation, then why construct an index?
Multicollinearity- when indicators are highly correlated
Assumes a linear form
Data-specific: non-comparable

Normative weights

Little philosophical or economic reasoning but provides insights on needs and preferences
Participatory - involving individuals but which individuals? And how do we ensure representativeness?

Impact Evaluations

Given resources and other pre-requisites, there may be scope to use counterfactuals even if not in a truly experimental sense. For projects with phased implementation for example, a pipeline method (use the beneficiaries that are not yet receiving support as comparator) can be employed. Non-equivalent counterfactuals can also be used.

The use of technology such as GIS mapping might also be informative in the context of ICF and BRACED programmes since it can effectively illustrate the resilience outcomes achievements of households/communities vis-à-vis the risks that they face. This of course still relies on good quality data and must still be complemented by other techniques to deepen understanding on household and community resilience.

As noted earlier, there are a number of studies reviewed either as part of the TANGO International paper or stand-alone (Oxfam) which went beyond measurement of resilience and tried to establish direct attribution. Most of these studies also used some of the techniques discussed above, or a combination of them, and then used the results in a single difference or double difference analysis to establish attribution.

Tulane University for example, after constructing the resilience dimensions through principal component analysis, used composite scores to measure the impact of humanitarian assistance on resilience using multiple regression analysis. Using matched data, effects on residents living in camps with those not living in camps in affected and non-directly affected areas were compared.[23] The study also made use of technology to illustrate the differences in outcomes between camp/non-camp areas directly affected by earthquake by mapping the composite scores of the seven dimensions onto radar graphs. The quantitative technique was complemented by focus group discussions to strengthen the results of the study.

[23] "Propensity score matching was used to control for differences between households based on potential targeting criteria for humanitarian assistance."

Annex 5 Assessment of applicability of methodologies to ICF/BRACED contexts

STUDY		RESILIENCE MEASUREMENT TECHNIQUE	ASSESSMENT NOTES
1. ACCRA	***Local Adaptive Capacity Framework*** The Local Adaptive Capacity Framework (LAC) was developed by the Overseas Development Institute (ODI) with Oxfam as an analytical lens for social protection, DRR, and livelihood programmes research. It is an outcome of extensive consultations with various stakeholders in Ethiopia, Uganda, and Mozambique. In this framework, adaptive capacity is broken down into five characteristics ("ACCRA's five characteristics of adaptive capacity") such as asset base, institutions and entitlements, knowledge and information, innovation, and flexible forward-thinking decision-making and governance. LAC also contextualises adaptive capacity by incorporating questions related to "situational context".	Paper presented a framework only and not a measurement method	**(1)** A framework only, applicable in social protection, livelihoods, and disaster risk reduction research **(2)** As a framework, may be applied to diverse contexts albeit limitedly since it operationalises adaptive capacity only and no other components of resilience **(3)** Paper does not say whether the five characteristics of adaptive capacity have been subject to statistical testing. **(4)** The framework may be useful for different purposes but as a framework, it still needs to be translated to programme requirements, e.g. map the characteristics onto the project logframe before it becomes functional. Selection of criteria is highly participatory: consultations included governments, CSOs, and ACCRA members. **(5)** Potential of capturing unintended outcomes if operationalised appropriately **(6)** Absence of description of data requirements makes estimates of VfM difficult. Limited to adaptive capacity dimension so limited learning potential for resilience.
2. FAO	**Livelihoods Strategies and Household Resilience to Food Insecurity: An Empirical Analysis to Kenya** Kenyan households are classified according to their own livelihood strategies using the Ward's cluster analysis technique on data from the Kenya Integrated Household Budget Survey 2005-06. The information on shares of income sources, productive assets and occupational activities have been used to let the data identify the most meaningful and homogeneous groupings	**Factor Analysis.** The resilience index is estimated using a two-stage factor analysis strategy. In the first stage, an index for each component is estimated separately using an iterated principal factor method over a set of observed variables. In the second stage, the resilience index is derived using a factor analysis on the interacting components. Explored the determinants of resilience without adjustment to shocks. Found that the determinants of resilience are different	**(1)** Specific to resilience to food insecurity. Theoretical framework was established adequately with a discussion of livelihood and resilience approaches based on academic literature and research. The study is more exploratory/descriptive- **aims at analysing the livelihood strategies of different socio-economic groups in order to better understand the structure of the Kenyan household economy- instead of determining impact of a project/programme and as such it does not really try to establish attribution/contribution.** **(2)** Applicability at the project level is subject to data availability since the measurement is based on secondary datasets. This limits indicators to what is available and measurable, instead of what is truly context-specific. Methodologically, avoids double-counting. **(3)** Selection of indicators is completely data-driven hence there was no

STUDY		RESILIENCE MEASUREMENT TECHNIQUE	ASSESSMENT NOTES
	of Kenyan households in terms of livelihood strategies: pastoralist, agro-pastoralist, small-holder farmers, large-holder farmers, entrepreneurs and wage employees. In order to understand the key determinants of each livelihood strategy and compare different livelihood strategies, the resilience analysis framework developed by Alinovi et al. (2008) was used and updated. Comparing resilience by livelihood clusters in the eight provinces of Kenya shows there are significant differences across provinces and among clusters. Nairobi is by far the most resilient province and Eastern province the least one. Moreover, the large-holder farmers' cluster is the most resilient whilst the pastoralist is the least one.	per each livelihood group. Those differences are relevant in terms of policy implications, considering the differences between the ultimate determinants of each component. In terms of access to basic services, for example, access to credit is much more relevant to pastoralists and large-holders than others. Access to water is more relevant to both farmer groups and agro-pastoralists, while access to electricity and telephone network is relevant to entrepreneurs and wage employees. The social safety nets (transfers per capita) for wage-employees are twice as much than for other groups: this is related to urban poverty, where the lack of other assets (land, livestock, etc.) reduces dramatically the urban poor coping capacity.	blending of methods **(4)** More an academic exercise- cannot be used for programmatic purposes. Measure will not yield any VfM assessment. **(5)** Measurement is not concerned about outcome achievements hence not able to address unintended outcomes **(6)** Use of existing data reduces costs of data acquisition, but limited potential for delivering VfM through learning and project quality control.
3. Oxfam GB	**A Multidimensional Approach for Measuring Resilience** The paper presented Oxfam GB's conceptual framework for measuring resilience based on a characteristics approach and drawing heavily on the ACCRA framework. There was no specific application in this paper but an application in the context of Disaster Risk Reduction Programming in Ethiopia's Somali Region was undertaken by Oxfam GB in a more recent paper. The study assessed the effectiveness of the third phase of the cross-border Regional Drought Decision Programme and the Somali Region Drought Recovery	**Alkire-Foster Approach.** Used to develop composite indices of resilience based on a number of indicators that were hypothesised to reflect "resilience". The approach was created originally as a measure of multidimensional poverty and was based on the original, income-based Foster, Greer, and Thorbecke (FGT) family of poverty measures (i.e. headcount ratio, poverty gap, squared poverty gap). As such the measure was originally a measure of shortfall/deprivation more than achievement (e.g. well-being). Under this approach, the selection of indicators, their weighting, the indicator cut-offs, and	**(1)** Presented a clear conceptual framework for measuring and operationalising resilience, largely drawing on a characteristic approach. In an application, the framework was mapped onto the project logic which defined the outcomes at the community and household levels. Addressed attribution/contribution, which was tested ex-post (however can easily be designed to be periodic). **(2)** Applicable at the project level and to a diverse range of contexts-specifications such as of indicators will however vary by context, etc. (there is a great deal of arbitrariness in the selection anyway). **(3)** Highly quantitative; study did not indicate inclusion of qualitative techniques. Indicators were clear and built on the conceptual framework and project logframe; comprehensive but perhaps too comprehensive. **(4)** Can be used for resilience tracking for monitoring and periodic evaluations purposes. Limited comparability across projects due to context-specific indicators and arbitrary cut-offs, weights, and thresholds. No mechanism to assess VfM or costs associated with

STUDY		RESILIENCE MEASUREMENT TECHNIQUE	ASSESSMENT NOTES
	and Preparedness project, both aiming to enable households to respond to and withstand drought.	interdimensional threshold are arbitrarily set (in the case of Oxfam, most of these were agreed with Oxfam field staff). Data on 37 indicators of resilience were collected. Measurement is based on characteristics/proxies only and without consideration of the shock. **Quasi-experimental design**. The measures of resilience developed through A-F approach was then applied in an ex-post impact evaluation to assess the effectiveness of an Oxfam programme. This was based on primary data. Baselines were collected through respondent recall.	delivering results. Participation (or consultations to be exact) was limited to field officers of Oxfam. **(5)** No mechanism to identify, measure, and explain expected outcomes except for unexpected quantitative results or perverse relationships between indicators if the impact evaluation was designed to be longitudinal (as opposed to ex post) **(6)** Potential significant cost implications associated with identification of, and gathering of data for, context-specific indices.
4. Tulane University	**Haiti Humanitarian Assistance Evaluation** **From a Resilience Perspective** A summative evaluation which aimed to build a framework for analysing resilience and the effects of humanitarian assistance on resilience outcomes in the aftermath of the 2010 earthquake. The evaluation utilised multiple research methods drawing upon secondary data and analysis as well as primary data collection including household survey data, community level key informant interview, and focus group discussions.	**Principal Component Analysis.** Construction of standardised dimension scores for the components of resilience. Each dimension score was scaled such that a higher score signified higher household resilience which was measured at a specific point in time. The indicators were then analysed in the post-earthquake context to measure the impact of humanitarian assistance on resilience. **Multiple regression and propensity score matching.** To estimate impact of humanitarian assistance on resilience outcomes. Comparison was between those that receive and did not receive assistance which was further disaggregated to the frequency of receipt of benefits. **Participatory and qualitative approaches.** in the definition of	**(1)** An evaluation resilience framework was presented. They developed the Haiti resilience Impact and Change Model to measure the relationship between a shock, resilience, and humanitarian assistance. **(2)** While the evaluation was on the portfolio of humanitarian assistance, the measurement method can be applied on the project-level and can accommodate/ be operationalised for various contexts and diverse factors influencing resilience. **(3)** Qualitative focus group discussions were undertaken to identify challenges to recovery that communities and households impacted by disaster face, as well as their resilience characteristics and the role humanitarian assistance has played in helping them recover. Dimensions of resilience were identified through review of literature, stakeholder consultation, and preliminary analysis of household dataset. Interviews with representatives from major entities involved in the humanitarian response also complemented surveys. **(4)** Coverage of perceptions of humanitarian actors' post-earthquake response gathered through interviews. No VfM assessment or approach to assess the cost side of the humanitarian assistance (except a descriptive portfolio analysis). Limited comparability because of the specificity of definition of resilience and indicators to the specific section

STUDY		RESILIENCE MEASUREMENT TECHNIQUE	ASSESSMENT NOTES
		resilience and tailoring it to the Haiti context, identifying key thematic areas that describe dimensions of resilience, identifying and developing key indicators and stratifications to be assessed in the primary data collection stage, establishing the need to track resource flow of humanitarian assistance, and identifying Haitian engagement of Haitian stakeholders and beneficiaries as paramount to the success of humanitarian assistance efforts. Interviews were used to survey perception of major stakeholders.	of population affected by the earthquake. Highly participatory. The study while not meant to evaluate specific project and its contribution, can be applied for on-going evaluations and monitoring. **(5)** Unexpected outcomes of humanitarian assistance, e.g. pertaining to the nature of assistance and equity of distribution were determined through qualitative inquiry **(6)** Costs not detailed in the evaluation report but likely to be significant due to highly context-specific and participatory nature of measures used.
5. University of Florence	**A resilience-based approach to food insecurity: The impact of Mitch Hurricane on Rural Households in Nicaragua** The main goal of the paper is to develop a methodology to quantitatively assess resilience to food insecurity. Applied to rural Nicaragua and particularly to the rural population in Nicaragua after hurricane Mitch in 1999.	**Modified World Vision methodology:** Multivariate model with a truly dynamic specification. The aim of the study is to develop a suitable method to measure household resilience to shocks in the domain of food security and to test it using panel dataset allowing a dynamic specification. Resilience index was calculated through factor analysis. Dropped shocks as determinant of resilience.	**(1)** Presented a framework of analysis particular to resilience and food security based on livelihood approach. The ultimate objective of the study however is not to measure resilience but to test whether it is a determinant of food security. Included a case study applying their measure to evaluating policy (i.e. rehabilitation and relief) impact on households hit by hurricane Mitch, thereby addressing attribution/contribution empirically. **(2)** Applicable to diverse contexts **(3)** Discussed the importance of qualitative approaches in resilience assessment but only as a part of the review of literature specific to methods. **(4)** Discussed the technical difficulties of comparability between households due to unexpected negative relationship between agricultural endowment and resilience index, which was hypothesised as a function of the livelihood strategies adopted by households. Came to the solution of calculating separate resilience indices for agricultural and non-agricultural households, which led to incomparability of results. Across- projects, comparability can only be descriptive with caveats. No consideration of value for money. Not participatory. **(5)** Same as World Vision response **(6)** Focus on quantitative methods and existing data may reduce costs

STUDY		RESILIENCE MEASUREMENT TECHNIQUE	ASSESSMENT NOTES
			compared to methods requiring primary data collection.
6. WFP	WFP has developed an approach to building resilience at the community, local, national, and sub-national levels ("three-pronged approach for resilience building"). *Analysis based on description in TANGO paper – no original documentation available.*	**Trend Analysis.** Utilised longitudinal data (annual post-harvest household surveys) to measure changes in historical food security indicators, with a focus on the speed and extent of recovery after a drought in 2009. Recovery rate (at one year post-shock) and recovery time were used to measure resilience as determined by three indicators- coping strategy index, food consumption score, and cereal stock duration.	**(1)** WFP has developed an approach to building resilience at the community, local, national, and sub-national levels ("three-pronged approach for resilience building"). The study as cited in TANGO International's study seemed to be more an exploratory study/analysis to measure resilience in Niger after a shock and was not particularly hinged on a conceptual framework. Does not address attribution/contribution- perhaps because it is not the study's aim to ascertain project impact on household/community resilience. **(2)** Trend analysis itself can be applied to assess resilience in any context. However, this relies to a great extent on data availability and quality. Applicability to other contexts will also be limited by the absence of a guiding framework on the selection of indicators. The shock/s that may be specific to a country/area is/are also not taken account of in the trend analysis. The causation is just assumed. **(3)** Quantitative methods only **(4)** Utility limited; no mechanism to allow internal learning and VfM assessment. Comparability across projects possible but must in descriptive terms only, e.g. trend through time given x shock but not for performance assessment purposes. No element of inclusion and stakeholder participation in measurement exercise; indicators data-driven. **(5)** Identification of unexpected outcomes will be limited to statistical results. There is no instrument though to explain or verify. It was not clear how the indicators were selected but given that they utilised an existing dataset, they most likely relied on available, measurable information. (6) Focus on quantitative methods and existing data may reduce costs compared to methods requiring primary data collection.
7. World Vision/Tufts University	**Resilience and Livelihoods Change in Tigray, Ethiopia** Since 2009 a team from Tufts University has been studying "livelihoods change over time" in Northern Ethiopia, focusing specifically on Eastern and South Eastern	**Multivariate model**. Measured changes in household resilience over time through primary panel data by identifying factors that play a role in livelihoods change and measuring resilience trajectories. Data	**(1)** Employed "Livelihoods Cycle Framework" to measuring resilience; no ToC per se and does not directly address attribution/contribution but the richness of primary panel data can be used in further analysis that address attribution/contribution. **(2)** Can be applicable to diverse contexts- indices are generic enough and components can be modified according to context; the same goes

STUDY		RESILIENCE MEASUREMENT TECHNIQUE	ASSESSMENT NOTES
	Tigray. The research objective was to understand the determinants of livelihood change—whether for the better or the worse—over time in a relatively risk-prone context. Initially conducted in collaboration with World Vision, a research partnership (funded by the Swedish International Development Agency (SIDA) between the Feinstein International Centre and researchers at the College of Dryland Agriculture and Natural Resources, Micelle University in Tigray) has been conducting a multi-round survey on livelihoods change over time (LCOT). The earlier work with World Vision focused on disaster risk reduction programs, and provided much of the qualitative background information for the LCOT survey. The LCOT survey collects panel data twice a year, in the post-harvest period and during the peak of the hunger season, from a sample of 300 households in two locations in Eastern and South Eastern Tigray. Two rounds of data collection have been completed, the first in August 2011 and the second in February 2012. This paper presents an initial analysis of that data.	were used to construct seven indices for livelihood, food security, and well-being outcomes with the use of factor analysis. Also included an analysis of resilience trajectories between the hunger season and the postharvest season and from year to year. Shocks that test household resilience are both exogenous and endogenous to the household; they include the recurring annual climatic, price, and health shocks experienced during the hunger season. According to the Of study (below), because shocks are embedded in the definition of resilience, this may have perverse consequences to the estimates as it can identify a household as resilient while it was only luckier.	for the measure of shocks. **(3)** Limited indication of qualitative techniques, e.g. hazard scores were scored through community ranking; indicators are a mix of resources and results, but focus is on household asset portfolios. Physical, economic, social connectivity, and some household characteristics were excluded. **(4)** Can be versatile- but more a potential. Costly however because of the frequency and size of data collection. There might be a cheaper way of achieving the same goals. Comparability is possible to a certain extent only- perhaps in a descriptive way only with thorough discussion of the variations in shocks and their magnitude, years of study, etc. No indication of stakeholder participation in the identification of indicators; presented no project M&E as the measurement exercise was not exactly undertaken for the purposes of project evaluations. **(5)** Aside from unexpected, quantitative results arising from the statistical analysis, there seems to be no built in mechanism to take into account of other unexpected results that can be fedback into projects for learning **(6)** Use of panel data costly because of the frequency and size of the data collection. *Note that the study is meant to look at the "dynamics" however the available data is only 2011-2012 which means that essentially, there was no analysis per se of the dynamics

Annex 6 A survey of ICF and BRACED project-level indicators

Indicator	ICF Project ID														BRACED Project ID												Comment
	11	13	20	25	40	44	71	73	81	91	92	105	120	137	003	014	020	021	028	035	039	043	045	047	071	084	122	
IMPACT																												
# People dying/injured/disease/ outmigrating (per year) from climate related disasters															✓				✓					✓	✓	✓	✓	Will need to be controlled against frequency and severity of climate shocks.
# people requiring emergency assistance due to climate related disasters																												As above
Development indicators (food security, nutrition, savings, employment, HDI, MDG 7, gender etc.)					✓						✓	✓		✓[24]				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Sometimes explicit reference to 'post-shock'
Reduction in $ losses due to climate change									✓																✓			81A does this at national level. However could also be disaggregated (to individual?)
Environment safeguarded																				✓				✓				
HHs able to sustain asset base																						✓						
OUTCOME																												
Number of people with improved resilience as a result of ICF support.	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓				✓				✓			KPI4. Good as headline. Can be disaggregated in terms of type of increased resilience, level of increase and category of person (gender, age, disability etc.). Degree of attribution of change due to ICF support may need to

[24] These are proposed by the mid-term evaluators, no actual LF was available for 137A.

Indicator	ICF Project ID														BRACED Project ID													Comment
	11	13	20	25	40	44	71	73	81	91	92	105	120	137	003	014	020	021	028	035	039	043	045	047	071	084	122	
																												be made explicit
Number of people whose main livelihood(s) (crop land, livestock, other) is managed using climate-resilient practices					✓																	✓					✓	Contributor to KPI4
Number of people with access to ecosystem services which are stable and climate-resilient																												
Number of people with appropriate risk reduction investment (infrastructure and capacity) in place to priority climate related (and other) disasters																			✓				✓		✓	✓	✓	Needs to be based on context specific analysis of hazards prioritised on likelihood, severity of impact and opportunities for impact reduction.
Number of people with good-enough access to climate related/other early warning																✓					✓			✓				
Number of people with access to good enough climate resilient WASH (Water, sanitation and hygiene)							✓																					
Number of people with access to good-enough social protection in time of acute need/disaster																												
PROCESS																												
Number of people covered by good enough adaptation/resilience policy AND implementation practice													✓		✓							✓	✓	✓		✓		What is 'good-enough' will need context relevant definition. Is this needed? Outcome?
New knowledge/innovation related to resilience/adaptation generated and being used					✓	✓						✓			✓	✓		✓										Qualitative description of the new knowledge/innovation and its transfer. 105A

Indicator	ICF Project ID														BRACED Project ID												Comment
	11	13	20	25	40	44	71	73	81	91	92	105	120	137	003	014	020	021	028	035	039	043	045	047	071	084	122	
elsewhere																												proposed a Research Outputs Index
Capacity (Gov/Council/PS/CBO/ community/ individual) to access information, analyse it and make appropriate adaptation/resilience decisions						✓									✓				✓		✓	✓				✓		Although this is a process indicator towards other outcomes, it is important as adaptation is a continuing process, rather than an end-point
Market and value chain resilience (stability, diversity, level of production, income, quality of coping, adaptation)																					✓	✓						
Community Resilience Index (, Coping Strategies Index															✓												✓	CRI mentioned in Mercy Corps LF but not in BC. CSI in 122
# people supported to cope															✓	✓	✓		✓		✓		✓		✓	✓		ICF KPI1 – but what does it mean in practice? How different from KPI4?
# women in leadership making decisions on resilience																	✓		✓	✓		✓	✓	✓		✓	✓	045 = women's reported perception of their role
HH food consumption score														✓														
Disaster Preparedness Index														✓														
Access to social protection														✓														
HH (livelihood) Assets, savings, buffers, reserves														✓	✓						✓	✓		✓		✓		039 & 084 included concept of assets and livelihoods protected as well
Community asset score – contributing to sustainable pastoral livelihoods														✓														
Community/Multi-stakeholder systems to improve ecosystem service governance													✓								✓						✓	120 = water basin level, 039 & 122 = pastoral resources and conflict avoidance

Indicator	ICF Project ID														BRACED Project ID													Comment
	11	13	20	25	40	44	71	73	81	91	92	105	120	137	003	014	020	021	028	035	039	043	045	047	071	084	122	
Area managed for payment for environment services (PES)/economic incentives for sustainable resource management											✓					✓												
(Gender?) equality of HH decision making															✓												✓	
Forest sector governance rating											✓																	Interesting indicator that could be used for other ecosystem services process indicators
# businesses/turnover from adaptation/resilience opportunities									✓																			
jobs from adaptation/resilience opportunities									✓		✓				✓										✓			Can be qualified by permanence of jobs, quality (conditions/min. wage?) and distribution (e.g. caste/gender)
Vulnerability Reduction Assessment (VRA) scores for health and water stakeholders							✓																					
Diversified livelihoods	✓					✓					✓								✓									Problematic indicator in absence of context specific link between diversified livelihoods and longer-term resilience
Increased capacity for adaptation/resilience(various)				✓	✓	✓				✓						✓		✓			✓	✓		✓		✓		What does adaptive capacity really mean? How do we measure? Need to have some indication of what the outcome of the increased capacity is in terms of impact on individual resilience

Indicator	ICF Project ID														BRACED Project ID												Comment
	11	13	20	25	40	44	71	73	81	91	92	105	120	137	003	014	020	021	028	035	039	043	045	047	071	084	122	
Adaptation/resilience policy changes or framework adoption			✓		✓	✓	✓		✓	✓	✓		✓								✓			✓				
Financial resources dedicated to DRR/ adaptation/ Resilience		✓	✓		✓	✓			✓		✓		✓					✓					✓	✓				Often not very helpful, as additionality/attribution difficult and effectiveness of additional spend not covered
$ value of new or existing infrastructure made climate resilient	✓												✓															
% change in water-use efficiency (in agric.)	✓																	✓										
# Ha land managed under climate-resilient approaches/with stable/improving condition	✓										✓						✓	✓			✓							Although it is easier to measure the area under a particular management regime, the real test is the outcome of that regime – which can be very different.
#people using financial/insurance services or savings groups																✓		✓	✓									Perhaps needs more context analysis on whether specific FS increase resilience
Production/income generation (resilience)																			✓		✓							039 – sustainability of income. Needs ToC to link increased production/income to resilience?
Animal survival rates post shock																				✓								
% adoption of specific recommendations																										✓		
Mechanisms to predict spikes in demand for health services																											✓	
% health facilities with resilience/surge capacity and																											✓	

Indicator	ICF Project ID														BRACED Project ID												Comment
	11	13	20	25	40	44	71	73	81	91	92	105	120	137	003	014	020	021	028	035	039	043	045	047	071	084	122	
plans																												
Perceived conflict over NR reduced																											✓	
OUTPUT																												
Number of publications																							✓	✓			✓	More common indicator than ✓ suggests
Models for building climate resilience developed/improved understanding on processes available																✓							✓	✓				Farm Africa refers specifically to models for PS role. 047 to models for social protection
Degree to which potential lessons have been analysed, learnt and disseminated																												Could be a percentage of the maximum learning and dissemination judged possible.
Participation by national government, local government, private sector, civil society in resilience building activities		✓								✓	✓										✓							Indicator may need to be refined (with scorecard?) according to project context
CC integrated into land use planning service																✓												
Number of actions/interventions that are innovative		✓																										
Evidence of what works				✓		✓	✓					✓				✓					✓		✓	✓	✓		✓	
Number of adaptation/resilience policy recommendations		✓				✓							✓					✓						✓				Will need unpacking on both appropriateness of policy and adequacy of implementation in order to get to indicator 5
Civil society empowered to advocate on resilience and adaptation						✓			✓									✓		✓	✓	✓	✓	✓				035 focuses specifically on pastoralist advocacy
Southern involvement and use of research												✓																Large number indicators in 105A

Indicator	ICF Project ID														BRACED Project ID												Comment
	11	13	20	25	40	44	71	73	81	91	92	105	120	137	003	014	020	021	028	035	039	043	045	047	071	084	122	
																												including composite publication index
Resilience/Adaptation action plans (various including urban)			✓	✓	✓	✓			✓	✓					✓	✓					✓	✓	✓			✓		
Number of people/groups involved in environmental management activities	✓										✓																	
Early Warning systems operational														✓				✓	✓		✓	✓	✓			✓	✓	
Number of people/groups involved in DRR	✓					✓															✓			✓				
Dissemination of learning (various formulations)	✓	✓	✓	✓		✓						✓			✓	✓					✓		✓	✓	✓	✓	✓	045 – good on community perception of quality of information
Local CC information generated				✓																								
Area restored or re/afforested		✓									✓																	There are possible issues of access by the marginalised that may need to be unpacked to get to indicator 3
Security of tenure (or functional tenure arrangements) of vulnerable/improved land														✓												✓		
Adaptation/resilience assessments done			✓										✓															
# People trained in resilience																			✓						✓			
Functioning livestock corridors																				✓								
Key pastoralist services including insurance																				✓								
Quality of stakeholder engagement (gender, age, poverty, ethnicity)																					✓	✓		✓			✓	TAMD – CCI 7?
# people receiving/aware off CC information																	✓					✓	✓					