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Please Note:

This is a draft report and has not been reviewed by DFID. It is an academic study and only reflects the views of the authors, and not those of DFID who commissioned the report, nor those of Evidence in Demand who have contracted this work.

It is being shared with BRACED grantees following a meeting on 30th January when the earlier findings of the study were presented. The reason for this is for BRACED grantees to provide comments that will inform the next draft of the report.

When the report has been finalised DFID will consider this in developing its work on measuring resilience. This will include how it might be applicable and inform actions under the BRACED programme. The draft report should **not** be interpreted as DFID views on what is needed under the BRACED programme on how it will measure resilience, and on how it could inform any BRACED programme and project monitoring and evaluation.

Draft Report

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

Nick Brooks, Eunica Aure and Martin Whiteside

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SECTION 1

Introduction

As responses to climate change focus increasingly on adaptation, there is a growing need for the development of methodologies for evaluating the effectiveness of adaptation interventions, and for assessing the extent to which countries, governments, institutions, sectors, communities and people are able to anticipate, cope with, recover from, and adapt to the manifestations of climate change. Analysis of the factors that make people resilient (or not) to climate change and its impacts is a key element of such assessment.

The study presented here addresses the issue of resilience at the community and household levels, and has been conducted on behalf of the UK Department for International Development (DFID) in order to inform the measurement of resilience for projects supported by the UK's International Climate Fund (ICF) and the Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) programme.

This report 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. It addresses the key challenges associated with the measurement of resilience, 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, in the context of the ICF and BRACED programmes and their monitoring, evaluation and reporting requirements. Finally, it proposes a methodology for the measurement of resilience as part of the monitoring and evaluation (M&E) of ICF and BRACED projects. It is intended that this proposed methodology will inform the wider discussion about the measurement of resilience and the M&E of adaptation, and that it, or aspects of it, might be adopted outside the ICF and BRACED contexts.

SECTION 2

Definitions and Conceptual Framing of Resilience

The term 'resilience' has its origins in ecology, where it 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[1]. 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 social, and coupled ecological-social, systems to return to a state similar to that pertaining before a disturbance or shock. 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' after a shock, but to improve their circumstances despite exposure to 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"[2]

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

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

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.

2.1 The DFID Resilience Framework & Adaptation Theory of Change

DFID has developed a Resilience Framework (RF), 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.

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 may take many forms, and may be climatic, environment, social, political, or economic in nature. In terms of climate variability and change, these disturbances will be climate *hazards* and related phenomena that 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);
iii. transient (weather extremes) or effectively permanent (e.g. sea-level rise, long-term aridification).

Climate change will increase the frequency, severity and likelihood of many of these hazards, which will interact with non-climate hazards to influence people's well-being.

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).

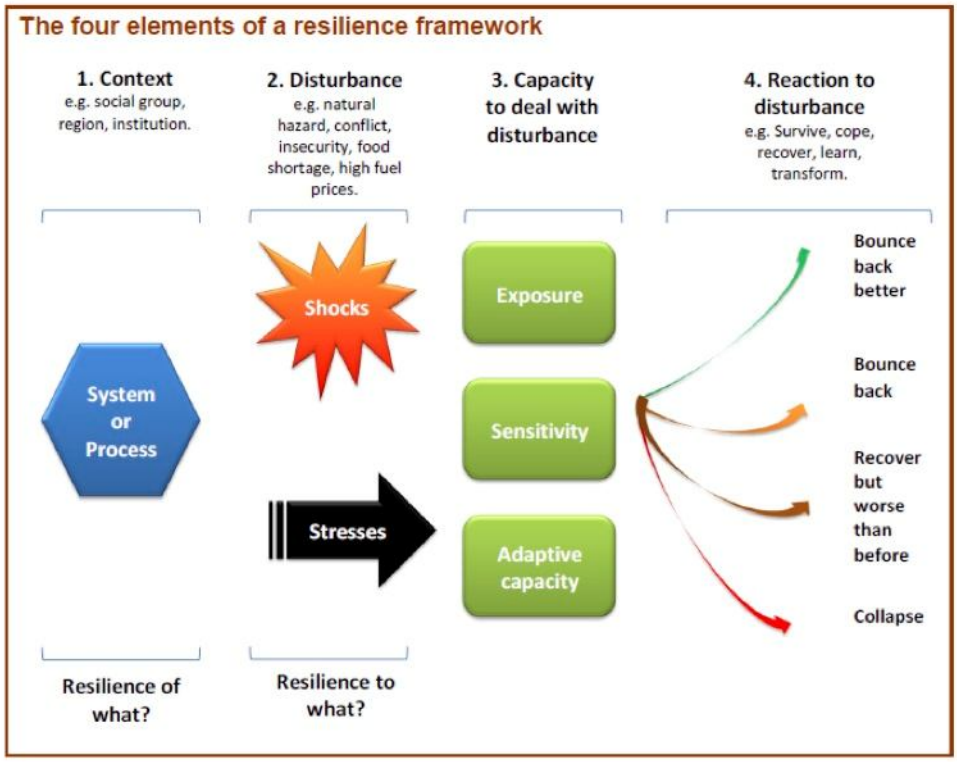
Element 4: Reaction to disturbance, in terms of whether the system or process continues to function as it did prior to the disturbance (bounce back), better than it did prior to the disturbance (bounce back better), worse than it did prior to the disturbance (recover but worse than before, or not at all (collapse). A resilient system will bounce back or recover so that it functions in a similar or more efficient way to how it did before the disturbance occurred, whereas 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.

The RF 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 the ease with which relief can be delivered (connectedness/isolation) 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 the context of storms and floods, but irrelevant in the context of drought. Other factors such as proximity to rivers or groundwater levels may influence resilience to these two types of hazard in opposite ways.

This Resilience Framework thus illustrates the impossibility of identifying 'universal' indicators of resilience. It does, however, provide a framework that aids in the identification of resilience indicators that are contextually relevant.

Figure 1 The DFID Resilience Framework



2.2 Resilience, risk and vulnerability

The DFID RF 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).

2.2.1 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 of 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 of 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 RF, 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 RF'. The greater the risk, the more likely it is that the system ('context' column of the RF) will recover but be in a worse condition than it was before it encountered the hazard, or that the system will collapse.

2.2.2 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 RF.

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.

2.2.3 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 RF. 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.

2.3 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-ecolgical) 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.

SECTION 3

Measuring Resilience

3.1 The case for measuring resilience

The ultimate goal of adaptation is to ensure that development interventions can deliver or facilitate desired and intended improvements in human well-being in the face of climate change that, in conjunction with other external stresses, might otherwise undermine, offset or even reverse such gains. The final test of adaptation success therefore will be whether or not development has succeeded in securing intended improvements in the material well-being of human populations, and in reducing losses and damages from climate-related stresses, despite the intensified risks posed by the manifestations of climate change (e.g. environmental deterioration, changes in the availability and distribution of natural resources, the intensification of climate hazards/extremes associated with disasters, etc). Although the impacts of climate change are already being felt, climate-related risks to people, the environments in which they are embedded and the systems, processes and resources on which they depend, will intensify over the coming decades as climate change accelerates. As well as helping people cope with emerging climate change impacts, today's adaptation interventions therefore need to prepare populations to cope with and respond to climate change impacts that will continue to evolve and (in most cases) intensify for the foreseeable future. Evaluating the success of adaptation using standard well-being and development indicators will require the monitoring of such indicators over periods of years to decades. These timescales are much longer than those associated with the M&E of most development projects.

In addition, it is unrealistic to assume that adaptation will mean that no adverse impacts are experienced when populations and the systems on which they depend are exposed to climate hazards, particularly where these hazards are intensifying as a result of climate change. In the absence of adaptation, such adverse impacts (e.g. losses and damages, other declines in human well-being) may be expected to increase over time due to an increase in the *exposure* of populations and infrastructure to climate hazards. Increased exposure will result from population growth, economic development that increases the value of assets in exposed areas, and the intensification of climate hazards due to climate change.

Effective adaptation *may* mean that no significant adverse impacts are experienced when a human population or economic system is exposed to certain climate hazards. However, it is more likely that adaptation will act to reduce the magnitude of such impacts. This may involve a reduction in losses or damages below some historical benchmark, or a reduction below a projected baseline assuming no adaptation. In the latter case, adverse impacts may increase relative to a historical benchmark, but remain below a projected/modelled value

assuming no adaptation. Evaluations based on conventional development indicators (e.g. poverty, household incomes, etc.) and loss and damage indicators (e.g. mortality per 100,000 population or losses in $US over a certain historical period) would fail to capture the benefits of adaptation under such circumstances, and would most likely conclude that adaptation had been ineffective. This would have implications for adaptation planning and programming, which might abandon partially effective measures on the grounds that they had not kept development 'on track', when a strengthening of such measures might deliver better results, and their cessation might make things considerably worse.

For the reasons outlined above, the use of conventional well-being and development indicators to assess adaptation that takes place over long timescales, against a backdrop of evolving climate hazards, needs to be undertaken with caution. For these indicators to be useful, they need to be interpreted carefully in the light of contextual information on variations and trends in climate and other hazards, or somehow standardised with respect to these evolving hazards so that they are comparable over time. While methodologies for achieving such standardisation or normalisation are available, they may not be applicable or practical in a given context because of a lack of data or technical capacity. Therefore, while such indicators have a role to play in the assessment of adaptation (as discussed below), they need to be complemented by other methods.

One way of assessing the success of adaptation investments and interventions over short timescales is to measure their effects on the factors that make people more or less *resilient* to the climate hazards that they face today and/or may face in the future. If a number of key factors that influence resilience can be identified, these factors might be represented by indicators that serve as proxies for resilience. By tracking changes in these indicators over time, and assessing the contributions of development/adaptation interventions to these changes, we can in principle measure the effects of interventions on these proxy indicators of resilience over the timescales typically associated with project-level M&E, even in the absence of significant climate or other shocks.

3.2 Dimensions and indicators of resilience

The DFID RF defines four 'elements' of resilience (columns 1-4 in Figure 1). The 'capacity' element (Element 3) of the RF corresponds to the concept of resilience as generally described in the literature. The RF further divides the capacity element into the following three 'dimensions': exposure, sensitivity and adaptive capacity.

The factors that influence resilience – like those that drive vulnerability – are numerous, varied, and interact in a complex manner. As discussed above, it is not possible to define 'universal' or 'off the shelf' indicators of resilience that can be applied at the operational level in all situations. Nonetheless, it is possible to identify different 'dimensions' of resilience – broadly defined categories 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.

Exposure: the extent to which people/systems experience disturbances/hazards. This corresponds to the concept of *differential exposure* as described in Section 2.2.3 above, with large-scale exposure relating to the disturbance element (Element 2) of the RF.

Sensitivity: capacity to cope with and recover from hazards and their impacts in the short term (low capacity equates to high sensitivity).

Adaptive capacity: capacity to adapt in the longer term (i) to changes in the frequency and severity of recurrent hazards, (ii) to hazards that unfold over long timescales, (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.

Viewing resilience in terms of exposure, short-term coping capacity, and longer-term adaptive capacity is useful for identifying the contextual factors that influence resilience. This might be done through participatory assessments in which community members are asked questions such as:

i. Who suffered most/least during/after the last flood or drought, and why?
ii. What was it that made some people better able to cope/recover than others?
iii. Do some people cope better with floods/droughts than they did before?
iv. If so, what changes have them made that enable them to cope better?
v. Do some people cope worse with floods/droughts than they did before?
vi. If so, why are they less able to cope?

These questions, or ones like them, should allow project personnel to identify key factors that help people cope and adapt to hazards in a particular community and risk context, through a process that is grounded in the experience of local people. Once these factors have been identified they may be represented by indicators. These indicators might be quantitative and continuous (e.g. household income), quantitative and discreet (e.g. level of education) binary (e.g. do people have access to a particular resource/asset or not), or qualitative (e.g. a factor such as health or mobility that can be described in terms such as poor, fair, or good).

Other frameworks disaggregate the factors influencing resilience into a variety of dimensions, and these are discussed in more detail in Section 4 below.

3.3 Using conventional development indicators alongside resilience indicators

As discussed above, using development and well-being indicators as measures of successful adaptation needs to take into account timescales and the changing (and perhaps deteriorating) external context (e.g. with respect to worsening climate hazards and other stresses).

Nonetheless, conventional development or well-being indicators are important if we are to understand the interplay between climate change, adaptation and development. These include indicators relating to poverty, inequality, health, education, conflict, governance, mortality and morbidity resulting from climate-related disasters, economic losses from climate-related disasters, and other indicators and indices such as those that constitute the Human Development Index (HDI). If such indicators tell us that well-being has improved, despite an increase in large-scale exposure to climate (and other) hazards, then it would be reasonable to conclude that adaptation has been successful, and that resilience has increased.

Where there is no improvement in well-being indicators, these indicators might still tell us something about adaptation. For example, stability of these indicators over time in the face of increased large-scale exposure to climate hazards might suggest that adaptation has helped to stabilise well-being where it otherwise would have deteriorated. For such a conclusion to be drawn, there would need to be evidence for increased large-scale exposure in the form of climate data indicating an increase in frequency or severity of climate hazards typically associated with negative effects on well-being (e.g. reduced crop yields and household incomes, elevated food prices, loss of assets, infrastructural damage, etc). The collection of relevant climate data, and the construction of appropriate climatological indices representing large-scale exposure where possible, therefore is a helpful element in the assessment of adaptation success. Such indicators might be readily available from, or constructed in cooperation with, national meteorological services or research organisations. Where this is not feasible, qualitative interpretations based on expert judgment and stakeholder experiences and perceptions might be used to ascertain whether or not climate and other hazards have worsened and to relate any changes in hazards to changes in well-being indicators.

Where indicators reveal a decline in well-being it should not automatically be assumed that adaptation has failed and resilience has not been enhanced. It is possible that adaptation and capacity building interventions have partially offset the adverse impacts of increased large-scale exposure and prevented an even worse situation. In order to determine whether this is the case, well-being indicators must be somehow standardised or ‘normalised’ to account for this increased large-scale exposure.

Normalisation of well-being indicators to account for increased large-scale exposure is far from trivial, and will not always be possible. However, it might be feasible where there are robust statistical relationships between climatological variables and key well-being indicators. In such circumstances, historical relationships between climate variables and

well-being indicators might be used to model expected variations in the latter over a period following a project intervention. The modelled variation in well-being indicators would then be compared with the observed variation, and any difference explained as a result of changes in resilience that might be explained in whole or in part as a result of the intervention. The contribution of the intervention would be evaluated based on qualitative information including stakeholder and beneficiary narratives (this can also be done in the absence of climate data).

Where statistically robust historical relationships between climate variables and well-being indicators do not exist or cannot be demonstrated, qualitative methods may be employed to evaluate whether a project has acted to ameliorate the consequences of increased large-scale exposure, even if indicators reveal a general decline in well-being. These are likely to be based on feedback and narratives generated by interaction with the intended beneficiaries of the project. Of course, the fact that a project may have slowed but not halted a decline in human well-being does not mean that no further action is required, or (depending on its objectives) that it has necessarily been successful. However, determining whether a project has had some beneficial impacts or none at all is crucial for learning and for the design of any subsequent interventions, making the nuanced interpretation of project impacts against a backdrop of evolving hazards essential to the process of enhancing resilience.

3.4 Contextualisation of well-being indicators with respect to hazards

The contextual interpretation of well-being indicators, as described above, can only be achieved if indicators are available that can track changes in large-scale exposure over time. These indicators will measure some combination of climate hazard frequency, severity and spatial extent. These may be composite indices such as the Palmer Drought Severity Index or the Power Dissipation Index, the latter of which objectively measures the destructiveness of tropical storms (Emanuel 2005). Alternatively they may be single indicators constructed from climatological or meteorological data. For example, the intensity of rainfall might be measured in terms of the maximum rainfall in a 24 hour period, or the number of days on which rainfall exceeds a certain threshold. Such indicators may be useful in determining whether increases in the frequency or severity of rainfall-related flooding are associated with more intense rainfall, or instead are the result of modification of runoff regimes resulting from factors such as changes in land use and urbanisation. Other measures that may be used to identify trends in temperature and precipitation extremes are provided in Chapter 2 of the Final Draft of Working Group 1 in the IPCC's Fifth Assessment Report (AR5) (Hartmann et al. 2013, p.63).

Data such as those discussed above may be available from publicly available gridded datasets or readily constructed from such datasets, or from national meteorological services. It should be stressed here that contextualisation of well-being indicators would be done using observed/historical data, and does not require recourse to future climate projections.

In some (perhaps many) cases, there may be insufficient data to construct objective climatological or meteorological indices. Where this is the case a more subjective approach might be to ask stakeholders and project beneficiaries to identify recent climate extremes based on their own experiences. This might at least provide an approximate estimate of the numbers of such hazards occurring over any given period, with the caveat that people may only identify hazards that they found problematic. Finally, past climate extremes might be reconstructed from historical records, as has been done for the Sahel by Tarhule and Woo (1997), who found a 90% correspondence between recorded historical famines and periods when local rainfall fell by more than 1.3 standard deviations below the long-term mean.

Climatological and meteorological data may be used to contextualise well-being indicators that are employed to evaluate project impacts, as described in Section 3.3. above. These data might also be used for quantitative normalisation of well-being data where appropriate, for example by scaling numbers killed or affected or economic losses by the frequency of relevant hazards. While such an approach might be viewed as somewhat clumsy, it at least provides some standardisation to account for the fact that certain types of hazard might not occur at all in some years, and be numerous in others. Historical data extending back years or decades prior to a project might be used to establish whether there are robust statistical relationships between climate variables and indicators related to human well being (e.g. agricultural output or income). If such relationships are found to exist they may be used to model expected changes in well-being indicators after project implementation. These modelled or expected changes in well-being indicators may then be compared with measured changes in the same indicators, so that discrepancies can be identified and attributed to project impacts and/or other factors.

3.5 Indicators in a project context

In project contexts, indicators are typically classified as output, outcome and impact indicators, which are associated with project outputs, outcomes and impacts as described in a project log-frame. The draft DFID/ICF Theory of Change for Adaptation (ToCA) provides some broad descriptions of outputs, outcomes and impacts.

Output indicators measure the extent to which a project has delivered certain goods and services, and might also seek to measure the quality of these goods and services. Outputs are highly specific to project contexts. The following outputs are specified in the ToCA:

1. "Support [for] effective national and international climate architecture to deliver effective adaptation finance."
2. "Build[ing of] global knowledge, capacity, and evidence which demonstrates climate resilient development ."
3. "Develop[ment], pilot[ing] and support [of/for] scaled up innovative and low regrets adaptation programmes in key vulnerable sectors."

Outcome indicators measure the extent to which outputs have resulted in changes in policies, processes and behaviour in the short to medium term, and are intended to capture changes that will (or that are assume to) lead to the realisation of longer term impacts on

human well-being. Outcomes are changes (e.g. in behaviour, capacity, access to resources, etc) that are seen as being generally desirable, and might also be influenced by factors outside of the project's influence. The ToCA describes outcomes in terms of "*Climate change impacts [being] specifically incorporated into planning and investments for a range of developing countries, UK ODA, other aid donors and MDBs*."

Impact indicators measure the extent to which human well-being has improved, and the contribution of projects to changes in well-being. Multiple projects and other (e.g. government) interventions will seek to deliver the same impacts (e.g. improved health and educational status, reduced poverty and inequality, lower mortality and economic losses from disasters, etc). A project will seek to contribute to a narrow set of impacts that are often explicitly linked with national development priorities. The ToCA describes impacts in terms of "*Vulnerable people in poor countries [being] prepared and equipped to respond effectively to existing climate variability and the magnified impacts of Climate Change*."

The ToCA therefore clearly identifies enhanced resilience as an impact of adaptation projects and the activities associated with them. In the context of programmes and projects explicitly designed to increase resilience and deliver adaptation, resilience indicators therefore may be described as impact indicators. However, the ultimate aim of adaptation and the building or resilience is to enable people to increase their well-being in the face of evolving climate hazards and risks. In the context of development at large, resilience therefore might be viewed as an outcome - an intermediate step in the process of securing and enhancing well-being, which is the ultimate intended impact of development interventions.

Because of the above ambiguity, and the tendency of different projects to define outcome and impact indicators differently, it is suggested that the terms 'resilience indicators' and 'well-being indicators' are used in general discussions of indicators.

Resilience indicators map to Element 3 of the DFID RF. These indicators can be used to track changes in resilience and (combined with attribution/contribution assessment) project contributions to these changes. Resilience indicators will be linked with specific project output and (depending on how they are defined) outcome and impact indicators[3], which should capture the processes that contribute to enhanced resilience. These indicators seek to describe the state or characteristics of a system, process, resource, or individual that influence its/their capacity to anticipate, plan for, cope with, recover from, and adapt to evolving hazards. They may therefore be viewed as *predictive* indicators that can be measured in the absence of shocks/before a shock occurs.

Well-being indicators map to Element 4 of the DFID RF. These indicators can be used to track changes in key aspects of well-being that a project seeks to influence, or in relation to which resilience is defined in the project context (e.g. resilience to drought with respect to

[3] For the sake of coherence across a programme, and based on conceptualization of resilience as a means of delivering improved well-being, there is an argument for classifying resilience indicators as outcome indicators. However, as discussed in this report ICF and BRACED projects define similar indicators variously and impact, outcome and even output indicators.

food insecurity will involve the selection of resilience indicators representing the factors that enable people to cope with and adapt to drought, and well-being indicators that represent food security). In the context of resilience and adaptation, these indicators reveal whether well-being has been secured or enhanced in the face of evolving and intensifying (climate) hazards when they are measured *after a shock has occurred.* They are therefore quite different in nature to resilience indicators in that they measure what happened, in a *retrospective* fashion.

Climatological indicators map to Element 2 of the RF. These indicators can be used to track changes in large-scale exposure, and therefore to contextualise or normalise well-being indicators to account for the impact of climate variability and measurement in the interpretation of project impacts on well-being. They should capture the key characteristics of the hazards associated with negative impacts on well-being, to which a project seeks to make people more resilient.

3.6 Relationship between resilience (predictive) and well-being (retrospective) indicators

It is conceivable that some potential well-being (i.e. retrospective/impact) indicators will also be potential proxies for resilience (predictive) indicators. For example, poverty and income might be important factors in determining people's resilience, as financial assets may be important in enabling people to cope with, recover from and adapt to shocks. However, reduced incomes and increased poverty might also be common results of climate and other shocks. In other words, where people lack resilience prior to experiencing a shock, they might be even less resilient as a consequence of the shock.

Such considerations are important in the interpretation and validation of indicators. Ideally, different variables would be selected as predictive resilience indicators and 'retrospective' well-being indicators. It would then be conceptually straightforward to examine the statistical relationships between these two types of indicator. Where resilience indicators were strongly correlated with well-being indicators it could be concluded that the former were reliable predictors of the latter, provided co-variation resulting from other factors could be discounted. However, in reality the factor that influence resilience themselves will be affected by shocks, and there is considerable potential for resilience and well-being indicators to overlap or at least be highly dependent.

This means that caution must be exercised not only in the identification of predictive resilience indicators and impact indicators based on measures of well-being, but also in their interpretation. This is particularly relevant for validation exercises that assess whether resilience indicators have successfully predicted impacts on well-being.

Where there is overlap between predictive resilience indicators and well-being impact indicators, It might be possible to compare the values of the former with changes in the latter after a specific shock, even where the indicators are essentially the same. This might be achieved by analysing the correlation between the absolute values of resilience indicators before the shock with *changes* in the values of impact indicators after the shock. For

example, income might be an important factor influencing resilience, but might also be strongly affected by shocks. In such a case, a validation exercise might examine correlations between absolute incomes prior to a shock and percentage changes in incomes between the period before the shock and a period following the shock. If higher incomes prior to the shock were strongly associated with small percentage changes in income following the shock, it cold be concluded that initial income was a good predictor of loss of income following a shock. Such an analysis might even identify income thresholds below which losses were particularly problematic, helping to identify where resilience needed to be strengthened most.

Such an analysis would require the occurrence of a well-defined shock during the project implementation period, affecting a coherent sample of project beneficiaries. Essentially, it would be an opportunistic study. Where such well-defined shocks do not occur, a project might establish mechanisms for monitoring resilience and well-being impact indicators over time, including beyond the lifetime of the project. Correlations might then be examined between predictive resilience indicators and well-being impact indicators, with the latter lagging the former by a suitable period, for example a year. Where sufficient data are available, correlations between lagged time series of predictive resilience and well being impact indicators, aggregated by locality or by socio-economic or demographic group, might also be examined to see if changes in resilience over time translated into the expected changes in well-being. Such approaches should in theory capture any impacts on well-being of changes in resilience across populations experiencing diverse hazards, without requiring case studies of individual shocks.

The purpose of the above analyses would be to establish whether resilience indicators are indeed reliable predictors of changes in well-being. Such analyses are therefore important from a learning perspective, and in ensuring that interventions target the right factors to enhance resilience and deliver the intended gains in well-being that are the ultimate goal of development interventions.

3.7 Individual indicators versus composite indices

Many studies have sought to represent vulnerability or resilience using a single composite index. Such indices 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.

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 RF. 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 effective 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 disaggregate 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. Discreet 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 might be the subject of some debate.

3.8 Scales of mesaurement and analysis

The DFID definition of resilience refers to the resilience of countries, governments, communities and households, and BRACED projects address resilience at all of these scales. In addition, the ICF KPI that seeks to track the impacts of projects on resilience (KPI4) refers to the "number of people whose resilience has been improved as a result of ICF support". Any methodology for measuring resilience that also enables projects to report against KPI4 therefore needs to include measures of resilience *at the level of the individual*, while recognising that people's resilience is heavily dependent on a variety of contextual factors.

The resilience of individuals may be viewed as arising from:

1. The physical and psychosocial characteristics of an individual that may make them more or less likely to cope with and adapt to stresses. These may be related to health, physical mobility, literacy, awareness of risks and options for reducing risks, world-views, and so on. Gender may influence these.
2. An individual's access to systems, processes and other resources that will help them to cope with or adapt to stress and change. Gender, age and position in the household and community may be strong determinants of individual access. Access to remittances and support systems (e.g. extended family) beyond their immediate community may be very important. The nature of the systems, processes and resources that are important for the resilience of individuals will vary across contexts, and these will need to be identified on a case by case basis. However, certain *types* of systems, processes and resources are likely to be important across contexts.
3. The resilience of those systems, processes and resources themselves in the face of stress. These systems, processes and resources may include natural resources such as water and rangelands, formal and informal support networks, governance systems and processes, particular institutions, information, policy outputs, etc.

Any methodology for measuring (changes in) the resilience of individuals will need to represent all three of the above sets of factors. There may be a case for representing these factors using (a version of) the DFID livelihood framework or a related approach, for example one based on a number of pre-defined dimensions of resilience. These dimensions might be the three dimensions of (differential) exposure, sensitivity and adaptive capacity as defined in the 'capacity' element of the RF. Each of these dimensions might be broken down into sub-dimensions. Alternatively, other dimensions of resilience may be defined that map more directly to the systems, processes and resources (i.e. assets) that are important for resilience. The identification of such dimensions of resilience is discussed in more detail below, in light of the results of the review of existing methodologies for measuring resilience, and of ICF and BRACED projects and M&E plans.

SECTION 4

Review of existing Methodologies for Measuring Resilience

A key element of the study described in this report was a review of existing frameworks and methodologies for measuring resilience. 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. Rather, it focused on a small number of methodologies and frameworks for measuring resilience described in literature highlighted DFID or identified by the consultants as being of particular interest, and included one new operational framework for measuring vulnerability on the grounds that this was of particular interest in the context of the current study due to the methods used.

4.1 Approach and frameworks/methodologies reviewed

Each methodology/framework was subject to a qualitative review against a set of six criteria, which were developed in consultation with DFID. These six criteria were derived from an initial list of 22 criteria identified by the consultants, and are listed in Table 1. Well-developed methodologies were also assessed by scoring them against these criteria. Assessment was based on expert judgment, with methodologies scored using a scale of 0 (does not meet criterion at all) to 2 (fully meets criterion). The results of the quantitative assessment of methodologies are presented below in Table 2.

The various frameworks and methodologies assessed define different dimensions of resilience or vulnerability, and these were compared to identify common elements and define a broader set of dimensions.

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

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 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. Include participatory elements, engaging intended beneficiaries in project-level M&E design, the identification of appropriate proxies/indicators, qualitative monitoring and evaluation of the project's effectiveness, and ongoing evaluation of project outcomes and impacts once the project has ended.

Table 1 Applicability criteria

The frameworks and methodologies reviewed are summarise below.

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". 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 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 RF (and indeed in other frameworks). Because LAC is a high-level framework, its utility depends to a great extent on how it will be operationalized to suit programmatic requirements and provide guidance on results measurement.

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. ICIMOD Multidimensional Livelihood Vulnerability Index (MLVI) (Gerlitz et al. 2014; Gerlitz et al. forthcoming)

The MLVI has been developed to assess household level vulnerability in mountainous areas of South Asia. The MLVI breaks down vulnerability into three main dimensions (based on the IPCC framing of vulnerability), which in turn are broken down into a number of sub-dimensions. Each sub-dimension is associated with a number of readily measurable indicators defined at the level of the household. The index is constructed using the method of Akire and Foster (2012), using weighted indicators with cut-off points to define vulnerability against the various sub-dimensions. The MLVI is intended to be used flexibly as a single-value index or decomposed into its three main dimensions, 12 sub-dimensions and/or 25 vulnerability indicators, in recognition of the need for disaggregation if such indices are to be used to inform the targeting and design of development and adaptation interventions.

The MLVI provides an approach that can be readily adapted to the measurement of resilience. Issues of potential concern with the index are (i) the mixture of indicators that would be applied at both the impact and outcome levels based on the discussion earlier in this report, (ii) the use of 'universal' indicators whose relevance might vary across contexts (iii) the fact that the selection of the indicators is, to an extent, driven by data availability, (iv) the subjective nature of the weightings and the concern that different weightings might be appropriate in different contexts.

4. IIED: Tracking Adaptation and Measuring Development (TAMD) (Brooks et al. 2011, 2013)

The TAMD framework has been developed by IIED with support from DFID through an ongoing research grant. The framework seeks to link institutional climate risk management (CRM) processes and mechanisms (described under 'Track 1' of the framework) with development and adaptation described in terms of reduced vulnerability, enhanced

resilience, improved human well-being, and reduced losses and damages associated with climate hazards (Track 2). The framework presents a set of indicators of institutional CRM, as well as a outline methodology for measuring vulnerability and converting contextual vulnerability indicators into scores that can be compared across projects and aggregated at the programme level. This methodology is the basis for the ICF KPI4 methodolgy. TAMD strongly emphasises the need to go beyond the measurement of outputs to measure outcomes and impact, and addresses the need to contextualise or normalise impact level well-being indicators and use these in parallel with predictive proxy indicators of resilience, as well as the use of project-level theories of change for attribution of project impacts. It does not currently identify any specific resilience indicators or indicator clusters, or address the dimensions of resilience. However, an indicator framework is in development and will described in a forthcoming working paper. TAMD has been tested in a number of countries, where it has been applied to the development of indicators of readiness to address climate change at the national level (e.g. Cambodia), and the development of sub-national level M&E frameworks and indicators to measure project and programme performance (e.g. Kenya, Nepal and Pakistan).

TAMD provides a useful and versatile framework that can be applied across a range of project context, and that can also be used to compare projects and assess results at the programme level. It addresses the key issues of linking outcomes with outcomes and impacts, normalisation/contextualisation of impact indicators, attribution/contribution, and learning. It stresses the contextual nature of indicators related to resilience/vulnerability, and emphasises participation. It provides some methodological guidance on indicator construction, and some specific indicators for application at the institutional level. However, it is a more of a framework than a tool, and would require significant further operationalization to be applicable in a project context. Nonetheless, as it is still in development if has considerable potential for application to BRACED in the near future. This will also be informed by the lessons learned from its application in various country and project contexts.

5. 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. As such, there is limited comparability across projects. 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.

6. 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 a high degree of 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.

7. 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.

8. 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 uted 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 address contribution/attribution, learning, comparability across projects, or value for money at the programme level.

9. 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.

4.2 Results of review

The results of the assessment of *methodologies* against the six applicability criteria listed in Table 4.1 are presented in Table 4.2 for six of the above nine studies. The ACCRA study and TAMD are not included in the table as they are frameworks rather than methodologies, although TAMD does contain some elements of methodological guidance. The MLVI is omitted as it explicitly addresses vulnerability rather than resilience.

On the basis of the formal scoring exercise, the most directly applicable methodology appears to be that of Tulane University, with the caveat that this was applied to a very specific context and would need to be adapted for use in ICF/BRACED contexts, in addition to the caveats listed above. Elements from the Oxfam multidimensional approach, and from TAMD, might also be incorporated into any methodology for measuring resilience in the ICF and BRACED contexts. However, all of the methodologies reviewed have shortcomings, and the ones that score highest have been developed for specific contexts. Greater flexibility is required in identifying context-specific indicators that are relevant to specific hazards and associated impacts across a divers range of situations.

In order to address all the criteria in Table 1, the need for greater attention to hazard contexts and the DFID RF at large, and the specific programmatic and project contexts of ICF and BRACED, it is concluded that a methodology should be developed that is tailored to the particular ICF/BRACED context.

Table 2. Scoring of frameworks and methodologies described in a number of studies of resilience, based on the six applicability criteria listed in Table 1. A score of 0 indicates that a criterion was not met at all, a score of 1 that it was partially met, and a score of 2 that it was mostly or fully met. Non-integer scores were assigned to reflect the extent to which a criterion was met.

	STUDY	APPLICABILITY CRITERIA						
		1	2	3	4	5	6	AVE
1	Tulane University	2	2	2	0.5	2	2	**1.75**
2	Oxfam GB	2	1	1	1	0	0	**0.83**
3	World Vision/Tufts University	0.5	2	0.5	0.5	0	0	**0.58**
4	University of Florence	1	2	0	0.5	0	0	**0.58**
5	FAO	1	1	0	0	0	0	**0.33**
6	WFP*	0	0.25	0	0	0	0	**0.04**

*based on TANGO paper only (Frankenberger and Nelson 2013); no copy of actual paper

Table 2

The review of existing methodologies was instructive in terms of what it revealed about how resilience is conceptualised. Table 3 lists the dimensions of resilience as identified in the five methodologies subject to formal review (Table 2).

Table 3. Dimensions of resilience/vulnerability as defined in five methodologies reviewed by this study. The dimensions defined by ICIMOD are the sub-dimensions under the main dimensions of exposure, sensitivity and adaptive capacity. The Oxfam dimensions are quite broadly defined, and encompass aspects described under many of the dimensions of the other methodologies.

ICIMOD	FAO	U. Florence	Tulane U.	Oxfam
• Socio-demographic status	• Assets	• Non-agricultural assets	• Wealth	• Social & institutional capacity
• Resources & energy	• Income & food access	• Agricultural assets	• Debt & credit	• Contingency resources & support
• Livelihood strategies	• Access to services	• Income & food access	• Community networks	• Livelihood viability
• Social networks	• Social safety nets	• Access to services	• Coping behaviours	• Innovation potential
• Physical accessibility	• Adaptive capacity	• Institutional social safety nets	• Protection/security	• Integrity of natural & built environment
• Wellbeing	• Stability	• Community social safety nets	• Human capital	
• Health & sanitation		• Adaptive capacity	• Psychosocial status	
• Food security		• Physical connectivity		
• Water security		• Economic connectivity		
• Environmental stability		• Household structure		
• Environmental shocks		• Household technological level		
• Socioeconomic shocks				

Table 3

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 methodologies. All the methodologies also include dimensions relating to adaptive or coping behaviours. These

are closely related, although arguments can be made that adaptive capacity and coping capacity refer to different timescales and different types of response to stress.

Access to services and key resources is represented in three methodologies by indicators relating to water, sanitation and health, and to distances or times associated with accessing water and services. Oxfam focuses on access to resources for agricultural and pastoral livelihoods. Assets are mentioned explicitly in three of the five case, and are addressed in the other two under 'wealth' (Tulane) and aspects of livelihood viability (Oxfam) Access to food/food security are explicitly identified in three cases, and are arguably implicit in the other two.

Dimensions relating to connectivity are listed by ICIMOD and the University of Florence, and are closely related to access to resources. Physical environmental contexts are identified as important dimensions by ICIMOD (environmental stability) and Oxfam (integrity of natural and built environment).

The methodologies reviewed reveal a high degree of commonality in the way they define dimensions of resilience and (in the case of ICIMOD) vulnerability, with safety nets, adaptive and coping behaviours, assets, and access to resources (including connectivity) occurring across most or all of the frameworks reviewed. Dimensions relating to environmental contexts are highlighted in a minority of cases. Knowledge and awareness are represented explicitly in the Oxfam frameworks, and Tulane also includes a dimension of psychosocial status.

A preliminary, draft set of dimensions of resilience might be defined based on the above review, including the following elements:

- Safety nets
- Access to services and resources
- Adaptive capacity
- Income and food access
- Material & financial assets/wealth
- Coverage by early warning systems & other risk reduction measures
- Environmental sustainability/resilience
- Household structure and human capital
- Physical connectivity
- Physical security
- Knowledge/awareness
- Wider societal/institutional resilience
- Quality/resilience of the built environment

This list might be streamlined by combining certain dimensions. With any given project context, a subset of dimensions might be identified as being of particular relevance, which can then be operationalised through the identification of relevant indicators. Alternatively, potential indicators might be identified 'from the ground up' in a specific context, and mapped onto the above dimensions as an exercise to identify which dimensions are represented, and

whether there are any gaps in indicator coverage (i.e. are there dimensions that are not represented but should be?)

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 available of adequate documentation of M&E plans and indicators. The projects examined were those whose titles suggested a resilience purpose and which log-frames were available to the consultants. 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 relared indicators identified in the project log-frames were clustered into groups, with each group being desribed in terms of a generic indicator (i.e. an indicator described in general terms, of which all the project 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 deailed below.

Number and diversity of indicators
The total number of indicators used across the projects was very large and varied[4]. 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 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 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. In addition to guidance on some common indicator definitions, the Knowledge Manage might also provide guidance on the appropriate levels at which certain indicators should be used (for example by mapping these indicators formally to the DFID Resilience Framework).

Composite indices
Many projects employ composite indices, for example Community Resilience Index, HH Food consumption score, Disaster Preparedness Index, Community Asset Score, 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

[4] 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.

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 vaguely, and further guidance on what constitutes transformational change might be desirable.

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 ToCA, but is compatible with an interpretation of the RF in which enhanced resilience is an outcome that contributes to improved well-being, and also with the way impacts are defined for development interventions at large[5]. 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[6].

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

6 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.

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;
(d) State of the environment.

As argued above in Sections 3.5 and 3.6, there is an strong case for separating **actual** human well-being measures, defined at the impact level, from **theoretical** proxies for resilience (albeit informed by empirical evidence), defined at the outcome level. The robustness of our prima facie definitions of resilience may be tested through the examination of correlations between such outcome and impact indicators, combined with an interrogation of the causal pathways linking the factors represented by resilience outcome indicators with well-being outcomes. Such an approach provides powerful learning opportunities that can enhance understanding of how resilience is constituted, 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 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 exclusive 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);
(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)[7].

[7] 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?)

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
(b) Number of people covered by private, 3rd sector and state **resilient service provision** lincluding 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, 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 operationalisation 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.

The outcome and impact indicators used in ICF and BRACED projects map quite well onto the suggested dimensions of resilience in Section 4.2.

SECTION 6

A Methodology for Measuring Resilience in ICF and Braced Projects

6.1 Methodological considerations

Any methodology for measuring changes in resilience in the context of ICF and BRACED projects, and across the programmes at large, needs to fulfil the criteria set out in Table 4.1. Such a methodology needs to be sufficiently flexible to be applied in diverse project contexts. It also needs to allow projects to report against relevant Key Performance Indicators (KPIs), particularly KPI1 (no. of people supported), KPI4 (no. of people with improved resilience), and KPI15 (transformational impact). It needs to accommodate the monitoring of resilience outcomes at the project level, as well as project evaluation and comparisons, and the aggregation of results, at the programme level. The methodology should be compatible with the DFID Resilience Framework (RF).

The diversity of project contexts means that it is impractical and undesirable to prescribe 'universal' resilience indicators. However, an understanding of the typical 'dimensions' of resilience will help project M&E staff identify appropriate contextual indicators. Furthermore, the identification of a set of very broadly defined well-being related impact indicators is desirable to provide a common reporting framework for certain Key Performance Indicators (KPIs). At the project level, indicators for the key elements of the DFID RF should be identified through processes that are highly participatory, in which project beneficiaries identify key climate and other hazards (Element 2: disturbance), the factors that affect how people cope/adapt (Element 3: capacity/resilience), and the nature of the adverse consequences of the hazards in question (Element 4: reaction/impact).

M&E at the project level should seek to maximise learning, particularly with regard to the identification of the factors that influence resilience (how and why these change over time) and the causal pathways that link project outputs to resilience outcomes and ultimately to impacts on human well-being. The methodology should facilitate this learning by specifying methods for testing the predictive power of 'theoretical' resilience indicators, for example through examination of the correlations of such indicators with actual impacts as represented by well-being indicators. The latter should be measured before and after shocks, and/or lag the resilience indicators whose predictive power is being tested.

The methodology should provide guidance on how to interpret changes in outcome and impact indicators in the context of climate change and variability, and other factors or hazards, that may exert an influence on resilience and well-being contrary to that of project

interventions. It should therefore include guidance on the identification, construction and use of contextual data including climatological indices.

Nonetheless, the methodology needs to strike a balance between technical rigour and complexity on the one hand, and practicality and accessibility on the other. Therefore, a methodology is proposed that consists of different 'levels of complexity'. The lowest level of complexity will involve the use of qualitative data and stakeholder/beneficiary narratives to identify perceived changes in resilience and well-being, complemented with quantitative data from existing, readily accessible sources where available. Analysis at this level will enable projects to report against the relevant ICF KPIs.

The highest level of complexity will enable projects to use a combination of qualitative and quantitative approaches to construct tailored, context specific indicators of resilience, impact and hazard; to examine relationships between resilience and well-being indicators using statistical methods; and to normalise impact indictors using quantitative hazard data (e.g. climatological indices).

Between the lowest and highest levels of complexity will be a spectrum of approaches involving a mixture of qualitative and quantitative techniques, to be deployed as appropriate in the context of any particular project. The question of attribution/contribution will be addressed at all levels.

The lowest level of complexity might constitute required reporting, but project staff should be free to judge what may or may not be appropriate above this level given the specific project context. This approach should facilitate learning and rigour, without making unrealistic demands on projects in terms of data gathering and analysis where data and resources are scarce.

6.2 Proposed methodology

Drawing on the considerations outlined in the previous section, and on the wider discussion in this report as a whole, a provisional methodology is proposed based on nine steps, outlined below. These steps have been constructed to map closely onto the DFID RF, 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.

The steps outlined below echo the BRACED programme design guidance – a consequence of the close attention to project contexts that is necessary if M&E frameworks are to identity contextually appropriate measurement methods and indicators, and address issues such as normalisation.

It is anticipated that this methodological outline/guidance will evolve in the interim period prior to the appointment of the BRACED Knowledge Manager, as a result of consultations with both DFID and BRACED grantees.

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

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 RF)

The identification of *hazards* is important for two key reasons. First, once these have be 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 RF)

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 the 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 RF)

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 RF, 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 (section 4.2 above), depending on what is appropriate in the context in question.

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 or 'normalised'

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 'normalisation' 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 RF.

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[8], 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.

[8] 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).

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[9], built around questions that address the extent to which 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

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

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.

SECTION 7

Recommendations and next steps

A provisional methodology for measuring the impact of ICF and BRACED projects on resilience – and ultimately on human well-being – has been outlined above. This methodology needs to be developed further before it is fully operational. Specifically, a number of key questions need to be addressed through further consultation with DFID and BRACED grantees. These include:

1. How projects will be evaluated at the programme level, and the extent to which the methodology will support this, including as related to issues such as payment by results.
2. How the methodology is presented and used in relation to programme or project development guidance (e.g. developed into more substantial technical guidance, disseminated through more 'light touch' guidance notes, supported by workshops and training for grantees and project staff).
3. The extent to which the methodology will incorporate/describe mandatory reporting elements (this is expected to be limited but not zero).
4. What the minimum requirements for project reporting will be under the methodology.
5. The extent to which project staff will carry out project evaluation (as opposed to monitoring), and the extent to which this will be carried out at the programme level, for example by the Knowledge Manager.
6. The amount of support that will be available during the project development stage for (i) indicator development, (ii) the establishment of baselines, and/or (iii) the identification of what elements of the methodology should be applied in a project M&E plan.
7. Whether or not specific dimensions of resilience (Section 4.2 above) will be defined against which projects are expected to report, and if so, how they should be defined (the same dimensions might not be equally applicable across projects).
8. How the links are made between individual resilience and the resilience of the systems, processes and resources on which individuals depend, particularly with reference to reporting against indicators such as KPI4.
9. How the links are made between individual resilience and the resilience of the systems, processes and resources on which individuals depend, particularly with reference to reporting against indicators such as KPI4.
10. How the methodology will address reporting against KPI1 and KPI15, as well as KPI4.
11. Whether the proposed broadly defined impact indicators (Section 5.3 above) should be adopted as reporting requirements or suggestions for BRACED projects.

12. How the methodology addresses the issue of value for money. A simple metric would be number of people with enhanced resilience scaled by project spending, but this is a somewhat blunt measure that fails to account for the diverse contexts, challenges, costs and needs associated with different projects.

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