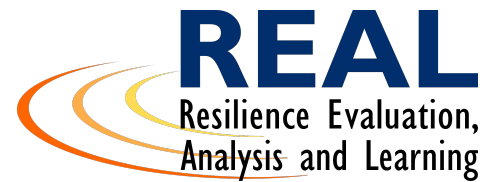




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CONCEPT NOTE

Measuring Resilience Across and Between Scales and How to Do It



Acknowledgements:

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Introduction

In this document, the importance and the challenges related to the measurement of resilience across and between scales is discussed. The document is written as a concept note, aiming to provide generic advice and practical guidance to agencies, practitioners and other stakeholders that are involved in resilience interventions in the international development field. Our point of entry for this document are resilience interventions implemented in humanitarian, development, and food security domains but the concepts may be applied to other sectors as well.

Why measure resilience at multiple scales?

In the context of this document, ‘scales’ are understood as “natural levels of observation or analysis,” and can be defined spatially, geographically, ecologically, socially, or institutionally. In domains such as humanitarian, development, and food security interventions, these levels are most often defined socially and the three main levels almost systematically considered are: individual, household and community. From a more ecological or bio-physical perspective, landscape and ecosystem levels could be considered as other relevant measurement scales. In urban contexts, city, town, or other administratively-defined spatial unit may also be appropriate (e.g., urban district, neighborhood, parish). Thus, scales of different types co-exist and overlap. The question then is: what are the benefits of recognizing different scales in resilience measurement? Resilience is already quite ‘tricky’ to measure, why should humanitarian, development, and food security initiatives make it more challenging by measuring resilience at different scales, or levels? What makes us believe that a ‘multi-scale’ lens is relevant – or necessary – for resilience analysis?

Resilience at multiple scales – hypothetical and empirical considerations

The importance of different scales and their relevance to resilience measurement has been widely noted in several other fields where the concept of resilience is used frequently. For example, the relationship between resilience and scale has long been discussed in the ecological literature (e.g., Peterson et al., 1998), and more recently in the social-ecological literature (e.g., Sundstrom et al. 2014; Cumming et al. 2015; Rash et al., 2017). Likewise, studies of global environmental change have long recognized resilience as a multi-dimensional and multi-scale key concept that can facilitate the understanding of various complex interactions among a broad range of social and natural dimensions (Vogel, 2006).

Beyond the importance paid to scales in other communities of practice, very strong conceptual and empirical reasons for measuring resilience at multiple scales can also be found within the humanitarian, development and food security sectors. One is the widespread empirical recognition of the multi-layered nature of vulnerability; shocks and stressors themselves occur at multiple scales and impact people at different levels. They may involve both local and global

factors such as the volatility of local food markets and global trends in climate change. The conceptual distinction between idiosyncratic and covariant shocks is in fact the very direct illustration of this: idiosyncratic shocks such as the death of the family's primary wage-earner, or the motorbike accident that immobilizes the eldest son for several months, or the acute diarrhea that affects the newborn baby, are all occurring at and affect both the individual and household levels. In contrast, covariate shocks such as flood, drought, environmental degradation, and economic crises typically affect whole communities, regions, countries, or continents.

It is, however, not just shocks and stressors that occur at different scales –it is in fact the overall environment within which people live and operate, as well as their capacities (e.g. capacities at individual or community levels) and wellbeing (individual, collective), which are characterized by this nested hierarchy of dynamics and scales.

This recognition leads to several key questions in relation to our objective: is resilience itself multi-scale and materializes itself at different scales? Further, can we think of resilience as an inter- or cross-scale process? For instance, could resilience be considered an emerging property¹ in such a way that resilience at the community level results from the construction of resilience at lower (e.g., individual, household) levels? Or is it a capacity at the community level that is related to, but independent from, the level of resilience at household level? Likewise, is resilience at household level just the results (the sum of) the resilience of the members of that household, or is it more than that?

All of those theoretical examples lead us to consider some form of positive or negative relation between resilience at different scales. Under that assumption, building resilience at the household level could for instance be contributing to the resilience at the community level—an example of positive cross-scale relation). Yet it is not totally unrealistic to imagine that on the contrary, the resilience at one level could be strengthened at the detriment of the resilience at another level—a case of negative relationship. Certainly, at the interface between individual and household, examples exist of those negative relationships. The spouse who voluntarily reduces her own consumption to maintain the consumption of the primary breadwinner of the household with the understanding that the overall resilience of the household is closely dependent on the ability of that primary breadwinner to secure regular income, is one of those examples. Along the same line, it is easy to imagine cases where certain households may manage to strengthen their resilience but only at the expense of the wider community, for example, by excluding other members from economic opportunities, or by limiting their access to community resources based on, e.g. ethnicity, kinship, or even financial/income level².

¹ Emerging property = In philosophy, systems theory, science, and art, emergence is a phenomenon whereby larger entities arise through interactions among smaller or simpler entities such that the larger entities exhibit properties the smaller/simpler entities do not exhibit. For instance, the phenomenon of life as studied in biology is an emergent property of chemistry. Likewise, psychological phenomena emerge from the neurobiological phenomena of living things.

² Pain and Levine (2012) for instance in their analysis of livelihood trajectories in rural Afghanistan give the example of landlords whose resilience is reinforced in ways which weaken the resilience of their sharecroppers.

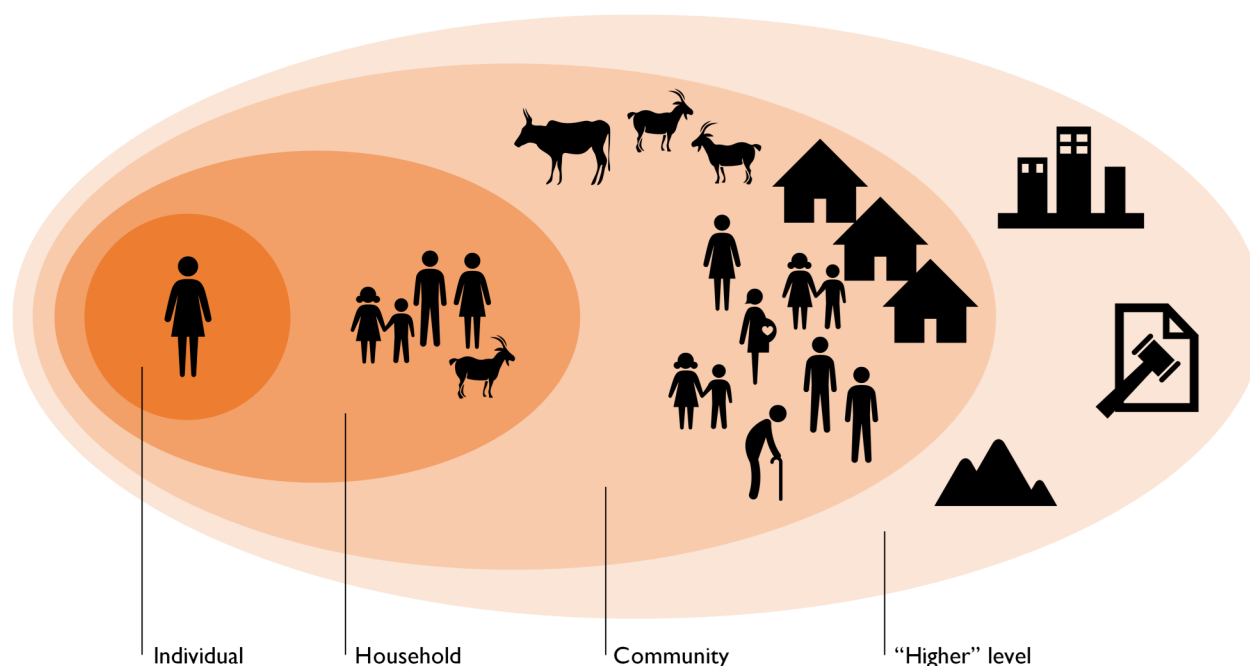
Such examples demonstrate the importance of considering scales when we plan for resilience interventions and when we aim to measure/assess resilience interventions. Yet the review of the literature indicates that the large majority of the approaches proposed in humanitarian, development or food security often limit their measures to one level – usually the individual or household level. Fewer propose some forms of measure at a higher, community level, and only a handful provide an approach or a methodology that allows us to operate at several levels simultaneously.

How to measure resilience at multiple scales?

In theory, measuring resilience at different scales is feasible. The choice of the scales is generally evident: unless there are specific reasons for focusing on only one level or to ignore one/several other one(s), the typical – and perhaps most natural – levels of observation for resilience analysis are:

- (i) Individual
- (ii) Household
- (iii) Community, and
- (iv) “Higher” level, where the nature of this last ‘higher-level scale’ will depend on the context and focus of the study.

Figure 1. Typical levels of observation for resilience analysis



Household and community are the ‘units’ at which activities in humanitarian and food security interventions are conventionally designed and implemented. This is also the two levels at which resilience interventions are generally planned and carried out.

Interventions at the individual level are rarer (see below). Even if in many cases the beneficiary involved in the activity is an individual person (the household head, the first wife, etc.), the objective is generally to have impact at the household level. As a consequence, the individual level is less often a natural entry point for resilience analysis even if, as we shall see below, resilience at this level should be more often considered.

As for the higher level, the literature indicates that this level is often geographical in nature, corresponding to either an administrative unit (e.g., district/province) or to an ecological system (e.g., watershed, landscape, valley) covering the area where the project is being implemented. Very often, especially in rural contexts where people's livelihood strategies are still heavily dependent on natural resources or agro-ecological integrity, the choice of an ecological system makes sense. In urban context, this is more often the case of administrative entities: neighborhoods, cities. In recent years, in particular in relation to the growing interest for food systems, one may also find some other units of analysis such as agri-food systems, supply chains, or foodsheds. Finally, market/financial, political systems can be appropriate levels of interest – although less often considered in the context of food security interventions.

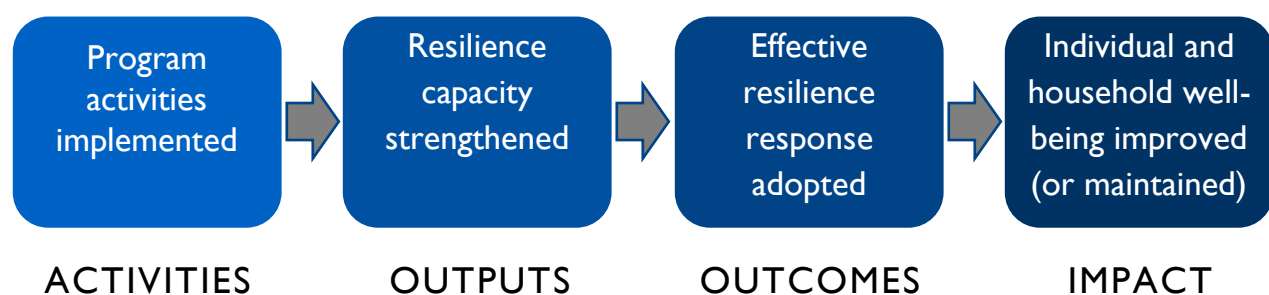
Beyond these examples, one could of course also consider measuring resilience at even higher scales (e.g., sub-national or national level), but the relevance of those higher-scale entities decreases rapidly as their physical sizes increase, for several reasons. One is the fact that the impact of the humanitarian or food security intervention under consideration is likely to be less significant at those higher levels. Thus, the relevance of considering the outcomes or impacts of a local—or even provincial—project on national statistics is not obvious. Perhaps more fundamentally is the fact that higher levels of analysis are unable to capture local heterogeneity, thus reducing drastically their relevance and representativeness—especially in comparison to the lower levels of the analysis. For instance, using a national average figure of, say, levels of infrastructure or financial inclusion, to help understand how access to basic services influences resilience at community level, does not really make sense.

Overall, the choice of measurement scale(s) at which a resilience analysis should be conducted is therefore straightforward. It should include the four levels discussed above. More challenging is the choice of the appropriate indicators and variables at each level, and how they are brought together in a coherent way relative to the resilience measurement framework. In this document, we use a combination of the TANGO/USAID (Frankenberger et al., 2013) and Béné, Frankenberger and Nelson's (Béné et al., 2015) M&E frameworks as our resilience measurement framework to illustrate the ways to consider multiple scales in resilience analyses. Those two frameworks are derived from a common vision of what constitutes resilience, how it is measured, and what a generic theory of change (ToC) for resilience interventions should look like.

This generic ToC is shown in Figure 2. The ToC, which is structured around activities, outputs, outcomes and impacts, indicates that for a resilience project the activities implemented are expected to strengthen the resilience capacities (i.e., outputs) of the targeted beneficiaries (e.g.,

households, communities). Drawing on their strengthened resilience capacities, households and communities are then better positioned to adopt appropriate responses (outcomes) in anticipation of (i.e., to prepare for) or in reaction to (i.e., to cope or respond to) specific shocks or stressors. In the long term, systematic adoption of appropriate—and positive—responses is expected to lead to improvement (or at least the non-deterioration) of people’s wellbeing in the face of shocks and/or stressors (i.e., impact). This generic ToC is therefore very useful in the sense that it helps us identify the points of entry (i.e., outputs, outcomes, impact) where indicators need to be identified and measured.

Figure 2. Generic theory of change for a resilience intervention



Source: Béné et al., 2015

Combining this generic ToC with the above discussion on scales, a matrix can be created, which provides us with an overarching framework for measuring resilience at multiple scales. This matrix is represented in Table 1.

Ideally, all the cells in the multi-scale resilience measurement framework would be populated. Even though resilience interventions in humanitarian, development, or food security projects aim to improve the wellbeing of a target population, and therefore indicators are mainly measured at individual, household, or community levels, higher level processes or dynamics should also be considered as key constitutive elements of people’s resilience and their ability to maintain or improve their wellbeing in the face of shocks or stressors. One can, for instance, very well envisage that some of the activities implemented at the community level may translate into changes at higher levels, which eventually have positive outputs or outcomes for the populations. A good example would be activities initially implemented at household or community level that aim at improving the water retention or at restoring the productivity of soil (e.g. *zaï* or *demi-lune* in the Sahel region³). When appropriately and regularly implemented on a sufficient large area, those techniques can eventually improve the general status of natural resources at a higher level, say, the watershed level. Healthier or better-managed natural resources at those higher scales can then lead to healthier livestock or more income for the households, thus potentially contributing to improved resilience capacities of the households, especially in time of crisis.

³ <https://www.ilesdepaix.org/wp-content/uploads/2014/09/Le-za%C3%AF-et-la-demi-lune.pdf>

Table 1. Multi-scale resilience measurement framework

<i>Level of analysis</i>	OUTPUTS Increased resilience capacities	OUTCOMES Positive responses	LONG-TERM IMPACTS Changes in wellbeing
Higher system	- ... - ...	- ...	- ...
Community	- indicator k - ...	- ...	- indicator x - ...
Household	- ...	- indicator i - ...	- ...
Individual	- indicator a - indicator b	- ... - ...	- ...

An important task is to identify the relevant indicators for each of the cells of the framework. To illustrate this process, we use below the TANGO/USAID framework, but the task could be completed with any framework that recognizes resilience as a set of capacities. For example, FAO’s Resilience Index Measurement and Analysis (RIMA) framework, which considers access to basic services, assets, and adaptive capacity as resilience pillars, could be also used (see e.g., FAO RIMA, 2016).

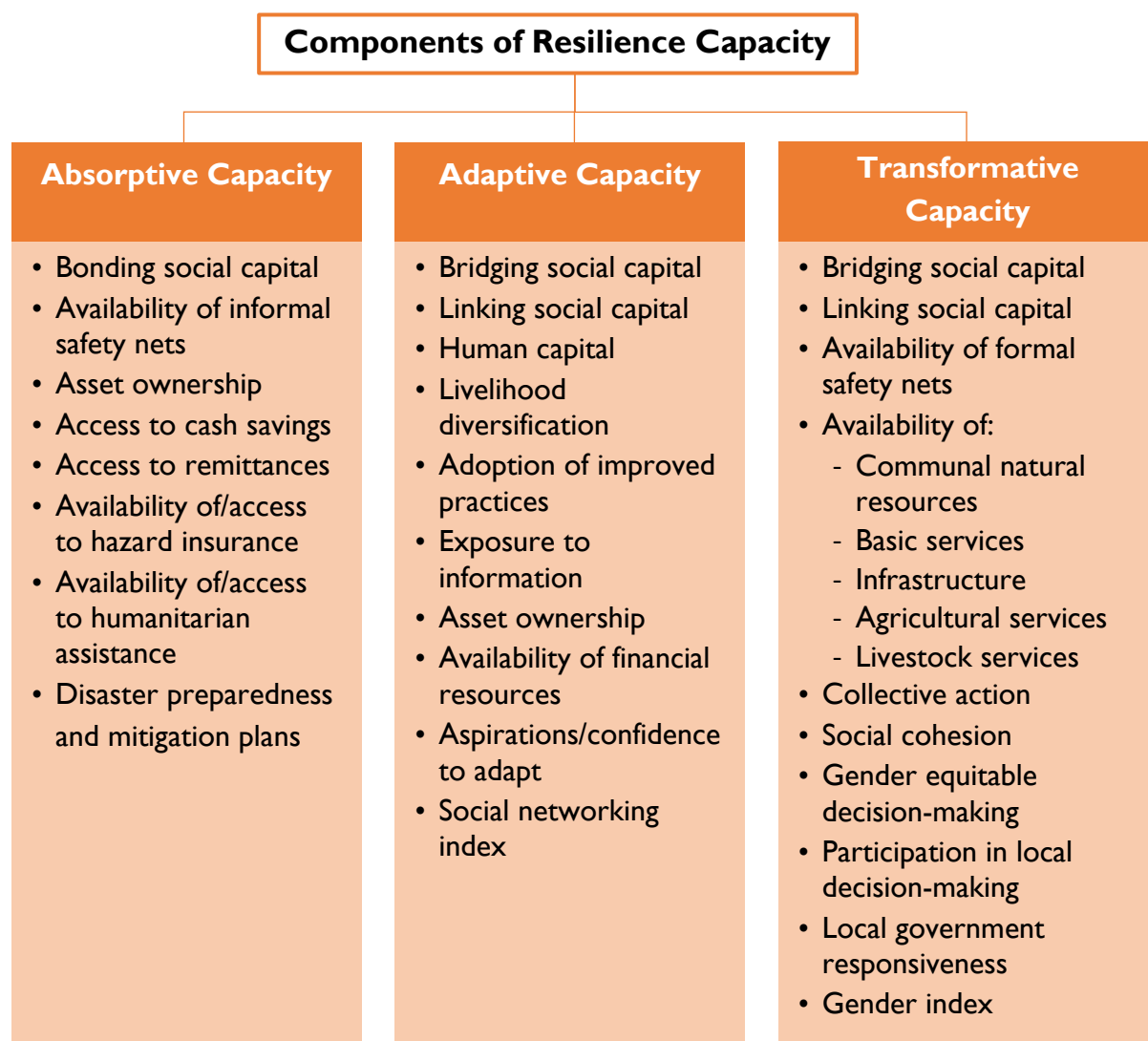
Multi-scale resilience capacities (output indicators)

As far as resilience capacities (i.e., outputs in Table 1) are concerned, the TANGO/USAID framework already provides potential indicators. They have been organized according to the original framework under three categories: absorptive, adaptive and transformative capacities (see Frankenberger et al., 2013) and are represented in Figure 3.

What is needed is to identify the appropriate level at which the different resilience capacity indicators are measured. Based on Figure 2, it appears that the majority of the absorptive and adaptive capacity indicators are mainly household-level indicators, although some may also be relevant at the individual level. In fact, the distinction between the two levels (individual vs household) is sometimes “blurry.” For instance, human capital is often based on the situation of the head of the household only (e.g., his or her highest level of education, different types of trainings received, etc.) and is used often as a proxy for the whole household. The underlying assumption is that the household head’s—rather than other family members’—level of education/training is most relevant to the household’s overall level of human capital⁴.

⁴ Several recent resilience studies have used “any adult” in the household rather than only the head to calculate human capital at the household level. Alternatively, the level of human capital for each adult member of the household could be scored and “summed” as a household-level measure.

Figure 3. Indicators of resilience capacity



Source: Frankenberger et al., 2013

Other indicators (e.g., cash savings, asset ownership) can be computed at the individual **and** household levels. However, the disadvantage of measuring certain indicators at the household rather than the individual level is that one may miss some important information regarding intra-household variation, for example, who in the household has savings or owns assets (and which ones). Intra-household dynamics can play a potentially important role in households' resilience and resilience capacities; men and women usually differ in their ability to access or own certain assets, and in decision-making around how assets are used. Thus, measuring only at the household level for some indicators (as it is very often done in resilience analysis) may introduce some bias and obscure certain intra-household resilience dynamics. Great care should be taken to avoid such biases when identifying indicators as well as the level(s) at which they are measured.

In the current version of the TANGO/USAID framework, most (though not all) indicators of transformative capacity are measured as community level indicators. Availability of markets, infrastructure, basic services, communal natural resources, agricultural and livestock services, and informal community safety nets are all community characteristics. As indicators, they measure whether these services are available to individuals and households in a community. That is, if they are not available in a community, they are not typically accessible either. Thus, households can be severely disadvantaged in terms of their ability to absorb or adapt to shocks and stressors if certain community resources are lacking. At the same time, however, availability of such resources does not necessarily mean households take advantage of them when preparing for, coping with, or recovering from shocks and stresses. Therefore, it is also important to measure whether any of the resources were accessed (i.e., used) by individuals or households in response to a shock or stress (outcomes in Table 1).

As for transformative capacity, the latter is defined in the TANGO/USAID framework as “the governance mechanisms, policies/regulations, infrastructure, community networks, and formal and informal social protection mechanisms that constitute the enabling environment for systemic change.” It is perhaps not surprising that the indicators of transformative capacity are therefore primarily measured at the community level. Transformative capacity provides the enabling environment that allows individuals, households, or communities to absorb or adapt to shocks and stressors in ways that do not have negative impacts on their wellbeing.

It should be noted however that transformation does not happen only at community level, or that a community-level supportive environment is not always absolutely necessary to build transformative capacities. Individuals and households can transform their lives, livelihoods and overall level of wellbeing at their levels. For example, in low or middle-income countries, education—especially higher levels of education—can be “transformative” at the individual level for women in particular. Level of education (i.e., human capital) is typically included as part of adaptive capacity, even though in this instance it may play a “transformative role” in the lives of women in some countries. It is therefore possible to identify indicators of transformative capacity that are relevant to lower levels than community.

Thus, the choice of appropriate output indicators should reflect local specificity of livelihood strategies, social and cultural characteristics of the targeted communities, and the ecological environment. Importantly, they should also be chosen so that they capture the capacities of those communities’ individual members.

It is important to reiterate, however, that resilience measurement and analysis does not just involve measuring changes in resilience capacities. Rather, it also involves measuring changes in resilience responses (i.e., outcomes) and ultimately, impacts.

Multi-scale responses (outcome indicators)

The next column in the framework concerns the types of strategies used by the targeted population in response (or anticipation) to shocks or stressors. Those correspond to *outcomes*—or resilience responses—in the ToC. As was the case for resilience capacities (*outputs*), resilience responses should also be considered at the individual, household, community, and higher levels.

At the individual or household levels, and in the context of humanitarian or food security interventions, the Coping Strategies Index (CSI) (CARE and WFP, 2003; Maxwell and Caldwell, 2008) is a particularly good example of potential outcome indicators for measuring resilience responses. The CSI records the occurrence of specific detrimental food consumption-related coping strategies adopted by households in response to specific shocks (Table 2). Other ex-post responses might also be relevant, such as those focusing on the adoption of cash or money-borrowing strategies, easily measured by indicators that capture access to or utilization of financial services (e.g., savings groups, credit).

Table 2. Coping Strategy Index (CSI)

1. Dietary change
a. Rely on less preferred and less expensive foods
2. Increase short-term household food availability
b. Borrow food from a friend or relative
c. Purchase food on credit
d. Gather wild food, hunt or harvest immature crops
e. Consume seed stock held for next season
3. Decrease number of people
f. Send children to eat with neighbours
g. Send household members to beg
4. Rationing strategies
h. Limit portion size at mealtimes
i. Restrict consumption by adults in order for small children to eat
j. Feed working members of household at the expenses of non-working members
k. Reduce number of meal eaten in a day
l. Skip entire days without eating

Source: Maxwell and Caldwell, 2008

Resilience building is not, however, just about avoiding certain detrimental short-term responses, particularly those that undermine absorptive capacity. Rather, it is also about nurturing or fostering an ability to engage in positive and sustainable responses in the short, medium, and long term. A good example of effective individual or household resilience behavior would be the increased use of early warning system information amongst nomadic communities for making decisions on livestock movement or destocking in arid or semi-arid regions. An increase in the

percentage of the population that is aware of, has access to, and effectively uses typhoon shelters in the context of the typhoon-prone coastal areas of many South-East Asian countries provides another good example.

Here again, as was the case for outputs, the distinction between *outcomes* at the individual and household levels may sometimes be difficult to make empirically, as a large number of coping strategies (i.e., responses) take place at the interface between individuals (as members of the household) and households per se (as the unit of operationalization of those strategies). For instance, reducing the household food or health expenses is a decision that is made by the head(s) of the household, but which generally affect the entire household—sometimes to different degrees.

Some responses, however, do not take place at the individual or household level, thus the importance of including higher scales in the framework, such as the community level. In particular, one of the key features (or value added of) distinguishing resilience responses at the community level from those at the household level is the possibility to observe collective actions. For instance, actions taken in an agro-pastoralist community to amend local rules governing access to communal water pools in response to an unusually long dry season (whether to make them more inclusive or more exclusive) should be recorded at the community, not the household, level.

Responses at higher levels are also important to consider because the ultimate effect of a shock or stressor on a targeted population does not depend *only* on responses at that population (individual or collective) level. Instead, the ultimate impact may also depend on how other actors—not necessarily directly affected by the shock—respond and at what level (e.g., local, district, provincial levels). For example, local authorities may implement strategies to reduce the ultimate effect of a shock or stressor for certain groups within a community, but with involuntary—or sometimes deliberate—consequences for others. The 2011 flood in Bangkok serves as a case in point. As the flood threat continued to increase during the month of October, efforts to build additional sandbag flood walls were undertaken by the Bangkok municipal authorities in order to prevent the Chao Phraya River from overflowing into the city. While the flood walls were successful at keeping the center part of Bangkok dry, they essentially diverted the flood to districts in eastern Bangkok that were located outside the flood wall, resulting in severe flooding precipitated by the diversion efforts rather than the original flood threat.

Resilience analysis should include, therefore, an evaluation of the effect—and trade-offs—of different response strategies at multiple scales (e.g., household, community, district, provincial, national). In addition to improving our understanding of the resilience itself (as demonstrated by the example above), the multi-scale framework is also important in terms of understanding and being aware of how power dynamics and political willingness (or lack thereof) at different levels can lead to more, or less, equitable resilience outcomes between levels.

Multi-scale wellbeing (impact indicators)

If we accept that the ultimate goal of resilience interventions is not the achievement of more resilience *per se*, but rather improvement (or at least non-deterioration) of long-term individual or household wellbeing in the face of shocks and stressors, then the indicators used to measure resilience program impact should capture changes (or preservation) in wellbeing. From our humanitarian/food security/development perspective, appropriate indicators could include: nutritional indicators (e.g., child weight-for-age z-score); food security indicators (e.g., Household Food Insecurity Access Scale – HFIAS) (Coates et al., 2007); Household Dietary Diversity Score (HDDS) (Swindale and Bilinsky 2006); monthly expenditure per capita; subjective wellbeing indicators (OECD, 2013); or psychological indicators, such as post-traumatic stress disorder (PTSD) or the CES Depression Scale (CES-D) (Kohn et al., 2005).⁵

Although all of these indicators operate at the individual or household level, community-level wellbeing indicators could also be easily considered. A decrease in the rate of prevalence of inter-household conflict over access to, or use of, natural resources (pasture, water), could be considered a good indicator of wellbeing at the community level for pastoralist populations⁶. Similar indicators could be developed for fishing communities or agro-forestry communities around access to relevant natural resources (fishing grounds, forests, etc.). In a more urban environment, the ability of the local food system to remain operational or to deliver food-products without excessive price fluctuations in the face of any type of shocks or stressors (e.g., a political crisis, road blocks or random attacks by local armed groups, a large magnitude earthquake, widespread flooding), could be considered as possible wellbeing indicators (in relation to food and nutrition security) at the community or higher level.

Table 3 summarizes some of the different indicators discussed so far in this section. They are provided as illustrative examples and do not represent in any way a comprehensive or definitive list.

⁵ As noted in Béné et al. (2015, p.18) the critical point to understand is that the absolute value of these indicators is not informative with regards to resilience. The absolute value of a z-score tells us about the actual severity of malnutrition, but does not tell us about the degree to which that level of malnutrition results from a particular shock or stressor; nor does it tell us about the connection between exposure to a given shock or set of shocks that might be mediated by a given resilience capacity or combination of capacities. It is only the change observed in the value of the indicator following the event (compared to its value prior to the event) that indicates the relative impact of that event on the indicator.

⁶ Absence, or decrease, in conflict prevalence at the community level is not simply an indicator of possible improvement in the management of common resources, it is also an indicator of more positive interrelations between the members of the community, thus contributing to the wellbeing of the community.

Table 3. Examples of indicators to be used in multi-scale resilience measurement frameworks

	OUTPUTS Increased resilience capacities	OUTCOMES Types of responses put in place	LONG-TERM IMPACTS Changes in wellbeing
Higher system	<ul style="list-style-type: none"> - Ecosystem degradation index - Level of infrastructure at the municipal level 	<ul style="list-style-type: none"> - Decision to establish a new local EWS 	<ul style="list-style-type: none"> - Local food system price stability
Community	<ul style="list-style-type: none"> - Access to markets - Social capital (bridging) 	<ul style="list-style-type: none"> - Collective effort to reinforce the village embankment 	<ul style="list-style-type: none"> - Prevalence rate of inter-household conflict over access to natural resources
Household	<ul style="list-style-type: none"> - Cash saving - Access to early warning system (EWS) information 	<ul style="list-style-type: none"> - Coping Strategy Index (CSI) - Use of local early warning system (EWS) information 	<ul style="list-style-type: none"> - Household Dietary Diversity Score (HDDS) - Food security indicators (e.g., HFIAS)
Individual	<ul style="list-style-type: none"> - Asset ownership - Education level 	<ul style="list-style-type: none"> - Level of cash borrowing - Adoption of new drought resistant crop 	<ul style="list-style-type: none"> - Post-traumatic stress disorder (PTSD) - Nutritional indicators (e.g., child weight-for-age z-score)

Accounting for time-scales

One important rule of both biophysical and ecological processes is the positive relationship between space and time scales. This relationship means that processes occurring at high spatial scales usually evolve at a slower pace than processes occurring at lower spatial scales. For instance, a localized storm may appear and disappear over a 12-hour period while an El Niño event may take months to build, and may then affect nearly the entire planet for another six to nine months. Likewise, many socio-economic processes that affect individuals or households are characterized by daily, weekly, or monthly dynamics (e.g., household food insecurity, allocation of household labor, which can evolve daily at the household level). In contrast, the processes that affect a community or a higher scale geographic unit (e.g., district) are usually characterized by slower paces of change: for instance, the level of infrastructure that characterizes a county or

district will not change significantly over years or even decades. Likewise, the formal or informal regulations that govern access to natural resources at the village level could take several years to be changed or amended. In other words, the frequency at which indicators of resilience capacity and response need to be monitored in order to appropriately and cost effectively capture changes will vary depending on their nature, but also the spatial scale at which they operate. In general, the higher the level at which they occur, the lower the frequency at which they need to be monitored⁷.

How to use the multi-scale resilience framework

The usefulness of the multi-scale resilience measurement framework embedded in the metric presented in Table I is not limited to the identification and use of output, outcome, and impact indicators at different levels in order to ensure that one completes a comprehensive multi-scale resilience analysis. It can also help identify potential cross-scale interactions (positive or negative), as well as highlight potential trade-offs between outputs, outcomes, and long-term wellbeing impacts.

Exploring cross-scale resilience interactions

At least three different *types* of cross-scale resilience interactions can be considered and are illustrated in Table 4. Before we detail these, note that blue arrows (from indicator *b* to indicator *i* and then to indicator *v*) are *not* cross-scale interactions. They indicate the expected pathway of sequential changes included in the generic ToC. In the present case, these are illustrated at the household level: project activities are expected to trigger positive changes in indicator *b* (outputs), which reflects a change (increase) in household resilience capacity. These outputs are then expected to lead to changes in the way households respond to specific shocks, which are captured in changes in indicator *i*. Eventually, improvements in response (outcomes) are expected to lead to improvement (or non-alteration) in household wellbeing—measured by indicator *v* at the impact level.

The first example of cross-scale interactions is represented by the orange arrow in Table 4 leading from indicator *a* (individual capacity level) to indicator *b* (household capacity level). This relates to the earlier discussion in this document where we pointed out that in some cases the capacity at one level (here the household level) mainly results from the aggregation of the capacity at lower level (here the individual level). A potential example would be productive assets. By helping specific members of a household (e.g., women) to acquire productive assets (through e.g., remuneration against labor), the project effectively strengthens the resilience capacity not only of the individual household members but often of the household as a whole.

⁷ Note that this rule of thumb applies however only *within* each column of the matrix, but *not across* columns. The measurement of outputs (resilience capacities) should be determined by the timing of the baseline and endline surveys (and possibly mid-term evaluation). In contrast, the frequency of measurement for resilience outcomes (responses to shocks/stressors) and wellbeing indicators (impacts) should, in theory, be much higher (monthly or bi-monthly) in order to capture the dynamics of any change(s) in the aftermath of a shock event – see Béné et al. 2015 for details.

Table 4. Cross-scale resilience measurement framework

	OUTPUTS Increased resilience capacities	OUTCOMES Types of responses put in place	LONG-TERM IMPACTS Changes in wellbeing
“Higher scale” level	- ...	- indicator p - ...	- ...
Community level	- indicator c	- indicator k - ...	- indicator x
Household level	- indicator b - ...	- indicator i - ...	- indicator v
Individual level	- indicator a - ...	- indicator g - ...	- ...

A second example of potential cross-scale interactions is represented by the red arrow linking indicator *b* to indicators *k*. It shows that changes in household capacities (output) can lead to some change in the responses at the community level (outcome). Using an example also mentioned earlier, changes in local rules governing the access to communal resources could emerge from changes which initially take place in capacities at household level. For instance, positive change in adaptive capacity at the household level in a large number of members of the same community (e.g. increase in off-farm diversified portfolios as a result of some successful project interventions) may alter the perception that the community has collectively about their dependence on natural resources and lead to the introduction of (positive, inclusive) changes in the local rules.

That very same change in the communal rules could have long-term positive effects on the wellbeing of the most asset-deprived households in the community, which would then be able to rely more heavily on communal resources when affected by shocks (leading for instance to a reduction in the drop in food security indicator following the impact of a specific shock). This is represented by the green arrow between indicator *k* (at community outcome level) and indicator *v* (wellbeing indicator at household level). This last case also illustrates that cross-scale resilience interactions do not only involve lower-to-higher level (emerging) processes, but also higher-to-lower (trickle down) processes - illustrated by the two vertical arrows on the right-hand side of Table 4.

Acknowledging cross-scale trade-offs

Cross-scale effects are not simply about *positive* interactions through the emergence or trickle-down processes of resilience. They are also about trade-offs. As suggested by the case of the

2011 Bangkok flood, detailed analysis of empirical experience reveals that building the resilience of some groups in the face of specific shocks or stressors may result in fragilizing/weakening the ability of other groups (or individuals) to deal with the same shocks or stressors. Many examples can be found within or between levels. Strengthening the resilience of the household may be achieved at the cost of the resilience of some individual members within those households. The gender-disaggregated statistics regarding the difference between men and women casualties following disasters is clear evidence of this issue (Bradshaw and Fordham, 2013). The framework presented in Table 4 can be used to account for this by analyzing the sign of the changes in indicators in each cell. Assuming that all the indicators have been identified in such a way that the anticipated changes should be positive, the repeated occurrence of negative changes for certain individual or group indicators may indicate the existence of those negative trade-offs. Three theoretical examples are provided in Table 5.

First, we represented the potential negative trade-off that may happen when building resilience capacities at household level (indicator *b*) can result in eroding resilience capacities at individual level within the same household (indicator *a*). The second type of negative trade-off corresponds to a scenario similar to the 2011 Bangkok situation whereby a specific response undertaken at a higher district level (indicator *p*) can result in negative wellbeing changes for lower level groups (indicator *t*—community, or indicator *s*—household levels). Finally, a third type of negative trade-off is represented between indicator *b* and indicator *k*. This example refers to a typical case of maladaptation where a positive change in resilience capacity at the household level could eventually translate negatively in terms of outcome (response) at the community level. A potential example of this type of scenario could be observed following a typical tragedy of the commons dynamic where decisions made by enabled individuals or households lead to unanticipated and unsustainable responses at the collective level.

Table 5. Cross-scale resilience trade-offs

	OUTPUTS Increased resilience capacities	OUTCOMES Types of responses put in place	LONG-TERM IMPACTS Changes in wellbeing
“Higher scale” level	- ...	- indicator <i>p</i> + - ...	- ...
Community level	- indicator <i>c</i> +	- indicator <i>k</i> - - ...	- indicator <i>t</i> -
Household level	- indicator <i>b</i> + - ...	- indicator <i>i</i> + - ...	- indicator <i>s</i> - -
Individual level	- indicator <i>a</i> - - ...	- indicator <i>g</i> + - ...	- ... - ...

Those last examples, although theoretical, resonate well with some of the empirical observations made in the field (e.g. Norris et al., 2008; Longstaff et al., 2010) where it is re-emphasized that potential negative trade-offs may occur. As such, those empirical examples like the theoretical ones proposed in Table 5 above, reinforce the main message of this document, that is, the importance to consider several scales in our resilience measurement framework.

Conclusion and recommendations

The objective of this Concept Note was to provide generic advice, as well as conceptual and technical guidance, about the measurement and monitoring & evaluation of resilience at multi- and cross-scales in the context of humanitarian, development, and food security interventions.

First, the rationale behind the importance of adopting a multi-scale and cross-scale framework when we implement resilience measurements and/or evaluations was laid out. This rationale relies essentially on two points. One is the empirical recognition that individuals, households, and communities are components of broader complex and interconnected systems (including food, markets, and political, social, and ecological networks). The second is that beyond—or even before—resilience, it is the overall context (including shocks and stressors) within which people operate which is characterized by a nested hierarchy of dynamics taking places at several different scales.

Recognizing this reality, four levels (or scales) which need to be included in any resilience analysis were identified: (i) individual, (ii) household, (iii) community, and (iv) a ‘higher’ level (which could be either a geographic/ecological element (such as e.g. a watershed) or a political/administrative entity (such as a municipality or a district). Combining those four levels with the generic theory of change describing the anticipated outputs, outcomes, and impacts of a resilience intervention, a framework for multi-scale resilience measurement was presented. Drawing on this framework, a series of technical guidance on how to select and sample adequate indicators for each scale and step along the theory of change pathway, with the objective to build an appropriate multi-scale resilience measurement framework was provided.

Additional elements of discussion were then provided to illustrate how the framework can be used to identify and test the existence of potential cross-scale resilience. Two types of cross-scale positive interactions were discussed: emergence whereby resilience at higher level emerges from the building of element of resilience at lower levels/scales; and trickle down, whereby resilience at lower level/scale benefits from the changes that take place at higher levels.

The discussion also stressed the existence of potential cross-scale trade-offs where the building of resilience at one level may take place at the expenses of resilience at other (higher or lower) levels. The occurrence of those cross-scale trade-offs was illustrated through examples that derived from actual field experiences.

Based on those different points the following recommendations can be made:

- Recognizing and integrating the **multi-scale nature of resilience** is critical in improving our ability to appropriately understand, measure and monitor resilience;
- In the context of humanitarian, development, and food security interventions (the focus of this document) it is important that **household or community are not the only scales** to be considered as entry point in the analysis;
- Recognizing the importance of a **higher level beyond the community** is key. This higher level should be used to capture geographic/ecological or political/administrative dynamics and processes beyond the community level;
- Recognizing the **individual level is also critical**. The consequence of systematically measuring certain indicators at the household rather than the individual level (e.g. food security) is that we may miss certain intra-household resilience dynamics. Great care should be taken to avoid such biases when identifying indicators as well as the level(s) at which they are measured;
- A multi-scale framework should not be applied only to resilience capacities but to **all the different steps along the theory of change** of the resilience intervention (outputs, outcomes, impacts);
- The multi-scale nature of resilience raises the hypothesis of **cross-scale resilience interactions**, which needs to be acknowledged and possibly investigated. The document provides an analytical framework to this purpose;
- **Positive cross-scale interactions** could lead to either: emergence of resilience whereby building elements of resilience (capacities) at lower levels/scales contributes to increased resilience (capacities) at higher level; and trickle down, whereby resilience (capacities) at lower level benefits from enhanced resilience (capacities) at higher levels; those two types of cross-scale will need to be explored more thoroughly;
- Cross-scale interactions are not necessarily always positive; empirical work draws our attention to the likely occurrence of **negative cross-scale interactions** (or trade-offs), whereby the building of resilience at one level may take place at the expenses of resilience at other (higher or lower) levels.

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