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Resilience Measurement Principles

TOWARD AN AGENDA FOR MEASUREMENT DESIGN

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I. Background

There is now wide agreement that the interactions among climate change trends, ecosystem fragility and geo-political instability have produced new configurations of risks that are increasingly difficult to predict. The combined effect of these new risk configurations has in turn placed a more pronounced set of negative pressures on the agro-ecological systems, economic resources, and social institutions that affect welfare dynamics. Consequently, the well-being of the world's poor, that portion of the world population with the fewest protections, is now subject to a more challenging series of shocks and stressors. Viewed by many as a strategic approach to deal with the range of unpredictable risks that undermine well-being, resilience has recently emerged as a key concept for policy and program development. The concept of resilience is now at the center of policy discussions for both US and European aid organizations and is the focus of large-scale interventions to which substantial streams of funding are directed (Appendix A provides an overview of a sample of resilience-related activities and emerging strategic initiatives pursued by various agencies and organizations). In a world where conventional approaches to dealing with humanitarian aid and development assistance have been questioned, resilience has captured the attention of many audiences because it is seen as providing a new perspective on how to effectively plan for and analyze the effects of shocks and stressors that threaten the well-being of vulnerable populations.

As a consequence of the elevated interest in resilience, a steady flow of white papers and policy statements has been released and a wide range of funded initiatives has been launched. Within this growing discourse, the topic of measurement has been accorded a relatively limited amount of attention[1]. Vaitla et al. (2012, p. 5) observed that "academics and practitioners have yet to achieve a consensus on how to measure resilience". Focused more directly on the conceptual challenges of the resilience concept, Frankenberger et al. (2012, p.26) noted that "[t]he continuous, complex and dynamic process of building resilience makes it inherently difficult to measure". There is now an urgent need to confront the difficulty of measuring resilience as interventions focused on building resilience at multiple scales continue to proliferate (Constas and Barrett, 2013). With the goal of providing credible, data-based insights about the attributes, capacities, and processes observed at various scales (e.g., individual, household, community, national), data obtained from resilience measures will support efforts to evaluate the impact of interventions and inform discussions of how to promote resilience.

In recognition of the need to examine measurement as an important part of broader discussions on the value of resilience for development, a three day Expert Consultation on Resilience Measurement for Food Security was held in Rome, Italy (February 19-21, 2013)[2]. The meeting, which brought together policy makers, program staff, researchers, and leaders from various agencies and organizations, provided an opportunity to share initial findings and raise questions about resilience

1. The most detailed empirical work on resilience measurement for poverty and food security has been carried out by Alinovi et al. (2010), where a latent variables approach was combined with a regression-based path analytic model.
2. Sponsored by The European Union (EU) and the US Agency for International Development (USAID), the meeting was jointly organized by the Food and Agriculture Organization (FAO) and the World Food Programme (WFP) in partnership with the Food Security Information Network (FSIN).

measurement. Reflecting the diverse mix of participants who attended the meeting, a range of analytical issues and practical concerns on resilience measurement was raised (Appendix B provides a summary of conclusions drawn from the meeting). Not surprisingly, one of the main outcomes of the meeting was agreement on the need to formulate and actively pursue an agenda to inform resilience measurement. As a follow up action to the Expert Consultation, the Resilience Measurement Technical Working Group (RM-TWG) was organized as a way to provide a mechanism for directing more sustained attention and concentrated work on the topic of resilience measurement (Appendix C provides the RM-TWG member list). The broad aim of the RM-TWG is to promote the adoption of technically sound "best" practices for resilience measurement. Recommendations generated by the RM-TWG should also support efforts to achieve consensus on a common analytical framework and guidelines for resilience measurement.

This paper sets an agenda for resilience measurement. It presents ten design principles that introduce the primary objectives and challenges associated with resilience measurement. In addition, it highlights general technical guidelines for use in promoting rigor in all measurement approaches. This FSIN Technical Series No.1 is the first of three papers[3] that will be issued over the course of the next year.

Following this first introductory section, the paper is organized into four primary sections, followed by a section on conclusions and next steps. Section II provides a succinct definition of resilience and introduces two initial measurement design principles related to this definition. Section III describes the concept of resilience and considers the characteristics of resilience that demand special attention from a measurement perspective. Given the large body of work dedicated to vulnerability, the fourth section examines the relationship between vulnerability and resilience and discusses the implications this relationship has for measurement. Section V outlines a set of general technical issues that are broadly applicable to the measurement enterprise. The final section summarizes the main points of this first paper and sets the stage for the next two papers that will be produced by the RM-TWG.

3. In addition to the present paper, two papers will be released in 2014: 1. an analytical approach paper to inform efforts to design resilience measurement for various types of initiatives across contexts, and 2. a set of technical guidelines that supports the development and implementation of resilience measurement tools.

II. Definition of Resilience: Resilience Capacity and the Value of Subjective States

The provision of a clearly stated definition of the object to be measured is a critical point of departure for measurement. While resilience has received a good deal of attention, it would be fair to say that the field has not reached consensus on a definition. The position taken by the RM-TWG is that it is important to provide a definition that is clear, concise, and ultimately, easily operationalized. Following a period of deliberation by the RM-TWG, the following succinct definition of resilience was agreed upon:

> **Resilience is the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences**

One of the key features of this definition is that resilience is understood and measured according to the instrumental effects it exerts on targeted development outcomes that may be affected by stressors and shocks. Defining resilience as a capacity means that resilience is comprised of a set of ex ante attributes and supports that should positively shift the likelihood function that describes the relationship between shocks and development outcomes, such as food security (see Barrett and Constas, 2013).

A fundamental question to answer from the outset concerns the distinctiveness of resilience. Does resilience offer a new perspective or does resilience simply offer a different vocabulary to describe vulnerability? While closely related to the concept of vulnerability, it is important to note that resilience is not merely the inverse of vulnerability. Vulnerability describes a set of conditions that prevents people from managing adverse events, resilience is comprised of a set of responses[4] that may counter the structural and stochastic factors that allow a household or other unit to be vulnerable when exposed to some set of shocks and stressors. In this sense, vulnerability refers to the set of characteristics that increases the probability of descent when exposed to risks. Expanding on the initial definition provided above, resilience capacity includes the array of characteristics, actions, and strategies taken to prevent and/or counter the effect of such risks. Whereas vulnerability has the effect of enabling the causal connections between shocks and negative outcomes, resilience has the effect of disabling or transforming those causal connections. A more extended discussion of the relationship between vulnerability and resilience is offered in Section IV of the paper.

The value added proposition of the resilience concept is that it draws attention to the inferential and programmatic benefits associated with including resilience as an additional explanatory variable, one that may improve our ability to more accurately estimate the effects that shocks and stressors have on a particular outcome. A simplified formulation highlights the relationship among resilience, vulnerability, and shocks in connection with, for example, food security:

> **Food security = f (vulnerability, resilience capacity, shocks)**

4. Responses refers to both ex ante and ex poste responses with respect to some shock or stressor.

To promote resilience as a pro-poor concept, it is also important **to define resilience as a capacity that prevents individuals, households, and communities from falling below a normatively defined level for a given developmental outcome (e.g., food security, poverty level, well-being).** This set of arguments about resilience as an instrumental capacity linked to a normative standard leads to the first design principle for resilience measurement:

Measurement Principle 1: Resilience as a Normatively Indexed Capacity

Resilience is a capacity that should be indexed to a given development outcome (e.g., food security, poverty, health) with a normative threshold. Measures of resilience should therefore be developed in relation to the instrumental value that such capacity has for a particular outcome. The outcome of interest should include a normative boundary that defines a threshold condition below which the well-being of an individual, household, or community is unacceptable.

In the context of development, both for humanitarian aid and for development assistance, resilience will be valued to the extent that it improves the well-being of targeted populations. While resilience may be viewed as a stand-alone outcome, the end-goal of building and measuring resilience is defined in terms of a particular outcome or set of outcomes. The inclusion of a normatively defined minimum threshold condition ensures that resilience is viewed as a capacity that enables households and communities to effectively function in the face of shocks and stressors. There are two additional points that should be made with reference to this first principle. First, the capacities that ensure adverse stressors and shocks do not have long-lasting adverse development consequences will likely be comprised of a set of capacities that are important for all outcomes and a set of capacities that are important for a specific outcome. Thus, the configuration of capacities that constitutes resilience will differ depending on the outcome against which those capacities are indexed. Resilience capacity for food security, for example, may differ from capacities identified for health-related outcomes, social outcomes, economic outcomes, or political outcomes[5].

Second, the idea of a normative threshold is important to include because it signifies that resilience represents a set of capacities that must be defined in terms of acceptable levels of well-being[6]. This means that a set of capacities that only allows a household or community to return to a prior unacceptable state does not meet the definition of resilience offered here. This is a point that is expanded upon in the discussion of desirable versus undesirable equilibria (see Principle 5).

5. The fact that outcomes are interconnected is an important but separate issue, one that has implications for how interventions are structured and analyses organized.
6. The idea of linking resilience to acceptable levels of well-being may be broadened to include positive trajectories toward acceptable levels of well-being. In such cases, it is important to distinguish between resilience capacities that allow households to maintain normative levels of well-being and resilience capacities that reflect positive growth below a normative threshold. The former may be viewed as a resilience state and the latter as a *resilience pathway*.

Work on poverty assessments (see Pradhan and Ravallion, 2000; Ravallion, 2012; Ravallion and Lokshin, 2000) has highlighted the need to include subjective measures. Subjective measures are important because they provide empirical access to perception-based indicators. The tacit assumption that resilience is a response to a shock or stressor highlights the need to collect data related to the mere recognition that the objective conditions that might be categorized as shock are aligned with the subjective perceptions that those conditions are recognized as a disturbance that threatens some element of human welfare. The assumption also calls attention to the need to collect measurement data on perceptions about the expected outcomes, both for the consequences of a shock itself and for actions that may be taken in connection with a shock. The highly individualized, deeply situated (in personal histories and local contexts) of such perceptions calls for the use of qualitative indicators alongside quantitative indicators.

Measurement Principle 2: Subjective States and Qualitative Data

The role played by subjective states in resilience, such as perceptions of shocks, perceived utility of actions taken or not taken, and general expectations of future states, should be included as key components of resilience measurement. The potential value of qualitative indicators should be included as an element of such subjective assessments.

III. Key Features of the Resilience Construct and Implications for Measurement

There is an extensive literature on resilience pursued in a variety of fields including ecology (Gunderson et al., 2010; Holling, 1973), engineering (Hollnagel et al., 2006), psychology (Garmezy, 1991; Cicchetti, 2010), and geography (Adger, 2000; Pike et al., 2010). A number of themes, which should inform the development of resilience measures, can be drawn from across these literatures. The key themes identified here highlight the importance of developing measures of resilience that are sensitive to:

- Systems and complex causality
- Shock and stressor specificity
- Desirable and undesirable equilibria
- Inherent volatility and instability
- Multiple-scales and multi-level interactions
- Rates of change and timing of measurement

At a general level, these themes illustrate some of the ways in which resilience requires a different approach to explain the dynamic relationship between shocks and stressors and well-being outcomes. Each of the six subsections below provides a brief explanation of the significance for each of these themes, followed by a measurement principle designed to inform the development of resilience measures.

Systems and complex causality – Factors that enhance resilience are often organized according to a systems-oriented framework (see Bahadur et al., 2010; Folke et al., 2010; Holling, 1973). A systems oriented approach has been applied to both poverty and food security (see Ingram, 2011; Pinstrup-Anderson, 2010, 2012). Extending resilience theory to studies of food security resilience, Alinovi et al. (2010, p. 10) described food systems as complex adaptive systems (following Perrings, 1998) that exhibit path dependency, discontinuous change, multiple equilibria, and non-linearity. The complex cause and effect relationships produced by such interactions should be modeled, both to serve the purpose of articulating change models to inform programs and to serve the purpose of articulating estimation models to inform analysis of measurement data.

Measurement Principle 3: Systems and Complex Causality

A vital first step in the development of resilience measures requires the modeling of an outcome of interest as the result of a series of interactions among the conditions, attributes and processes, and disturbances that affect well-being. Both qualitative and quantitative data will serve a valuable function in the effort to understand resilience capacity and map its origins and influences.

Disturbance specificity – Within ecological systems, resilience is measured as a response to shocks or a collection of stressors. The disturbance could be a catastrophic event shared by a large group of people (covariate shock) or a shock experienced only within a given household or community (idiosyncratic shock). The disturbance might also be the result of stresses that are less dramatic and garner less attention, but have a combined cumulative effect that nonetheless threatens food and nutrition security. Households and communities may experience multiple shocks and stressors simultaneously. The full range of shocks and stressors need to be understood over time. If resilience is a response, either in the form of anticipatory actions taken in advance of a shock, or in the form of actions taken during and after the shock, detailed data on the shocks itself are central to resilience measurement. Responses to different types of shocks and stressors could be contradictory and the strategies for managing these different shocks could be at odds. One therefore needs to start with a comprehensive analysis of the potential hazards, their trends and their links to local contexts.

Measurement Principle 4: Shock and Stressor Specificity

Resilience measures should be sensitive to the specific types of shocks and/or stressors that are seen as threatening a given development outcome. The necessity of highly detailed, technically sound shock modules is therefore central to resilience measurement.

Desirable and Undesirable Equilibria – Although the bounce-back feature of resilience is a common point of departure for discussions of how resilience might be applied to development, the tendency to emphasize the return to a prior equilibrium state should be questioned. When the prior state is characterized as one of high poverty and perilously low food security the idea of "bouncing back" is clearly sub-optimal. Structuring our empirical expectations and measurement objectives as a "return to prior state problem" is not consistent with more nuanced views of resilience and is at odds with humanitarian principles that undergird both emergency response and development assistance strategies. It may, however, be the case that returning to a prior state is desirable for some elements of a system of interconnected conditions that affect food security.

For example, the reconstitution of productive social groups and the recovery of basic infrastructure (e.g., roads, communication systems) that may have been disrupted by a shock are two conditions where the return to stability would be favorable. Conversely, the post-shock reinstatement of systems of governance and institutions that undermine food security would not be desirable. Judgments about when a return to prior state is advantageous and when it is not, represents one of the challenges of designing measurements of resilience for food security.

Measurement Principle 5: Desirable and Undesirable Equilibria

Resilience measures should contain indicators that help one identify those instances when the return to a prior state is and when it is not desirable.

Inherent Instability and Chaotic Behavior – In addition to raising questions about the stability of conditions on which food security depends, the assumption that a prior state could be characterized as stable may or may not reflect the reality of target populations. Situations where food insecurity exists may sometimes be characterized by high volatility. The idea that food security itself is dynamic rather than static is well established (see Christiaenson et al., 1999; Devereux, 2006). The assumption that the conditions prior to and following a disturbance can be understood in terms of stability or equilibrium may often be misguided. One of the measurement challenges associated with the stability-volatility question involves decisions about how measurement tools can be sensitive to the existence and effects of inherently unstable components of food security.

Measurement Principle 6: Inherent Volatility and Instability

Resilience measures should be sensitive to the fact that conditions before and after a shock may be best characterized by systemic volatility or by patterns that can only be described as chaotic. Resilience measures, and associated analytical methods, should be structured to detect, measure, and model such volatility and chaotic behavior.

Multi-Scale and Multi-Level Interactions – Although a definition of resilience has been offered above, it is useful to consider other definitions of resilience that highlight important features of the resilience concept. Frankenberger et al. (2013a, p.1), for example, defined resilience as "[t]he ability of countries, communities, and households to anticipate, adapt to, and/or recover from the effects of potentially hazardous occurrences (natural disasters, economic instability, conflict) in a manner that protects livelihoods, accelerates and sustains recovery, and supports economic and social development". An important feature of this definition is that it describes resilience as a multi-scalar (from countries to households) concept and that it focuses on economic and social components that underwrite food security. Resilience is likely to be influenced by the interactions of different processes at different levels and scales. For example governance structures at various levels can have a significant impact on household resilience. For this reason it is important to identify the key drivers of resilience at higher and lower levels and across scales. Modeling strategies used to capture these interactions (e.g., hierarchical models, agent based models, and structural equation models) will be an important feature of resilience measurement.

Measurement Principle 7: Multiple Scales and Multi-Level Interactions

Resilience is a capacity that can be observed at different levels, ranging from individuals, to households, communities, and nations. One of the challenges of developing measures of resilience involves identification of the mechanisms that explain how resilience capacity functions within and between levels to exert positive effects on well-being outcomes.

Rates of Change and Temporal Sensitivity – Viewing resilience as the interaction of dynamic factors that change over time means that the timing of measurements should be carefully specified. This argues for non-arbitrary specification of data collection events. Ideally, the timing of measures should be determined according to knowledge of expected rates of change for both the outcome of interest and the factors that influence those outcomes. The idea of differently speeded variables posited by resilience theory (Gunderson and Holling, 2002) suggests that outcomes at different scales (e.g., household, community, institutional) are likely to change at varying rates. One would not expect, for example, that institutions and systems of governance on which food security may depend would change at the same rate as food security related behavior of individuals or households. Similarly, macroeconomic factors, such as trade policies that may protect against commodity price spikes at the national level, will not change at the same rate as pricing schemes at local markets that may affect food security. Furthermore, different shocks and stressors operating at different scales will have different time frames to manifest themselves. The general rule here, adapted from ecology, is that larger scale units of observations are likely to change more slowly. In light of the multi-scalar view of resilience, decisions about when (and for how long) data will be collected should be informed by knowledge of expected rates of change.

Measurement Principle 8: Rates of Change and Timing of Measurement

The time points at which data on resilience capacity, and shocks and stressors are collected should be informed by knowledge of expected rates of change/growth associated with a particular unit or scale of measurement for resilience capacity.

IV. Resilience and Vulnerability: Resilience as a Mediating Capacity

The relationship between vulnerability and resilience has been the topic of extended debate in the field (see Adger, 2006; Folke, 2006). As a phenomenon to be measured, vulnerability draws attention to sensitivity to disturbances whereas resilience is concerned with the various ways a given entity prepares for and responds to shocks and stressors that threaten their well-being. As noted above, resilience is now regularly introduced as a new concept for development (Bene et al., 2012). It is, however, important to acknowledge that an interest in understanding the dynamics that explain how households and communities deal with adversity in developing contexts is not new. There is, for example, a long tradition of work on vulnerability (e.g., Chambers, 1989; Davis, 1996) that has focused on problems similar to those highlighted by the concept of resilience. The effort to develop comprehensive resilience measures should also build on tools such as the Coping Strategies Index (see Maxwell, 1996) that measure some of the ways in which vulnerable populations respond to shocks and stressors. These observations about connections among resilience, vulnerability, and coping lead to the ninth measurement design principle.

Measurement Principle 9: Resilience-Vulnerability Connections

Resilience measures should build on the knowledge gained from studies of vulnerability and the contents of existing vulnerability measures and coping measures should be used as key points of reference for constructing resilience measures.

A question that must first be settled as a key part of the resilience measurement effort is as follows: *does resilience offer a new perspective on how to describe and model how people respond to and recover from shocks and stresses in a manner that affects food security and nutrition?* To help clarify the distinction between vulnerability and resilience, two definitions may be considered. The first definition is an accepted definition of vulnerability and the second is the focused definition of resilience for food security offered above:

1) **vulnerability** is the "likelihood that at a given time in the future, an individual will have a level of welfare below some norm or benchmark" (Hoddinott and Quisumbing, 2010);

2) **resilience** is the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences.

One obvious distinction between the two definitions is that vulnerability refers to a negative likelihood function while resilience refers to a positive likelihood function. A second distinction is that vulnerability draws attention to sensitivity to disturbances whereas resilience is concerned with the collection of responses that reduce the consequences of such disturbances. The concept of resilience is useful because it provides an overarching organizational scheme within which vulnerability, shocks,

and heterogeneity of recovery pathways may be measured. Thus, resilience is not simply the inverse of vulnerability[7]. Rather, following the path dependence view of resilience, a measure of resilience for food security provides a tool to improve our understanding of different trajectories associated with risk exposure events.

To further explain the connection between vulnerability and resilience we can assume that initial vulnerability can be represented by some composite variable comprised of assets, protections, and expectations. We might assume, for the sake of illustration, that resilience can be represented by some composite variable comprised of the capacity to absorb, adapt to or transform in response to some risk exposure event (shock) or recurrent condition (stressors). In this scheme, food and nutrition security, is seen as the dynamic interaction of conditions (vulnerability levels), events (shocks and stressors), and capacities (resilience). In some designated period following a shock, any given unit (e.g., individual, household, or community) may end up in one of three states with respect to food and nutrition security: worsened food security, recovery of initial food security, and improved food security.

Table 1 provides a simple illustration of the heterogeneity of effects that may emerge from the interaction among initial vulnerability, exposure to shocks and stressors, resilience capacity, and subsequent vulnerability.

Table 1. Food and nutrition security (FNS) as a function of vulnerability, shocks, and resilience

Initial Vulnerability at T1		**Measured Level of Resilience Capacity and Associated Food Security Status**			**Subsequent Vulnerability at T3**
		Low	**Medium**	**High**	
Low	**Exposure to and effects of shocks and stressors at T2**	Worsened FNS status	Recovery of FNS status	Improved FNS status	?
Medium		Worsened FNS status	Recovery of FNS status	Improved FNS status	?
High		Worsened FNS status	Recovery of FNS status	Improved FNS status	?

Reconstitution of vulnerability groupings from T1 to T3 as the dynamic interaction between initial vulnerability, shocks, and resilience capacity

7. If resilience was conceptualized as the inverse of vulnerability, the task of measuring resilience would entail little more than providing directions to guide the reinterpretation of data gathered from existing vulnerability measures.

With a focus on capacities as noted above, resilience provides a perspective that may help us understand why households with similar profiles (e.g., asset profiles, livelihood profiles) may respond differently to the same set of shocks and stressors. It is possible that groups of individuals who have the same level of measurable vulnerability will exhibit different levels of resilience which will in turn affect food and nutrition security of individuals, households, and communities. In this sense vulnerability and resilience are functionally related to one another. By treating resilience capacity as mediator of shocks and stressors may shed light on observed heterogeneity of post-shock pathways for individuals who share vulnerability profiles. The ability to measure resilience should facilitate efforts to explain heterogeneous response to shocks and stresses observed in households and communities with different and similar levels of vulnerability. Measures of resilience should assess the way in which resilience capacities mediate the consequences of shocks.

Measurement Design Principle 10: Tool for Interpreting Heterogeneity

The ability to explain heterogeneous effects of vulnerability conditions that lead to food insecurity represents one of the key challenges of measurement and analysis. The ability to measure resilience should facilitate efforts to explain heterogeneous response to shocks and stresses observed in households and communities with different and similar levels of vulnerability. Measures of resilience should assess the way in which resilience capacities mediate the consequences of shocks.

V. General Technical Guidelines for Resilience Measurement

Sound measurement generates data on a construct that reflects the content of what is measured and satisfies a set of technical criteria that ensures measurement procedures are capable of generating accurate representation of that construct. As a follow-up to the ten principles that are specific to resilience measurement, there a number of other basic concerns about how to develop rigorous measures of resilience. There are five significant features associated with such practices and standards that are worth highlighting:

- Theoretical formulations and latent variables
- Multidimensional nature of complex constructs
- Context specific and cross-cutting measures
- The importance of quality standards
- Precision through appropriate disaggregation
- Inferential aims and estimation models

Theoretical formulations and latent variables – Measurement highlights the fact that much of what one sets out to measure can only be accessed indirectly through indicators. Decisions about how to select those indicators should be aligned with a theoretical account of the construct measured. On a programmatic level this requires a clearly articulated theory of change that is amenable to operationalization. On an analytical level, the demand for theory requires a plausible explanation of the relationship among variables that constitute a given construct. In empirical terms, the constitution of a particular construct should take advantage of the well-established latent variables approach that has been applied to measurement problems in general (see Bartlett, 1937), to specific challenges of poverty measurement (Krishnakumar, 2008; Krishnakumar and Ballon, 2008), and, more recently, to resilience measurement and food security (see Alinovi et al., 2010).

Quality standards – The importance of specifying a set of indicators that are valid and reliable is at the heart of sound measurement practice. Failure to satisfy this foundational condition of measurement will have the effect of generating inaccurate and inconsistent estimates. In addition to satisfying standards of validity and reliability, measurement also draws attention to the technical standards of feasibility of implementation, utility of findings, and ethics of administration and data use (see Appendix D for a summary of standards). Adherence to quality standards for measurement must be a priority for resilience measurement. Standards related to the validity, reliability, feasibility, utility, and ethics of measurement should be given careful consideration as part of the process of developing and administering resilience measures for food and nutrition security. The aims associated with each standard are as follows:

- **Validity Standards** – Examines the accuracy of a given measure and the accuracy of components (i.e., subscales) that constitute the measure.

- **Reliability Standards** – Examines the consistency of measures, the degree to which a measure assesses relatively stable traits or capacities.

- **Feasibility Standards** – Examines constraints that affect the likelihood of a given measure being implemented in real-world settings.

- **Utility Standards** – Examines the extent to which measurement results may or may not be applied to practical settings.

- **Ethical Standards** – Examines the procedures that guard against harm that might be caused by measurement activities and/or from the release of associated results.

Appendix D provides additional details on the technical criteria of measurement by listing the components of a given standard that should be attended to as part of measurement.

Multidimensional nature of complex constructs – The view that resilience is best expressed and measured as a multidimensional construct is consistent with classical measurement theory (see Cronbach and Meehl, 1955) and confirmed by more recent development studies on multidimensional poverty assessment (see Alkire and Foster, 2011; Bourginon and Chakravarty, 2003). Resilience measures should be based on a notion that reflects an understanding of the various dimensions of resilience that influence the ability to anticipate, prepare for, withstand, and respond to shocks and stressors.

Common and Context-Specific Indicators – A major challenge of resilience measurement will involve identifying the set of attributes, processes, and supports that hold across all conditions along with those that depend on local conditions. This point highlights the need to specify both a common set of resilience indicators that permits aggregation of data over time and across settings and a set of resilience indicators that is sensitive to local conditions.

Precision and appropriate disaggregation – Measures of resilience should be sensitive to the way the capacity to absorb, adapt and transform in the face of shocks may operate differently in different targeted populations. An interest in population-specific dynamics should be underwritten by sampling strategies and tailored sets of indicators that will support the need to draw inferences about resilience dynamics for specific sub-groups in a study population.

Inferential aims and estimation models – Decisions about what data to collect, at what points in time, from what populations, and under what conditions should be specified in relation to the kind of inferences that one hopes to draw. This means that the type of data collected to measure resilience for food security should satisfy the empirical requirements of subsequent modeling procedures. Data requirements for modeling should be an integral part of measurement planning.

VI. Conclusions and Next Steps

The present paper is an initial step toward building a framework of principles that can be used by groups (e.g., programmer staff, monitoring and evaluation staff, policy makers) working in emergency response and development assistance who need to understand how households and communities deal with an array of shocks and stressors that threaten the well-being of targeted populations. The specific goal of this first paper of the RM-TWG was to identify a set of measurement design principles that would provide an agenda for the RM-TWG. The ten design principles, in combination with the general technical guidelines, highlight the set of substantive issues and analytical concerns that will be pursued by the RM-TWG as it moves forward with its two principal tasks of specifying a common analytical framework and developing technical guidelines for measurement. On a more general level, this first paper of the RM-TWG was conceived of as a document to describe some of the issues that might be used to establish a shared agenda for advancing resilience measurement. This first paper was also conceived of as a document to share recent events (e.g., expert consultation on resilience measurement) and provide an overview of emerging work.

Building on ideas expressed here, the next set of papers in this FSIN series represent an attempt to further advance the resilience measurement agenda. As a way to respond to some of the challenges associated with resilience measurement, the initial work of the RM-TWG has been organized into five clusters. The clusters were created to provide a mechanism for giving more dedicated attention to the some of the core topics around which a resilience measurement agenda might be based. The five clusters, along with orienting questions, are as follows:

- **Shocks and Stressors Cluster** – What are the issues that need to be considered in order to measure the nature and consequence of multisource shocks that affect food and nutrition security?

- **Scale and Systems Cluster** – What are the different levels at which resilience data should be collected and what is the best way to conceptualize and assess dependencies that exist over multiple scales, within and across interacting systems, over varying time periods?

- **Qualitative and Subjective Measures Cluster** – In what ways will qualitative data increase understanding of resilience dynamics and how will subjective aspects (e.g., perceptions, projections) of resilience be measured?

- **Estimation/Explanatory Models Cluster** – What are the key features of how resilience will be modeled? What are the methodological conditions (e.g., sample design, number of waves of panel data, counterfactuals) that need to be satisfied to generate and test models?

- **Existing Constructs and Data Resources Cluster** – What are sources of data and readily available measures that contain indicators and measurement approaches useful for resilience?

Appendix E provides a list of the individuals who will lead the work within each of the clusters.

An added objective of the RM-TWG is to form a community of practice (CoP) comprised of regional bodies, non-governmental organizations, and donors committed to resilience. The resilience measurement CoP is intended to promote a balanced approach that is both sensitive to the field-based demand for resilience measures that may be applied to programs and policies and reflective of the research-based theoretical formulations of resilience measurement that direct analysis and justify inferences. The papers produced by the TWG will serve as touchstone for discussion and provide a set of resources for the CoP as it aims to achieve this balance.

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VIII. Appendix A – Emerging Approaches to Food Security Resilience

Recent years have seen an exponential growth in reference to the concept of resilience among the development assistance and humanitarian aid communities. While actors have yet to reach consensus on a number of conceptual and technical constructs underpinning "resilience", several ongoing efforts show considerable potential for enabling positive responses to shocks and stresses that compromise food security among vulnerable populations. The table shown below summarizes the types of activities pursued by a range of agencies and organizations.

Agency / Organization	Description of Activities
Department for International Development (DFID)	The UK Government committed to embed resilience building in all DFID country programs by 2015. In support of the commitment, in 2011 DFID published guidance entitled Defining Disaster Resilience: A DFID Approach Paper. The paper presents DFID's conceptual framework for resilience and discusses key issues to take into account in designing and implementing resilience-building programs.
United States Agency for International Development (USAID)	USAID's recent Policy and Program Guidance – entitled Building Resilience to Recurrent Crisis – presents USAID's own conceptual framework for resilience, outlines key operational challenges to better coordinating humanitarian relief and development efforts (through Joint Planning Cells), and identifies opportunities to layer, integrate and sequence USAID-supported initiatives aimed at enhancing resilience to food insecurity. USAID's multi-dimensional approach to measuring resilience in the Horn of Africa and the Sahel seeks to identify resilience factors contributing to food security in the face of droughts. The model focuses on creating indices around six domains of resilience, each of which "contributes to and collectively constitute" resilience: income and food access, assets, social capital/safety nets, nutrition and health, adaptive capacity and governance (Collins, 2013).
European Commission (EC)	The EC's recent communication on resilience outlines ten steps aimed at enhancing resilience and reducing the vulnerability of the world's most vulnerable populations. These steps include support for the design of national resilience strategies, disaster management plans and efficient early-warning systems in disaster-prone countries, as well as supporting innovative approaches to risk management in partnership with private industry (e.g. insurance).

Agency / Organization	Description of Activities
Intergovernmental Authority on Development (IGAD)	In conjunction with USAID, the EU and over 50 other development partners, IGAD was instrumental in launching the Global Alliance for Action for Drought Resilience and Growth in April 2012. Currently the Alliance is actively supporting development of Country Program Frameworks that will help to closely align donor priorities, government strategies and program design for drought affected-populations in Horn of Africa.
L'Alliance Global pour l'Initiative Resilience Sahel (AGIR – Sahel)	Led by the European Commission, AGIR-Sahel was launched in 2012. Involving a range of stakeholders including USAID, UN agencies, and host governments, AGIR-Sahel serves as the vehicle for achieving the EU's roadmap for better coordinating humanitarian and development efforts in the Sahel region.
United Nations Food and Agriculture Organization (FAO)	FAO is moving towards including the concept of resilience into the FAO Strategic Framework. FAO has developed an index for measuring resilience based on empirical evidence gained from research in several countries. FAO's model involves development of a suite of latent variable indices that are derived from a number of observable indicators. These indices are then used to derive a single resilience index that is a weighted sum of the factors (Alinovi et al., 2008; Alinovi et al., 2010). FAO and WFP have played complementary roles as members of the recently established Food Security Information Network (FSIN). One important function of the FSIN will be to serve as an umbrella mechanism under which follow-up actions for resilience measurement will be undertaken.
World Food Programme (WFP)	WFP has taken steps to incorporate the concept of resilience into WFP's Strategic Framework. WFP is using trend analysis of historical food security indicators to monitor household resilience in Niger (Bauer et al., 2013). Analysis focuses primarily on the speed and extent of recovery following the drought in 2009. WFP is piloting a similar approach in several other countries for measuring resilience. WFP, together with FAO, is a member of the recently established FSIN. One important function of the FSIN will be to serve as an umbrella mechanism under which follow-up actions for resilience measurement will be undertaken.

Agency / Organization	Description of Activities
Africa Climate Change Resilience Alliance (ACCRA)	ACCRA is a consortium of NGOs – Oxfam GB, Overseas Development Institute (ODI), Save the Children Alliance, CARE International and World Vision International – seeking to promote evidence-based design and implementation of humanitarian and development interventions to improve the adaptive capacity of poor and vulnerable communities. ACCRA's Local Adaptive Capacity (LAC) Framework focuses on the intangible and dynamic processes and functions that support adaptive capacity – particularly in the context of climate change.
International NGOs (various)	Catholic Relief Services (CRS), Mercy Corps, Oxfam GB and World Vision have each been working on aspects of resilience measurement in various programming areas. CRS's Sahelian Resiliency Study analyzed not only exposure to specific types of shocks, but also the types of risk management strategies households adopt in order to deal with them, including coping responses (short-term adjustments until the household returns to its prior livelihood strategy) and adaptive responses (structural changes in livelihood strategies in response to shocks or longer-term stressors). The Mercy Corps study examines household resilience factors most closely associated with the conflict, drought and governance shocks that resulted in the 2011 famine in Somalia.

IX. Appendix B – Summary of Key Issues Derived from an Expert Consultation on Resilience Measurement for Food Security

February 19-20, 2013
Rome, Italy

Supported by the European Commission and USAID, FAO and WFP hosted an Expert Consultation on Resilience Measurement for Food Security in Rome in February 2013. The focus of the event was to elicit the measurement needs of donors and implementing agencies and cataloguing key metrics and measurement approaches used by different agencies. The following section summarizes several of the key issues discussed during the Consultation that will have an influence on resilience measurement (see Frankenberger and Nelson, 2013b).

- **Differing stakeholder objectives for resilience measurement**

  Resilience measurement needs are not the same across humanitarian and development program managers, donors, and academics involved in socio-economic research. From a donor perspective, resilience measurement should include a significant focus on determining the most cost effective way of helping targeted beneficiaries, i.e., value for money. Donors feel that more analytical work is needed on the relative costs and benefits of different interventions within different contexts, particularly quantifying benefits over the longer-term. Despite this focus, there was an acknowledgement that initiatives that provided value for money today may not be equally cost effective tomorrow. This led to the conclusion that an emphasis on value for money over program impact may not prove satisfactory from a donor perspective in the long run, particularly when considering the cost of not taking action. Academic participants felt that more work was needed to ensure the reliability and validity of resilience measurements especially in the development of resilience indices. At the same time, the pursuit of increased precision and better analytics has made it more difficult for development programmers to understand what is being measured and how it applies to determining better resilience practice.

- **Types of resilience measurement**

  Debate continues among donors, academics, and implementing institutions regarding whether the emphasis of resilience measurement should be on resilience outcomes or processes. Understandably, all actors are interested in determining "what works" and thus encourage an emphasis on measuring resilience outcomes. Meanwhile, some argue that since resilience is properly viewed as a process, measurement of resilience should also focus on attainment and/or strengthening of different capacities. Measuring these capacities – such as the ability to lean on others in times of stress or the ability to adjust livelihood strategies in anticipation of continued climate change – is more challenging than measuring outcomes for which the state of the science is fairly well-advanced. This is because measurement of important aspects of these capacities is based on self-perception and may be assessed when resilience is not being put to the test (e.g. in the event that there is no "shock").

The logical conclusion is that both objective and subjective approaches are important in measuring resilience. For example drought, a common shock throughout sub-Saharan Africa, can be quantified using the Water Requirements Satisfaction Index (WRSI) and the Normalized Differences Vegetation Index (NDVI). Meanwhile, the impact of drought can also be measured subjectively, using consultative/participatory qualitative methods in order to shed light on higher level factors of resilience that can be difficult to capture through objective measures (e.g. collective community responses to drought stress, barriers to livelihood diversification among pastoralists, perceived equity of government infrastructure and agriculture investments). Regular collection of qualitative data also enables better understanding of the perceived significance of changes that are measured quantitatively (e.g. number of income sources, dietary diversity, educational attainment).

- **Unit of analysis**

The main unit of analysis in most resilience studies is the household. Household level measurements – typically conducted through population-based surveys – may not adequately capture certain key indicators that reflect resilience at the community level (e.g. social capital). There is currently less work being done to measure resilience at the community or higher systems levels (regional, national, ecosystem), where indicators can help capture non-linear trends and tipping points or thresholds. In such situations, mapping and assessing interactions and relationships between groups (i.e., social network analysis) may be more insightful for understanding the interconnectedness between people, communities and organizations than strict quantitative measurement of the number of groups people belong to within their communities. Measures of community resilience are often better captured through qualitative techniques that include proxies for social cohesion, socio-political organization, community-based planning, reciprocity (including informal risk mitigation mechanisms), community-based ecosystem management, intercommunity relationships/cooperation and ability to restructure community capacities.

- **Data collection issues**

Despite the on-going proliferation of instruments aimed at measuring resilience at the household level, most do not appear to be capturing all the relevant and dynamic dimensions of resilience. This argues in favor of development of a core set of questions – that could be added to existing surveys – in order to capture certain domains of resilience, and the need for higher, systems level analysis. Data collection is expensive and time-consuming. Integrating resilience measurement into other monitoring and evaluation activities provides value for money and can help reduce the likelihood of assessment fatigue through fewer and more streamlined surveys. A key aspect of doing so will be determining which domains of resilience are best captured through quantitative and qualitative data collection methods.

Temporal considerations are also critical to measuring resilience. For example, the length of time required to affect certain aspects of resilience (e.g. changes in governance, institutional processes, or ecosystem health) may be longer than most program lifespans and donor timeframes. There is general agreement among practitioners that development of "lighter" questionnaires and other measurement tools would allow for more frequent collection of relevant data for resilience measurement. Likewise, increasing measurement intensity of a few key variables could help capture adaptive processes amid rapidly changing contexts.

- **Technical standards**

More work is needed to ensure the reliability and validity of resilience measurements, especially in the development of resilience indices. For instance, great care needs to be taken when identifying factors to be included in such analysis and in assigning weights to particular indicators. Ideally two sets of metrics will be integrated to measure the effectiveness of programs aimed at enhancing resilience to food insecurity: standard measures and context-specific measures. An important first step in developing a set of harmonized standards, methods, tools and indicators for resilience measurement will be reaching agreement on a common overarching analytical framework.

Standard measures should be measured at baseline and end-line and collect information on well-being and living conditions[8]. This includes measures related to food security, health/nutrition, assets, social capital, access to services, infrastructure, ecological/ecosystem services, psychosocial status and poverty. Resilience measurement should also include disturbance measures (shocks, stressors) and resilience response measures.

Disturbance measures include measuring the type, duration, intensity and frequency of shock or disturbance. It is important to note that disturbances can occur as rapid onset shocks or longer-term stresses or trends and can be idiosyncratic or covariate in nature.

Resilience response measures can be measured before, during and after shock and at household, community and higher systems levels. They focus on the extent to which external interventions and/or community responses influence three critical capacities: **absorptive capacity** (e.g., coping strategies, risk management, savings groups), **adaptive capacity** (e.g., use of assets, attitudes/motivation, livelihood diversification, human capital) and **transformative capacity** (e.g., governance mechanisms, policies/regulations, infrastructure, community networks, formal safety nets). While a single index for resilience measurement may well predict food security, such an approach has little diagnostic value for programming. Alternatively, deconstruction of indices into their separate components can be very useful, especially for understanding the complex nature of resilience and the relationships between the different components or variables. Unpacking individual factors and indicators helps identify constraints and programmatic priorities, and can verify or expose as false common assumptions or proxies. Longer-term, it is envisioned that continued assessment and identification of new indicators to better measure resilience will be necessary as evidence accrues.

8. These standard measures can be single indicators or composite indexes that represent some level or state of well-being/condition and can be measured.

X. Appendix C – Technical Working Group Members and Agency Level Leadership

Resilience Measurement Technical Working Group (as of November 2013)

Christophe Béné	Institute of Development Studies (IDS), University of Sussex
Tesfaye Beshah	Intergovernmental Authority on Development (IGAD)
Gero Carletto	Development Research Group, World Bank
Richard Choularton	Climate Change and Disaster Risk Reduction, World Food Program (WFP)
Greg Collins	U.S. Agency for International Development (USAID)
Dramane Coulibaly	Food and Agriculture Organization (FAO)
Mark A. Constas[9]	Applied Economics and Management, Cornell University
Marco D'Errico	Food and Agriculture Organization (FAO)
Katie Downie	International Livestock Research Institute (ILRI)
Tim Frankenberger	TANGO International
Alessandra Garbero	International Fund for Agricultural Development (IFAD)
John Hoddinott	International Food Policy Research Institute (IFPRI)
Dorothee Klaus	United Nations Children's Fund (UNICEF)
Jon Kurtz	Mercy Corps
Daniel Maxwell	Feinstein International Center, Tufts University
Nancy Mock[10]	Tulane University School of Public Health and Tropical Medicine
Donato Romano	University of Florence

The FSIN Steering Committee members

Joyce Luma	WFP
Luca Russo	FAO
Maximo Torero	IFPRI
Teunis van Rheenen	IFPRI
John McHarris	WFP
Mark Smulders	FAO

The FSIN Secretariat members

Alexis Hoskins	WFP
Kaisu-Leena Rajala	WFP
Lavinia Antonaci	FAO
Veronique De Schutter	WFP
Cecilia Signorini	WFP

9. Chair of the Resilience Measurement Technical Working Group
10. Co-Chair of Resilience Measurement Technical Working Group

XI. Appendix D – Technical Standards for Measurement[11]

Technical Criteria for Resilience Measurement		
Standard	**General Aim**	**Components**
Validity	Examines the accuracy of given measure and the accuracy of components (i.e., subscales) that constitute the measure.	• Content validity • Criterion related validity • Concurrent validity • Predictive validity
Reliability	Examines the consistency of measures, the degree to which a measure assesses relatively stable trait or capacity.	• Inter-rater reliability • Test-retest reliability • Parallel forms • Internal consistency
Feasibility	Examines constraints that affect the likelihood of a given measure being implemented in real-world setting.	• Cost constraints • Time constraints • Human resource constraints • Political constraints
Utility	Examines the extent to which measurement results may or may not be applied to practical settings.	• Programmatic alignment • Policy alignment • Generalizability • Contextual adaptability
Ethical	Examines the procedures that guard against harm that might be caused by measurement activities and/or from the release of associated results.	• Informed consent • Confidentiality • Anonymity • Proprietary data-issues

11. Adapted from *Standards* published by the American Educational Research Association, American Psychological Association & National Council on Measurement in Education (1999), and from the American Evaluation *Association Guiding Principles for Evaluators* (2004).

XII. Appendix E – Resilience Measurement Working Group: Clusters and Cluster Chairs

Cluster	Cluster Chair
Shocks and Stressors	Richard Choularton, WFP
Scales and Systems	Nancy Mock, Tulane
Qualitative and Subjective Measures	Dan Maxwell, Tufts
Estimation/Explanatory Models	John Hoddinott, IFPRI
Existing Constructs and Data Sets	Gero Carletto, World Bank

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Technical Series No. **1**

Resilience **M**easurement **T**echnical **W**orking **G**roup

Resilience has recently emerged as a framework for enhancing people's and communities' capacities to reduce their exposure, cope with and/or adapt to shocks. However, a common understanding of how to assess and predict resilience levels, and to evaluate the impact of resilience programmes, is lacking. In this context, the *Resilience Measurement Technical Working Group* (RM-TWG) was established under the auspices of the Food Security Information Network (FSIN) to identify and promote means of **operationalizing the concept of resilience** in humanitarian and development practice, primarily through research and technical oversight related to resilience measurement.

Operationalizing resilience measurement will require that practitioners provide credible, data-based insights into the attributes, capacities and processes observed at various scales (e.g., individual, household, community, national) and maximize the use of available data from ongoing resilience initiatives.

Therefore, the RM-TWG will promote adoption of best practice in resilience measurement through collaborative development of three primary outputs:

- a **paper** on resilience measurement principles and definition of resilience;
- a common **analytical framework** for resilience measurement; and
- **technical guidelines** for resilience measurement.

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