A COMMON ANALYTICAL MODEL FOR RESILIENCE MEASUREMENT
CAUSAL FRAMEWORK AND METHODOLOGICAL OPTIONS

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Presentation based on a paper by Mark Constas, Tim Frankenberger, John Hoddinott, Nancy Mock, Donato Romano, Christophe Bene and Daniel Maxwell.
Background

• The combined effect of climate changes, economic forces and socio-political conditions have increased the frequency and severity of risk exposure among vulnerable populations.

• For this reason interest in resilience has increased with an associated call for measurement

• The Resilience Measurement Technical Working Group (RM-TWG) was formed in June of 2013*

RM-TWG was an outcome of the expert consultation on resilience measurement for food security (February 2013)
see http://agrilinks.org/library/summary-expert-consultation-resilience-measurement-food-security
Motivation for the Technical Working Group – Why measure resilience?

Need empirical evidence of what factors contribute to resilience, under what contexts, and for what types of shocks.
RM-TWG membership

- Christophe Bene, IDS
- Tesfaye Beshah, RAU
- Gregory Collins, USAID
- Mark Constas, Cornell University
- Dramane Coulibaly FAO/CILSS
- Gero Carletto, World Bank
- Richard Choularton, WFP
- Katie Downie, The Technical Consortium
- Marco D’Errico, FAO
- Tim Frankenbger, TANGO International
- Alessandra Garbero, IFAD
- John Hoddinott, IFPRI
- John Kurtz, MercyCorp
- Ky Luu, Tufts University
- Dan Maxwell, Tufts University
- Nancy Mock, Tulane University
- Eugenie Reidy, UNICEF
- Donato Romano, Univ of Florence
- Rachel Scott, OECD
- Nigussie Tefera, JRC/EU
Two Papers Produced by the RM-TWG

January 2014

Resilience Measurement Principles
TOWARD AN AGENDA FOR MEASUREMENT DESIGN

November 2014

A Common Analytical Model for Resilience Measurement
CAUSAL FRAMEWORK AND METHODOLOGICAL OPTIONS
Additional accomplishments

• Reached consensus on a definition of resilience
• Planned a series of technical briefings on resilience measurement
• Established a community of practice on resilience measurement
• Directed attention to measurement as a vital part of the resilience agenda
Organization of Presentation

- Definition of resilience
- Focus on Paper No. 2
- Next steps for the technical working group
- The future of the technical working group
Definition of Resilience

• The RM-TWG offers the following definition of resilience:

  • “Resilience is defined as a capacity that ensures stressors and shocks do not have long-lasting adverse development consequences”

• RM-TWG Position - Implications of this definition:
  • Capacity focus
  • Multidimensional
  • Shock and context specificity
  • Linked to an outcome of interest (e.g., food security)
  • Instrumental value
Addressing ambiguity of resilience
Input, outcome, both, connected to some observed development outcome over time?

- **Input** – As multidimensional capacity to be included in a model that predicts some future development outcome
- **Input and outcome** – As a capacity (input) for which there are factors that determine the value and effects of the dimensions that constitute resilience capacity
- **Development outcome** – As a value of food security, poverty, livelihood status – observed over time in the face of shocks
Resilience as a functional expression

Measuring Resilience:
Development  = f (vulnerability, resilience capacity, shocks)
Outcome

• Treating resilience as a capacity is important because of the effect that it may have on a development outcome in the face of shocks.
• The inclusion of resilience capacity along side vulnerability signifies that resilience is not merely the inverse of vulnerability.
• Resilience capacity represents a particular set of measurable resources and capabilities that households, communities and systems may use to prepare for and respond to shocks.
Resilience as an innovative approach
Is resilience a new approach or just relabeling

Five distinctive features of resilience compared to vulnerability
Compared to vulnerability and other frameworks on risk-exposure-response dynamics resilience is:

- **Capacity focused**
  - Positive variable that serves absorptive, adaptive, and transformative functions

- **Systems oriented**
  - Views shocks and stresses from a systems perspective

- **Agro-ecological focused**
  - Incorporates an ecological approach

- **Multi Scale** (unit, temporal, and spatial)
  - Cross-scale interactions with implications for data collection and modeling

- **Measuring Uncertainty**
  - Accepts and seeks to model uncertainty rather than treating it as noise

These five features, which together provide a unified approach to understanding resilience, will be expanded upon at various points in the presentation
Three Capacities of Resilience

- **Absorptive capacity** – the ability to minimize exposure to shocks and stresses through preventative measures and appropriate coping strategies to avoid permanent, negative impacts;

- **Adaptive capacity** – making proactive and informed choices about alternative livelihood strategies based on an understanding of changing conditions; and

- **Transformative capacity** – the governance mechanisms, policies/regulations, infrastructure, community networks, and formal and informal social protection mechanisms that constitute the enabling environment for systemic change.
Operationalizing resilience as:

A set of capacities → Realized in connection with some disturbance → Indexed to an outcome
Focus on Paper No. 2 - Common Analytical Model

- Distinguished between conceptual models and analytical models
  - Focus of measurement and analytical procedures
- Identified components of measurement
  - From definition of constructs to analysis
- Highlighted causal framework
  - Sequence of related cause and effect relationships
- Provide sample indicators of resilience – data architecture
  - Focused attention on resilience capacities
- Described data collection methods
  - Use both quantitative, qualitative and subjective measures
- Outlined structure of estimation models
  - Prediction model and econometric details
From a conceptual model to an analytical model

- **Analytical models focus attention on:**
  - Timing of data collection
  - The characteristics of what will be measured
  - How to access those characteristics empirically using different methods – qualitative and quantitative
  - Technical criteria for data quality
  - How data are represented as change over time – based on theories of change
  - Specific structure and techniques used to model data and make inferences
Components of a Common Analytical Model for Resilience Measurement

Analytical Elements for Resilience Measurement

- Resilience Construct Assumptions
- Resilience Causal Framework
- Resilience Indicators and Data Structure
- Resilience Expected Trajectory
- Resilience Measurement Data Collection
- Resilience Measurement Estimation Procedure

Foundations of Sound Measurement
- Construct validity
- Latent properties
- Operationalization
- Multidimensionality
- Reliability standards
- Validity standards
- Utility standards

Product of Analytical Model of Resilience Measurement
Appropriately focused, technically rigorous resilience measurements
Resilience Measurement Causal Framework

Resilience Defined as an Instrumental Capacity that Affects Well-Being in the Face of Shocks and Stresses

Indicators Required to Model Resilience

Ex-ante Component
- Initial States and Capacities
- Categories of Indicators
  - Resilience capacities
  - Initial well-being
  - Initial vulnerability

Disturbance Component
- Shocks and Stressors
- Categories of Indicators
  - Natural disasters
  - Pest/disease outbreaks
  - Political conflicts
  - Economic shocks/stresses...

Ex-post Component
- Subsequent States and Trajectories
- Categories of Indicators
  - Resilience capacities
  - Well-being
  - Vulnerability

Multiple Scales
- Household
- Community
- Region
- National
- Systems

Multiple Methods
- Quantitative
- Qualitative
- Objective
- Subjective

Local Components
- Contextual Factors
- Categories of Indicators
  - Political factors
  - Cultural factors
  - Agro-ecological factors...

Operational and Analytical Goal of Resilience Measurement
Collect and analyze data to model recovery and well-being trajectories over time as a function of initial states and shocks/stressors, mediated by resilience capacity.

Time- and Event-Sensitive Measurement
### Resilience Capacities Data Structure

<table>
<thead>
<tr>
<th>Resilience Capacity Categories</th>
<th>Sample Indicators</th>
<th>Resilience Functions</th>
<th>Measurement Tactics to Increase Validity of Resilience Measures</th>
<th>Time Periods and Trigger Events</th>
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</thead>
<tbody>
<tr>
<td>Social capital* RC-SC</td>
<td>• Bonding</td>
<td>• Absorb</td>
<td>• Individual</td>
<td>• Short term</td>
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<td></td>
<td>• Bridging</td>
<td>• Adapt</td>
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<td>• Medium term</td>
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<td>• Linking</td>
<td>• Transform</td>
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<td>• Long term</td>
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<td>Human Capital RC-HC</td>
<td>• Education</td>
<td>• Objective</td>
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<td>• Event sensitive</td>
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<td></td>
<td>• Skills &amp; abilities</td>
<td>• Subjective</td>
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<td></td>
<td>• Health and wellness**</td>
<td>• Quantitative</td>
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<tr>
<td>Economic resources RC-ER</td>
<td>• Assets -financial &amp; productive</td>
<td>• Qualitative</td>
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<td></td>
<td>• Market access/market mechanisms</td>
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<td>• Supply chain efficiency</td>
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<td>Service infrastructure RC-SI</td>
<td>• Roads &amp; transportation</td>
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<td>• Water &amp; sanitation</td>
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<td>• Medical</td>
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<td>Livelihood strategies RC-LS</td>
<td>• Food security &amp; financial</td>
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<td></td>
<td>• Diversity</td>
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<td></td>
<td>• Adaptive</td>
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<td>Inst. &amp; governance RC-IG</td>
<td>• Coverage</td>
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<td>• Structural integrity</td>
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<td></td>
<td>• Effectiveness</td>
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<td>Risk strategies RC-RS</td>
<td>• Risk exp. history/perception</td>
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<td>• Risk landscape assessment</td>
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<td>• Problem definition</td>
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<td>• Decision making &amp; planning</td>
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<tr>
<td>Tech. &amp; innovation RC-TI</td>
<td>• Agriculture</td>
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<td></td>
<td>• Food handling/production</td>
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<td>• Business</td>
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<td>Social protection RC-SP</td>
<td>• Focus &amp; type</td>
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<td>• Strategic aim</td>
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<td></td>
<td>• Integration &amp; duration</td>
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<td>Agro-ecological RC-AE</td>
<td>• Soils &amp; water resources</td>
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<td>• Cropping/grazing practices</td>
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<td></td>
<td>• Natural resource management</td>
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* Aldrich, 2013
**Includes both physical and mental wellness
Note on timing and frequency of measurement data – a few questions

• When should measures be administered?
• With what frequency should measures be administered?
• At what point can one draw conclusions about resilience?
Resilience as shock sensitive outcome observed over time
Summary - Three Core Features of the Common Analytical Model Presentation

• Components of the common analytical model
  • Describes the tasks that need to be undertaken to measure resilience

• Resilience measurement causal framework
  • Describes the causal structure of resilience, identifies critical areas of measurement, and highlights requirements of resilience measurement

• Resilience pathways
  • Describes different trajectories following shocks and demonstrates the importance of observing outcomes over appropriate periods of time
Estimation models

To determine whether greater resilience capacity reduces the negative impact of shocks on well-being outcomes the following estimation models are used.

**Simplified estimation model:**

Food Security = f (vulnerability, resilience capacity, shocks)

**Time-sensitive model with subjective measures:**

Food security$_t$ = f (vulnerability$_t$, resilience capacity$_t$, shock$_t^{0,s}$)

**Functional form estimating food security using resilience capacity:**

\[
\Delta \ln FC_{hvt} = \sum_i \alpha_i CS(i)_{vt} + \sum_i \beta_i S(i)_{hvt} + \sum_v \delta_v R C_{hvt} + \gamma X_{hvt} + \Theta Z_{hvt} + \Delta \varepsilon_{hvt}
\]
Next Step Part I: Resilience Measurement Briefings

**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?
Opportunities & challenges

- Leveraging existing data and ongoing data collection efforts
- Dealing with restricted time-frames for reporting required by donors and agencies
- Managing cost and capacity issues associated with multi-scale data collection
- Capitalizing on cell-phone based data collection platforms for frequent, timely collection of measurement
- Identifying workable modelling procedures for resilience that reflect the full complexity of a systems approach on which resilience programming is based
Thank you!