



**Evaluating Resilience:
Partnering to Measure Complexity**



AEA – October 2014 – Denver

- Ø **Karen Campbell** – University of Pennsylvania, Wharton Center for Risk and Decision Processes, Philadelphia
- Ø **Scott Chaplowe** – International Federation of Red Cross and Crescent Societies (IFRC), Geneva. Scott.Chaplowe@ifrc.org
- Ø **Adriana Keating** – International Institute of Applied System Analysis (IIASA), Vienna
- Ø **Colin McQuistan** – Practical Action, Climate Change and Disaster Risk Reduction, United Kingdom, Colin.McQuistan@practicalaction.org.uk
- Ø **Michael Szoenyi** – Zurich Insurance Company LTD, Zurich



Session Objectives

- 1. Acknowledge methodological challenges to measuring a complex and dynamic phenomenon such as community resilience**
- 2. Zurich Resilience Alliance to measure and assess the impact of community flood-resilience programming = *Interesting collaboration between private, public and civic partners.***
- 3. Use of a consistent measurement methodology for community resilience to floods over time and place.**



Session Agenda

1. **Scott Chaplowe** – “Measuring Community Resilience – Considerations for Implementing Organizations”
2. **Karen Campbell** – “Measuring Community Resilience – Sources, Outcomes & Measuring Flow”
3. **Adriana Keating** – “Community Resilience – from Measurement to Evaluation”
4. **Colin MeQuistan** – “Community Resilience – learning from the field”
5. **Michael Szoenyi** – “How to Measure Resilience?”




Measuring Community Resilience: Considerations for Implementing Organizations



Scott Chaplowe
AEA 2014, Denver

Three Key Measures for Resilience	
1. Resilience	<ul style="list-style-type: none"> Ø Resilience to what? - shocks, stresses, chronic vulnerabilities Ø What capacity/ability? - respond, cope, recover, absorb, adapt, transform? Ø Outcome or process? Ø Unit of analysis - resilience for whom? Ø Timeframe?
2. Attribution Analysis	<ul style="list-style-type: none"> Ø To what extent can we <i>attribute</i> any measured resilience to our intervention versus other factors?
3. Contribution Analysis	<ul style="list-style-type: none"> Ø To what extent did we achieve our objectives that we identify as <i>contributing</i> to resilience?



Potential of the Resilience Agenda = A Systems Perspective

“The ecosystemic view of individuals as embedded in a web of complex, interacting relationships has given rise to a new interest in community resilience” (Kumayer 2009).

“Resilience is frequently described as a ‘system’ or a ‘system of systems’... a system-wide approach to resilience needs to capture a range of activities, actors and processes that are part of a resilience building system” (UNDP 2013)(UNDP 2013).

Challenge for Measuring Reliance = A Systems Perspective

“It is by no means obvious what leads to resilience in a complex system, or which variables should be measured in a given study of resilience” (Cumming 2005)

Increasing Critique

Levine (ODI 2014): 12 conceptual and methodological challenges for measuring resilience. His conclusion?

“The perceived ‘problem’ of quantifying resilience both stems from and drives the tendency to create a distinct resilience sector. In philosophical jargon, we are making the mistake of ‘reifying’ resilience – that is, treating it not as an abstract idea, but as if it were something concrete....

If we no longer have the illusion that there is a separate box of resilience activities we are freed from the need to create a new quantification tool for use in measuring resilience.”

Carriage Leading the Horse

(W)hen we try to measure what is important, we make important what it is that we measure (Levine 2014).

The most significant weakness of an inductive method to resilience measurement is the circular logic of such an approach: ‘If we define a priori the variables that lead to system resilience, then our conclusions will be largely driven by our initial selection of variables’ (Cumming 2005).

Political Dimension

“(R)esilience is inherently a matter of social framing by actors with different preferences and resources...

It is not necessarily “good” or “bad,” and interventions seeking to strengthen resilience will have to contend with potential “winners” and “losers.” (Bene et. al. 2012)

Proof versus Evidence

In the absence of irrefutable *proof*, it can still be possible to collect awfully good *evidence* for the resilience-strengthening agenda:

- Improved service delivery (resilience-strengthening)
- Accountability

“The case for investing in resilience is an argument for targeting aid differently, and for incorporating an analysis of vulnerability and risk as key considerations in planning in all sectors” (Levine 2014).

Complexity Challenge Increasingly Acknowledged in Evaluation Community

- **Patton. 2012:** Developmental Evaluation: Applying complexity concepts to enhance innovation and use.
- **Hargreaves. 2010:** Evaluating systems change: A planning guide
- **Morell. 2010.** Evaluation in the face of uncertainty: Anticipating surprise and responding to the inevitable
- **Williams & Imam 2007:** Systems Concepts in Evaluation

Three Methodological Considerations

1. **Mixed methods**
2. **ZA: look at resilience in the face of a specific event (e.g. floods)**
3. **ZA: “(W)hen it comes to ground reality, a community largely defines itself.”**

International Federation of Red Cross and Red Crescent Societies | IASA | PRACTICAL ACTION | Wharton University of Pennsylvania | ZURICH

Measuring Resilience: Sources and Outcomes



Karen A. Campbell, PhD
karenca@wharton.upenn.edu

International Federation of Red Cross and Red Crescent Societies | IASA | PRACTICAL ACTION | Wharton University of Pennsylvania | ZURICH


Quick Terms and Systems Thinking

✓ **Disaster Resilience:** the ability of a system, community, or society to pursue its social, ecological, and economic development and growth objectives, while managing its disaster risk over time in a mutually reinforcing way.

HUH???


This means what we all think resilience means ---

The ability to continue to thrive in the face of risk.




Quick Terms and Systems Thinking

- ✓ **Complex Adaptive System:** made up of *elements, relationships* and a *function or purpose* and is able capable of growth or change
- ✓ **Properties of Resilient Systems:** Robustness (strength to withstand), Redundancy (flexibility), Resourcefulness (identify problems, mobilize and apply resources in new ways), Rapidity (quickly respond, learn and adapt)
- ✓ **Source of Resilience:** anything that provides a resilient property to the system, which enables it to absorb, withstand or quickly recover and learn from a risk event
- ✓ **Outcome:** Variable or variables of interest that indicate whether the system is continuing function or achieve its purpose (aka key performance indicators, goals).



The Two Time Frames of Resilience


1. Before a crisis or risk event
 - § Resilience is a latent characteristic of a community (or organization, or person, etc.)
 - § There are various sources or properties within the system (community system, etc.) that contribute to the latent resilience characteristic
 - § Depending on the structure of the system (community, organization, etc), and the type of risk event, these sources may have varying effectiveness for actual resilience
2. After the crisis or risk event
 - § Actual characteristic Resilience is revealed in the systems ability to withstand or quickly bounce back from and (for complex adaptive systems) learn and grow stronger from the risk event



What do we Measure?

- ✓ If we want to evaluate a communities actual resilience – we measure such things as total losses, time to return to some standard of normal operations, etc. after the risk event has occurred.
- ✓ If a community wants to know before a risk event whether it will be resilient, then we have to measure the latent characteristic.

**THIS IS HARD
IT IS INVISIBLE
IT HAS NOT YET BEEN TESTED TO REVEAL IT!**



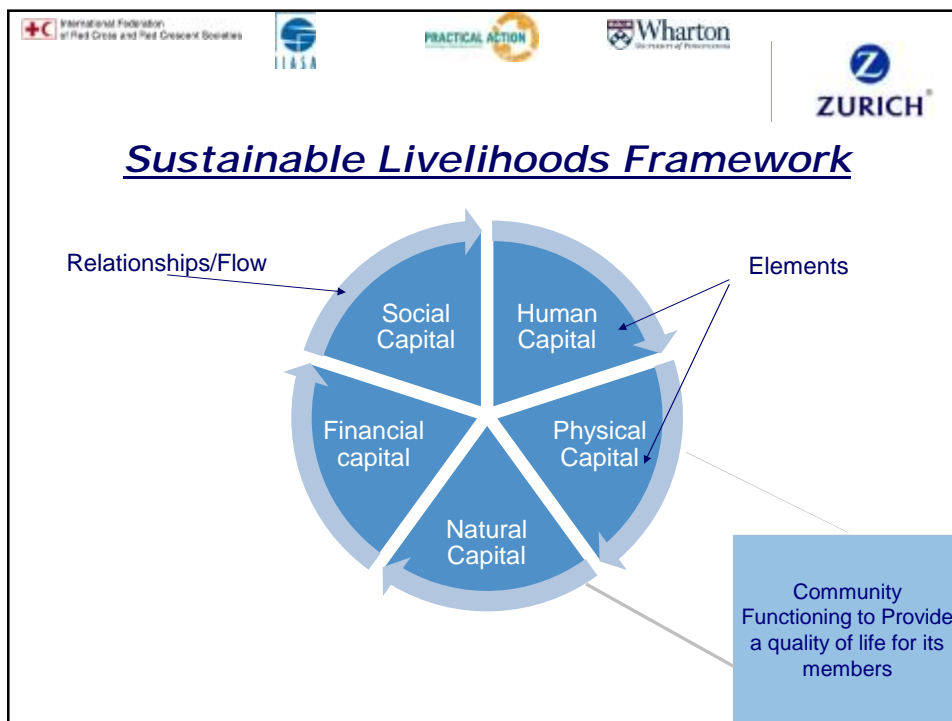
A Community System

Purpose: To provide a desired standard of living (well-being) for its members

Elements: People, animals, resources (natural capital, physical capital, social capital, financial capital)

Relationships: governance (rules-formal and informal), work and trade, education and training,


The elements form interdependent relationships to achieve the overall purpose of the system.



Logos at the top include: International Federation of Red Cross and Red Crescent Societies, IASA, PRACTICAL ACTION, Wharton University of Pennsylvania, and ZURICH.


Identifying Resilient Outcomes

- ü What are the goals of the community (health, education, jobs, savings/wealth, natural resources, cohesion)?
- ü What measures indicate that a community is achieving its purpose or goals?
- ü If a flood event happens, what would be a resilient outcome for these goals? (no diseases run rampant, no loss in educational attainment, no loss of livelihoods, etc.)




Identifying Sources of Resilience

- ü Human: if maintaining educational attainment is a goal, are there backup plans in place (floating schools (robustness), extra homework assignments (resourcefulness), “disaster days” built into the school calendar (redundancy)); if health is a goal, are people trained and understand good sanitation practices (resourcefulness)?
- ü Social: if maintaining cohesion is a goal, do people check on their neighbors during a flood (redundancy)? are there plans in place to help vulnerable populations (resourcefulness)?, if evacuation is necessary, are there plans for bringing people back when it is safe (rapidity)?
- ü Physical: if maintaining roads and buildings is a goal, are they built to flood specification (robustness)? Are there multiple communication systems in place (redundancy)?
- ü Natural: is there a waste management system, so waste does not clog drainage systems (robustness)? Are there rules to limit logging or replanting programs, to minimize soil erosion (resourcefulness)?
- ü Financial: Are there funds set aside or insurance purchased for a flood event (resourcefulness)? Are there alternative livelihoods or sources of income during a flood (redundancy)?




Testing Measures of Latent Resilience




$$\text{Change in Resilient Outcome}_{t+1_i} = \text{Change in Sources of Resilience}_{t-1_i} + \text{Community characteristics}_{t-1_i}$$

t = time
 t₀ = flood event (t+1 is post flood, t-1 is pre-flood)
 i = community



How We Can Use Measures of Resilience

- q Benchmark and track progress on both sources of resilience and outcomes (on track for achieving goals even if no risk event occurs).
- q Contribute to understanding of what are effective sources of resilience.
- q Be able to measure impact of resilience enhancing projects or programs.
- q Be able to better evaluate and prioritize investment decisions.



Thank you!

For further reading:

Keating, A., Campbell, K., Mechler, R., Michel-Kerjan, E., Mochizuki, J., Kunreuther, H., Bayer, J., Hanger, S., McCallum, I., See, L., Williges, K., Atreya, A., Botzen, W., Collier, B., Czajkowski, J., Hochrainer, S., Egan, C. (2014) Operationalizing Resilience against Natural Disaster Risk: Opportunities, Barriers, and a Way Forward. Zurich Flood Resilience Alliance at http://opim.wharton.upenn.edu/risk/library/zurichfloodresiliencealliance_ResilienceWhitePaper_2014.pdf

“Enhancing community flood resilience: a way forward.” Zurich Risk Nexus, May 2014 at http://opim.wharton.upenn.edu/risk/library/zurichfloodresiliencealliance_ResilienceIssueBrief_2014.pdf



**Community Disaster Resilience:
From measurement to evaluation**



Adriana Keating


International Institute of Applied System Analysis (IIASA), Vienna



Biggest bang for the resilience buck?!




Unfortunately things are not that simple!



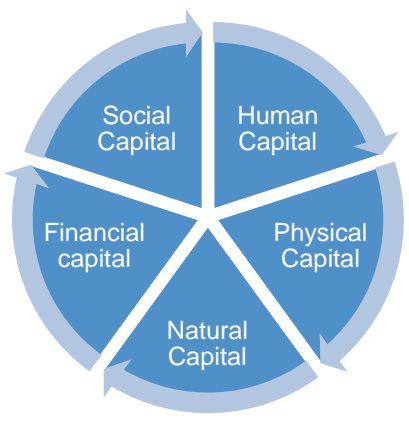
Community disaster resilience decision-making

Three critical inputs in participatory decision-making for disaster resilience:


- Thinking across the 5Cs, 4Rs, and dynamically – understanding the disaster resilience system; why the different bits of the measure are important
- An expert assessment/measure of disaster resilience to map current disaster resilience and identify where critical gaps lie
- Tools for systematically weighing up the trade-offs associated with interventions into complex systems



Thinking 5C/4R and dynamically
- from DRM to Disaster Resilience



Changing thinking is critical to enhancing disaster resilience. For any disaster resilience measure to have credibility with the people it is designed to serve, we must establish the foundations for thinking about disasters right across the 5Cs, incorporating the 4Rs and thinking dynamically.



Cost-Benefit Analysis for disaster decision-making

- Ignores indirect (such as erosive coping) and intangible (social and environmental) impacts
- Underweights low probability/high impact events
- Focuses on hard infrastructure because costs/benefits are more easily estimated
- Takes a narrow spatial and temporal scale which ignores dynamic interactions
- Struggles with multiple value systems
- Struggles to value 4Rs, in particular redundancy
- Valuation of loss of life and discounting the future typically result in deep ethical unease



Decision-support tools

Decision support tool	Advantages	Challenges	Applications
Cost-Benefit Analysis (CBA)	Rigorous framework based on comparing costs with benefits	Need for monetising all benefits, difficulty in representing plural values	Well-specified hard-resilience projects with economic benefits
Cost-Effectiveness Analysis (CEA)	Ambition level fixed, and only costs to be compared. Intangible benefits part. loss of life do not need be monetised	Ambition level needs to be fixed and agreed upon	Well-specified interventions with important, non-monetizable intangible impacts, which should not be exceeded (loss of life etc.)
Multi-Criteria Analysis (MCA)	Consideration of multiple objectives and plural values	Subjective judgments required, which hinder replication	Multiple, soft-resilience and systemic interventions (education, health) involving plural values
Robust approaches	Addressing uncertainty and robustness	Technical computing required and skills	Projects with large uncertainties and long timeframes





Community Resilience – learning from the field



Ø **Colin McQuistan** – Practical Action, Climate Change and Disaster Risk Reduction, United Kingdom, Colin.McQuistan@practicalaction.org.uk



How to measure resilience?



Capturing process and difference....



Some things are relatively straight forward....



Others are less so...



How to measure the resilience contribution of safe water during a flood?



Or of safe housing when flooding occurs?



International Federation of Red Cross and Red Crescent Societies | IASA | PRACTICAL ACTION | Wharton University of Pennsylvania | ZURICH

Building on individual action...



Institutions...

International Federation of Red Cross and Red Crescent Societies | IASA | PRACTICAL ACTION | Wharton University of Pennsylvania | ZURICH

Are resilience building actions the same for all communities?





But are resilience building actions the same for everyone in a community?



Unintended consequences...





How to measure resilience?

Zurich Flood Resilience Alliance
Michael Szoenyi



Why flood resilience?

- Floods affect more people globally than any other types of natural hazard –in fact floods and related issues affect more people than earthquake, tornado, drought and hurricanes put together.
- Flood risks are increasingly interconnected and interdependent and cannot be enhanced by one stakeholder alone
- There is an opportunity to innovate and promote pre-event risk reduction instead of post-event flood relief
- By bringing together partners with unique skills and expertise in hazard and risk management we can identify new and innovative solutions to pre-event risk reduction

The flood resilience program is a key focus area of Zurich's corporate responsibility strategy



RISK MANAGEMENT



INVESTMENT MANAGEMENT

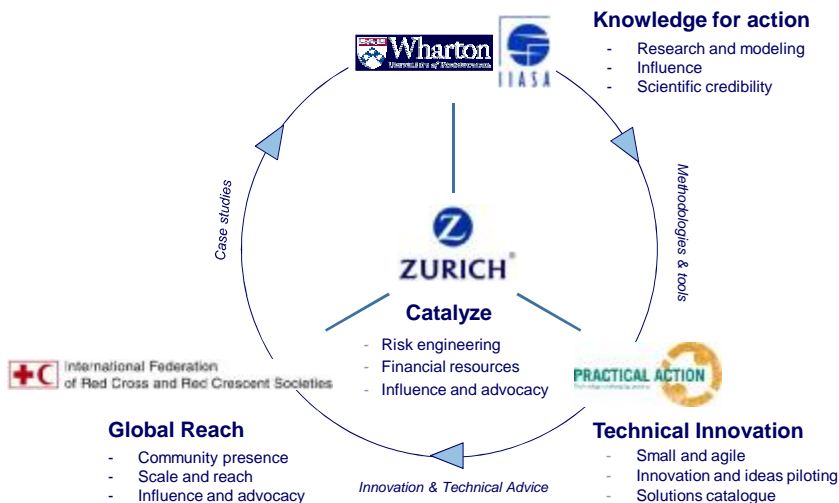
responsible investment



CONFIDENTIAL

47

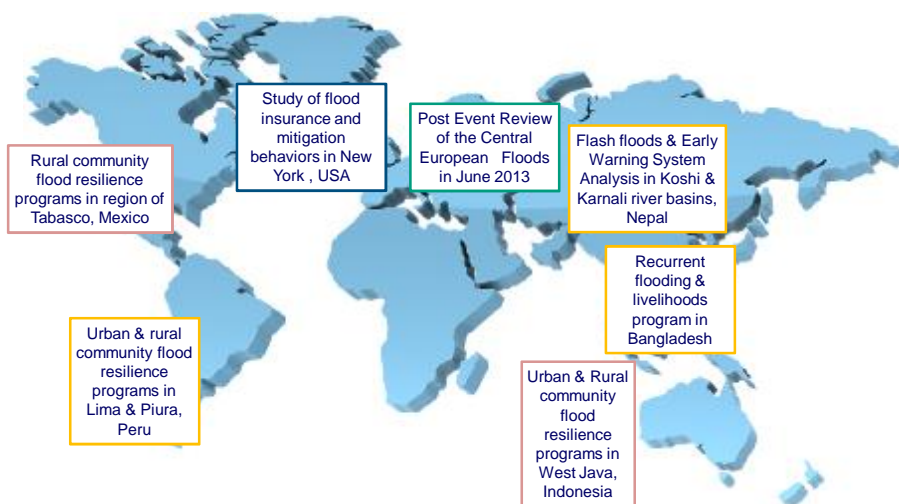
What are we doing differently?



CONFIDENTIAL

48

Our current community & research activities are looking at flood risk in different locations and settings



CONFIDENTIAL

49



Motivation – Why measure resilience?

- Many attempts to define and measure resilience
- No «one size fits all» - audience and context dependent
- Our motivation - Demonstrate the impact of our intervention on the ground
 - “no general measurement framework for disaster resilience has been empirically verified yet” – UNDP, Feb 14
- Our aim – address this measurement gap
- Our use – assess strengths and weaknesses based on the consistent measurement approach. Prioritize actions. Demonstrate impact (increase of resilience) over time.

CONFIDENTIAL

50

Defining our approach

- Definition of «flood resilience»
- Definition of «community»

- Mahendranagar and Prakashpur are neighboring wards
- Both split by the Koshi river
- Communities on the left and right banks have more connection than with their administrative neighbors
- LHS (P+M) and RHS (P+M) are more natural community definitions

CONFIDENTIAL
51






Comprehensive approach to measure sources of resilience

r⁴
resilience

- Robustness
- Redundancy
- Resourcefulness
- Rapidity

c⁵

CONFIDENTIAL
52

Risk management measurement methodology

Category	Factors	Grading
Human Capital	Factors: sources of resilience; Category: made up of # factors; each factor contains one or several "R"s	A, B, C or D (or E)
Social Capital
Natural Capital
Physical Capital
Financial Capital
		Resilience Score

- Measurement principles
- Hazard & Risk Engineering & Risk Management expertise
- Household & community level data gathering

CONFIDENTIAL
53







Ground reality testing



CONFIDENTIAL
54