

Measuring and Managing Urban Disaster Resilience

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Photo: John Claude White

1883/84



Photo: Marcus Nüsser

11. Oct. 2011

What is at stake?

- *Unprecedented losses*
- *Compounding effect on the poor and vulnerable*
- *Threat to development and social progress*



Tehran

120,000 to 380,000
projected death toll

Istanbul

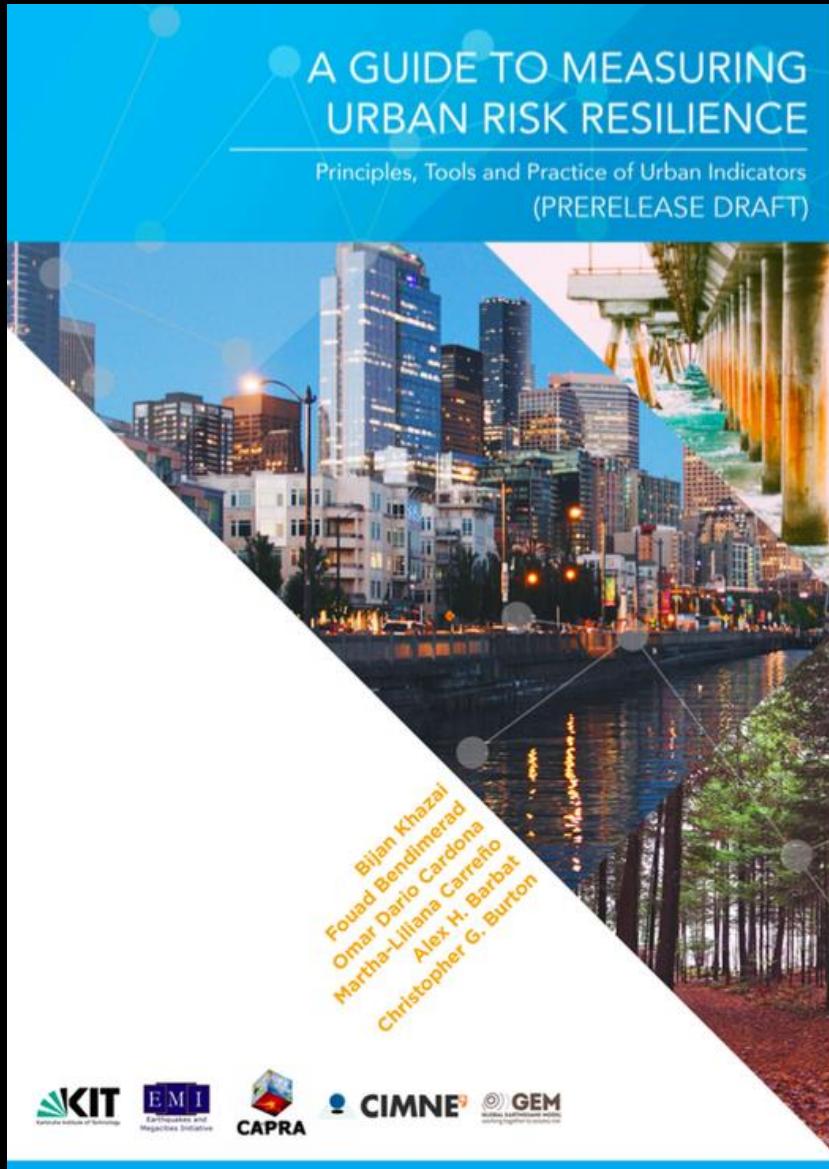
40,000 fatalities
200,000 injured

Kathmandu

22,000 – 40,000 death toll
60% heavily damaged bldgs

What gets measured gets managed! What gets monitored gets done!





- Manizales
- Bogota
- Istanbul
- Amman
- Mumbai
- Metro Manila
- Pasig
- Quezon City
- Dhaka
- Lalitpur
- Addis Ababa
- Algiers (new)
- Dar es Salam (new)

Measuring Risk and Resilience: Indicators

Indicators

Quantitative variables intended to represent a characteristic of a system of interest

Indices

Multiple indicators combined to construct composite indicators, or indices

Uses

Inform decision making, build consensus, improve stakeholder participation, explore underlying processes, advocacy, measure progress over time

Simplify complexity to a single metric



FIFA/Coca-Cola World Ranking

Rank	Team	Total Points
1	Germany	1558 (1558.49)
2	Brazil	1431 (1430.57)
3	Belgium	1298 (1298.32)
4	Portugal	1274 (1273.69)
5	Argentina	1241 (1241.45)

INDU	-325.76	VOL
INDP	9999.62	UVOL
NYX	-326.48	DVOL
NYX	8782.48	TRT

The City System ...



People



Infrastructure



Politics



Environment

... and its Resilience Dimensions

Resilience: ability of an urban systems to adapt to, cope with and transform in view of potential adverse impacts.

QUANTIATIVE DATA

Demographic Characteristics

Socio-economic Status

Education

Health

Land Tenure

Crime

**Integrated Disaster Risk Index
(Urban Disaster Risk Index)**

QUALITATIVE DATA

Legal & Institutional Arrangements

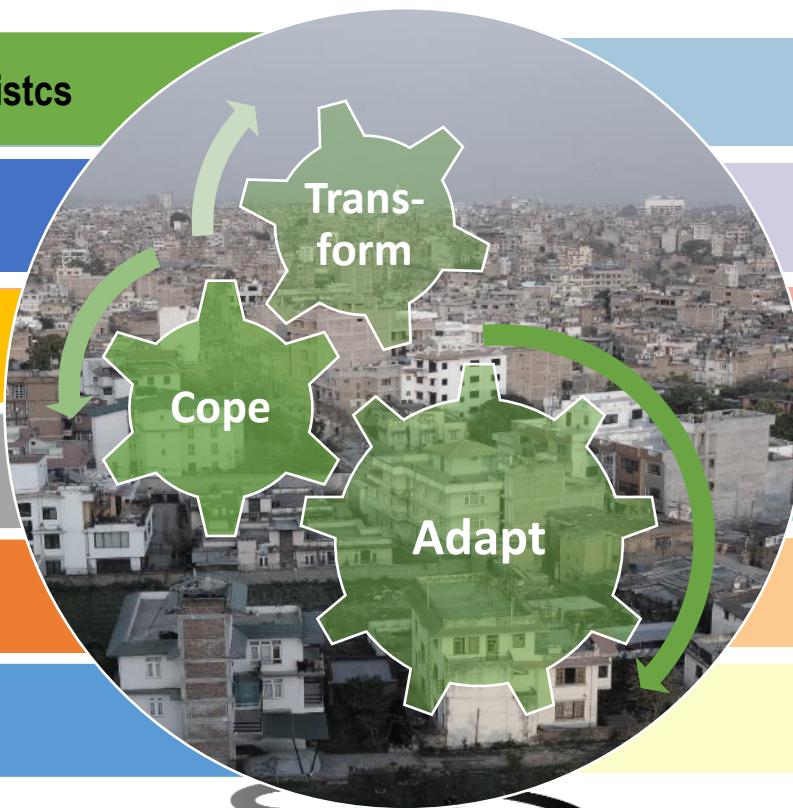
Social Capacity

Critical Services and Public Infrastructural Resiliency

Emergency Preparedness, Response and Recovery

Planning, Regulation and Mainstreaming Risk Mitigation

Awareness and Advocacy



Resilience Performance Scorecard



Integrated Disaster Risk Index

Quantitative

Integrated Seismic Risk

Physical Seismic Risk

Probability of damage and loss to people and structures due to earthquakes

Socio-Economic Vulnerability and Resilience

Vulnerability of society and economy and their capacity to cope with earthquake events

Seismic Hazard

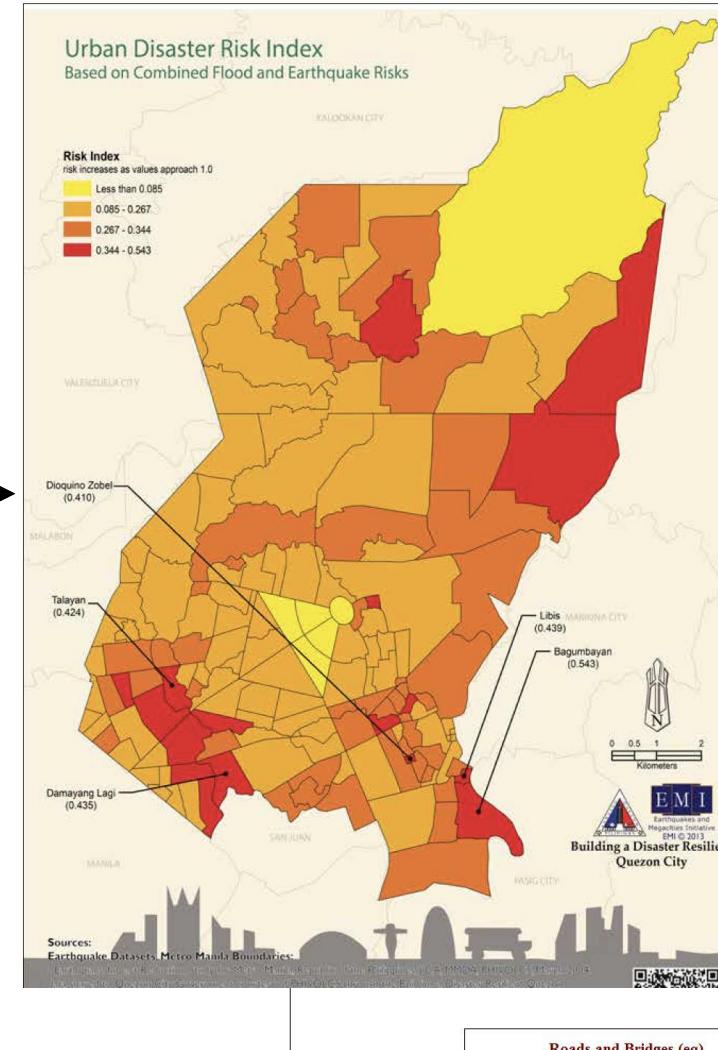
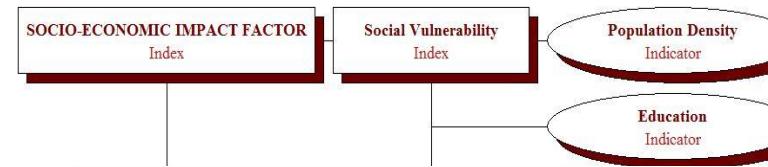
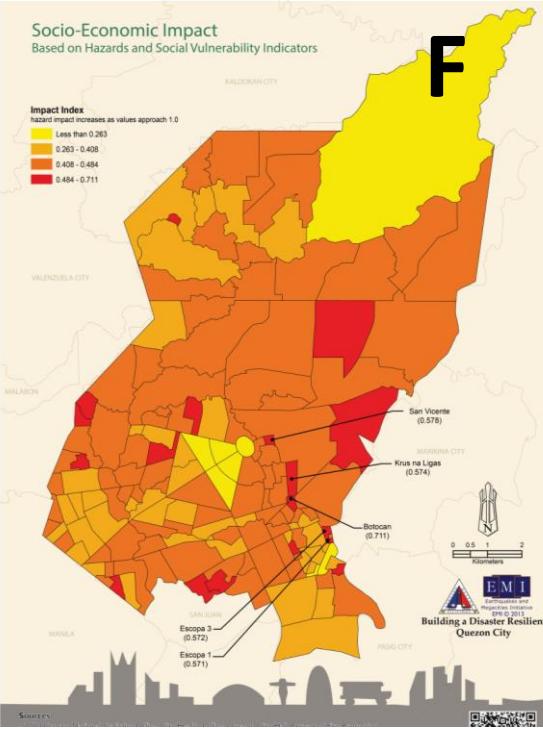
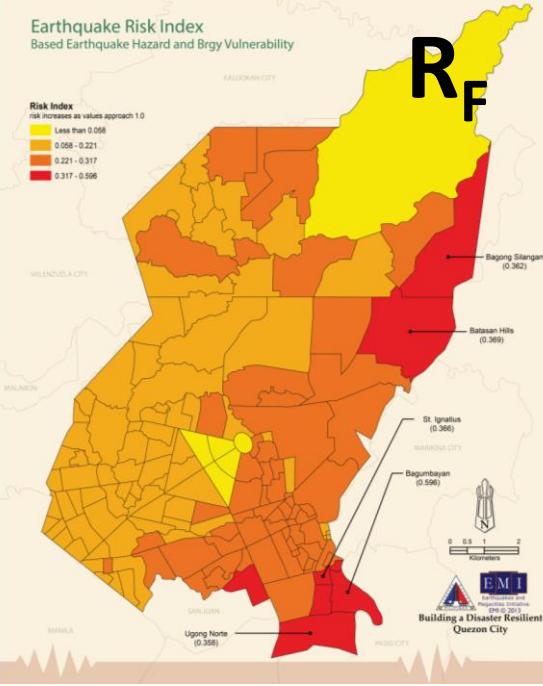
Probability of ground shaking due to earthquakes

Exposure

Elements at risk

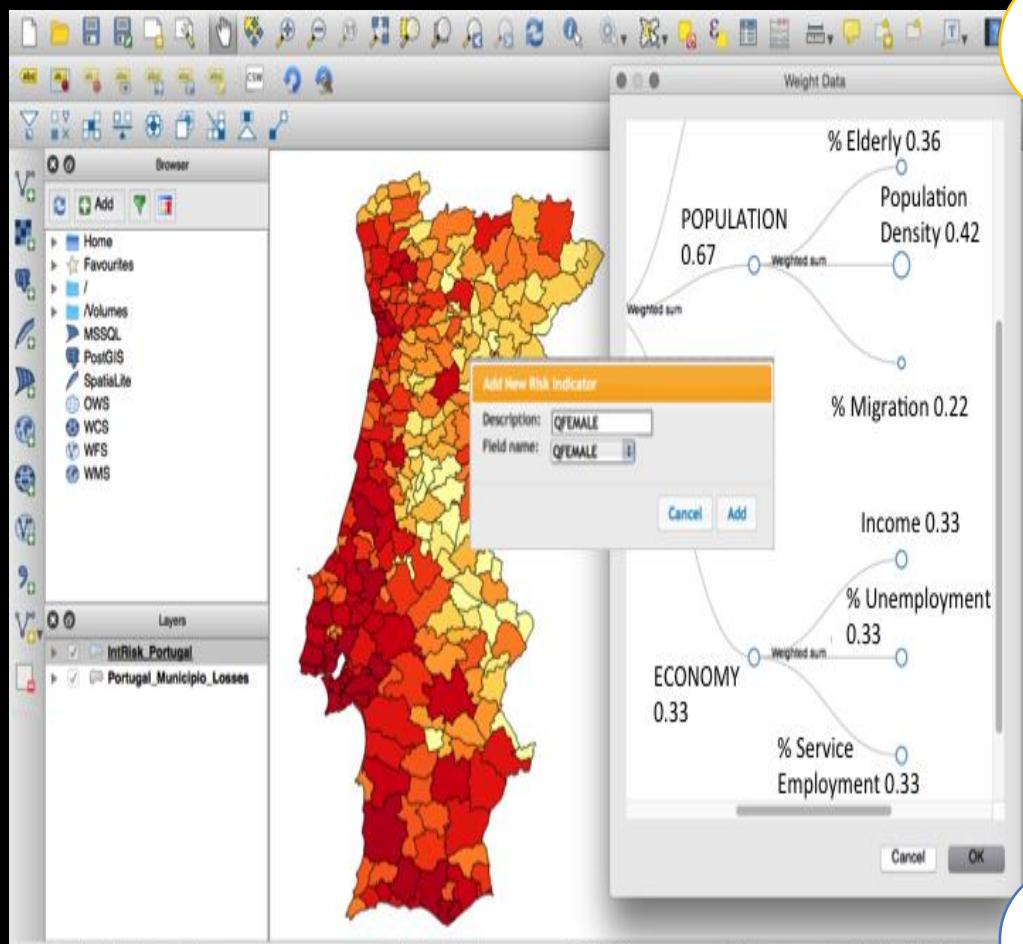
Physical Vulnerability

Vulnerability of structures and their occupants to seismic hazard



$$UDRI = \frac{\sum_{i=1}^n R_i}{\sum_{i=1}^n R_i} \times (1 + F_i)$$

Integrated Risk Modelling in OpenQuake



Selection of Indicators

Normalization

Multi-variate Analysis

Weighting/Aggregation

Link to Physical Risk

Visualization

MapQuest Openstreet

Load Project

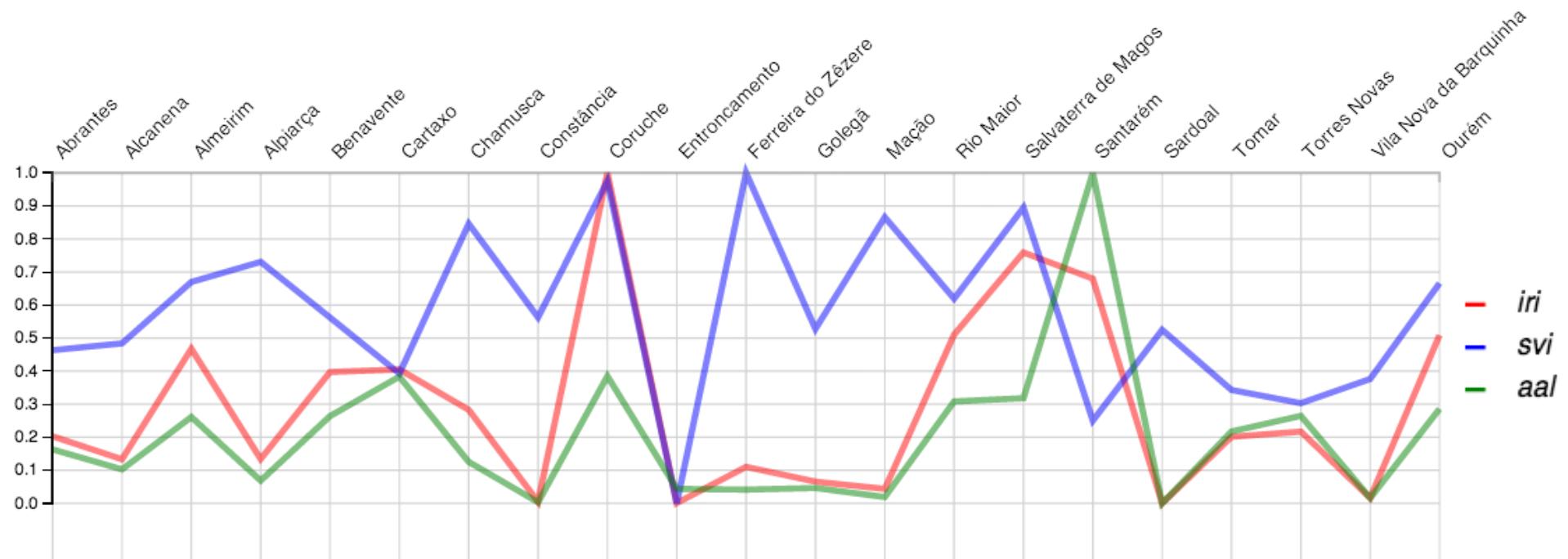


Project Def

IRI Chart

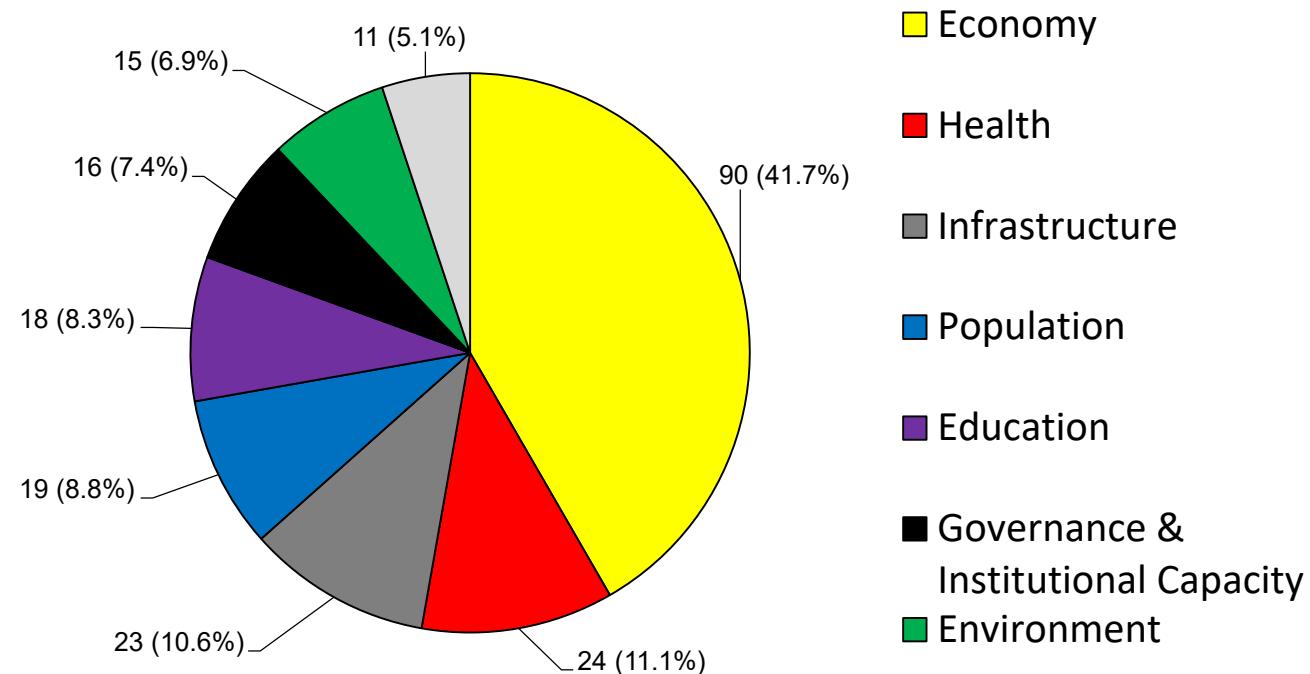
Category Chart

Primary Chart

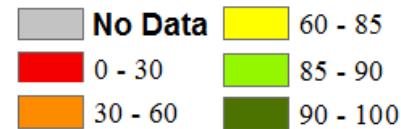


Global Socio-economic Vulnerability Database

- **317** socio-economic vulnerability indicators



Data Completeness by Country (%)

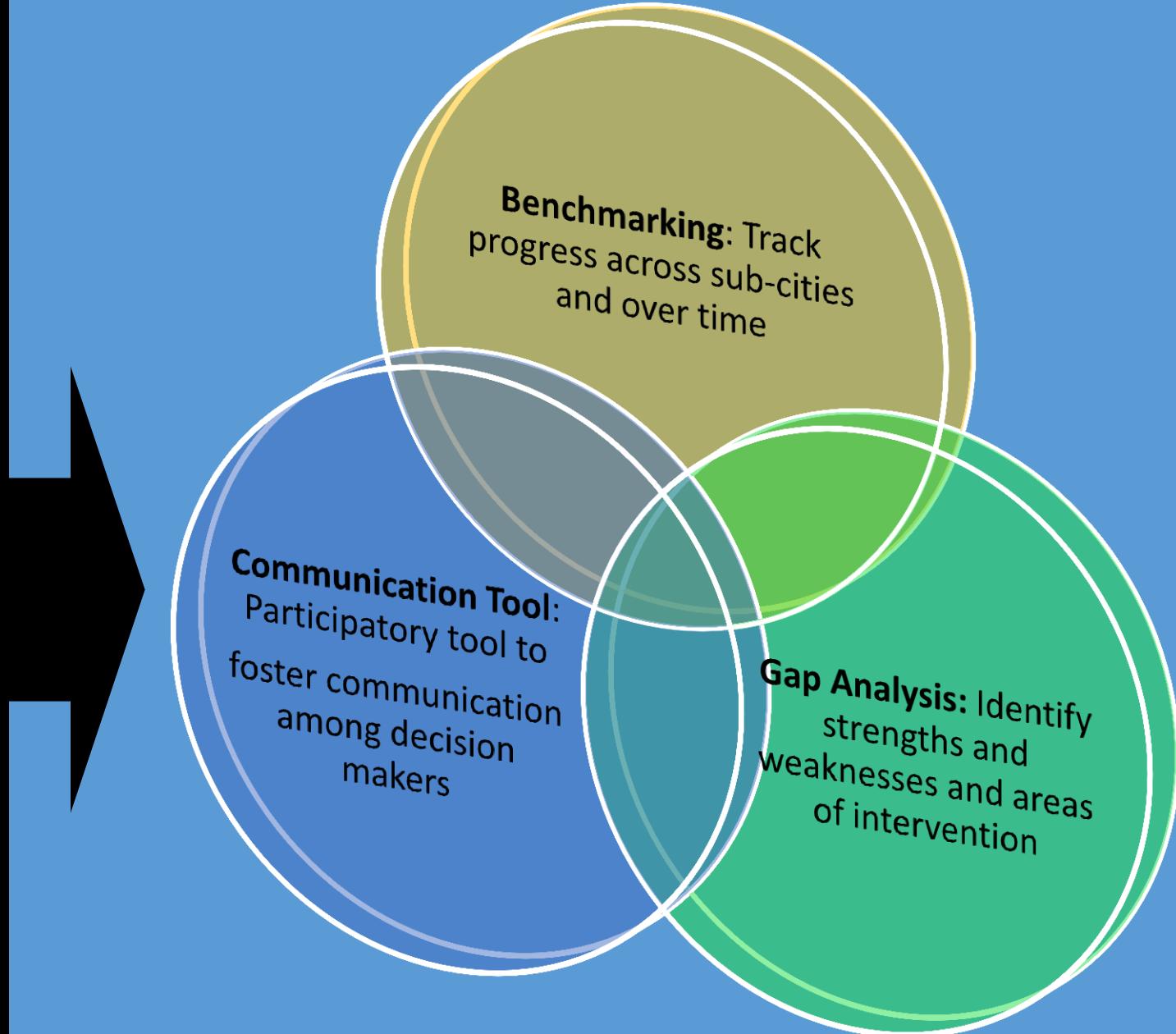


A large, semi-transparent blue circle is centered in the middle of the image, covering approximately the upper half of the cityscape. Inside this circle, the text is displayed.

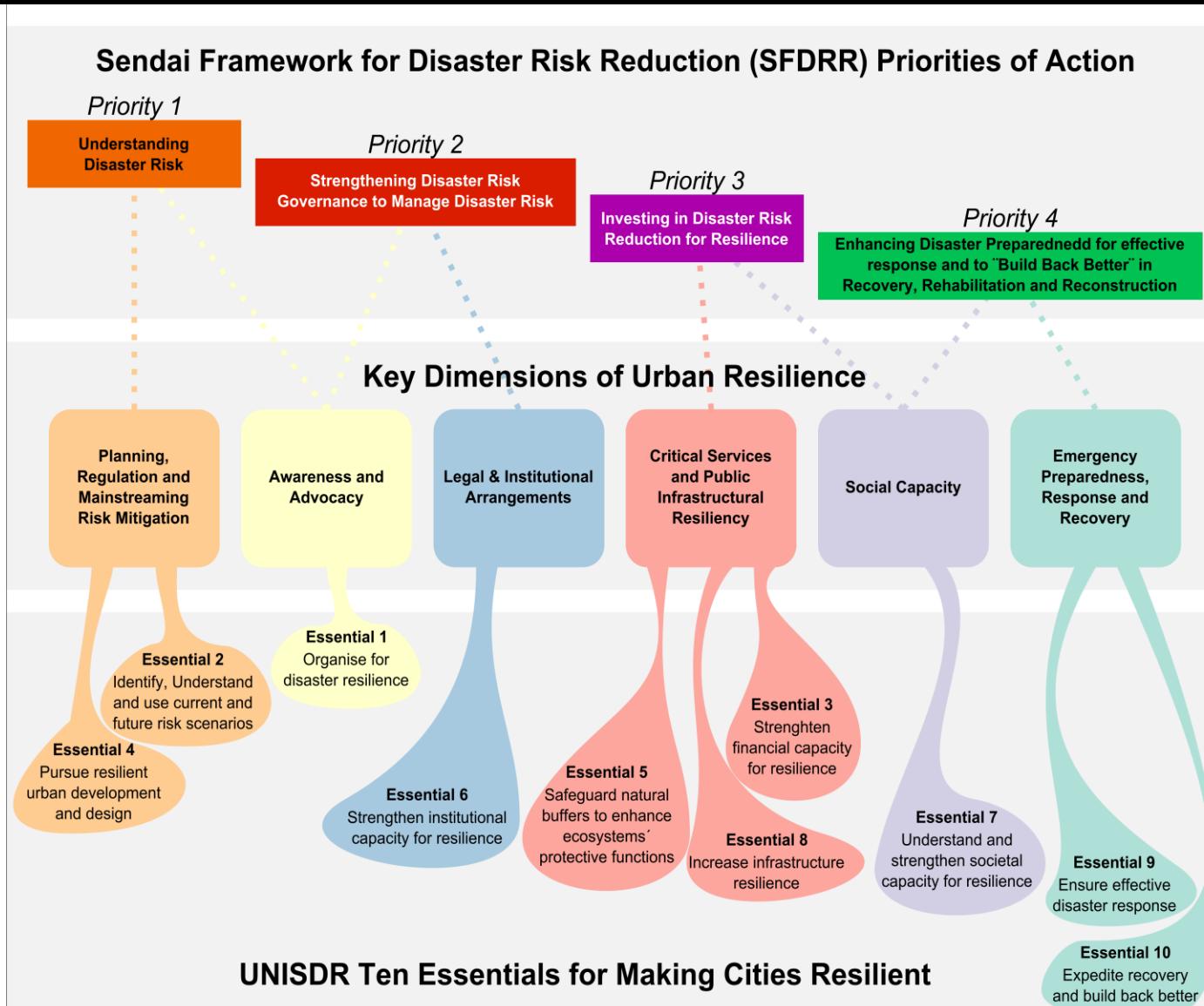
Resilience Performance Scorecard

Qualitative

3 Key Aims of Resilience Performance Scorecard



Dimensions of the Resilience Performance Scorecard



Participatory Development Approach



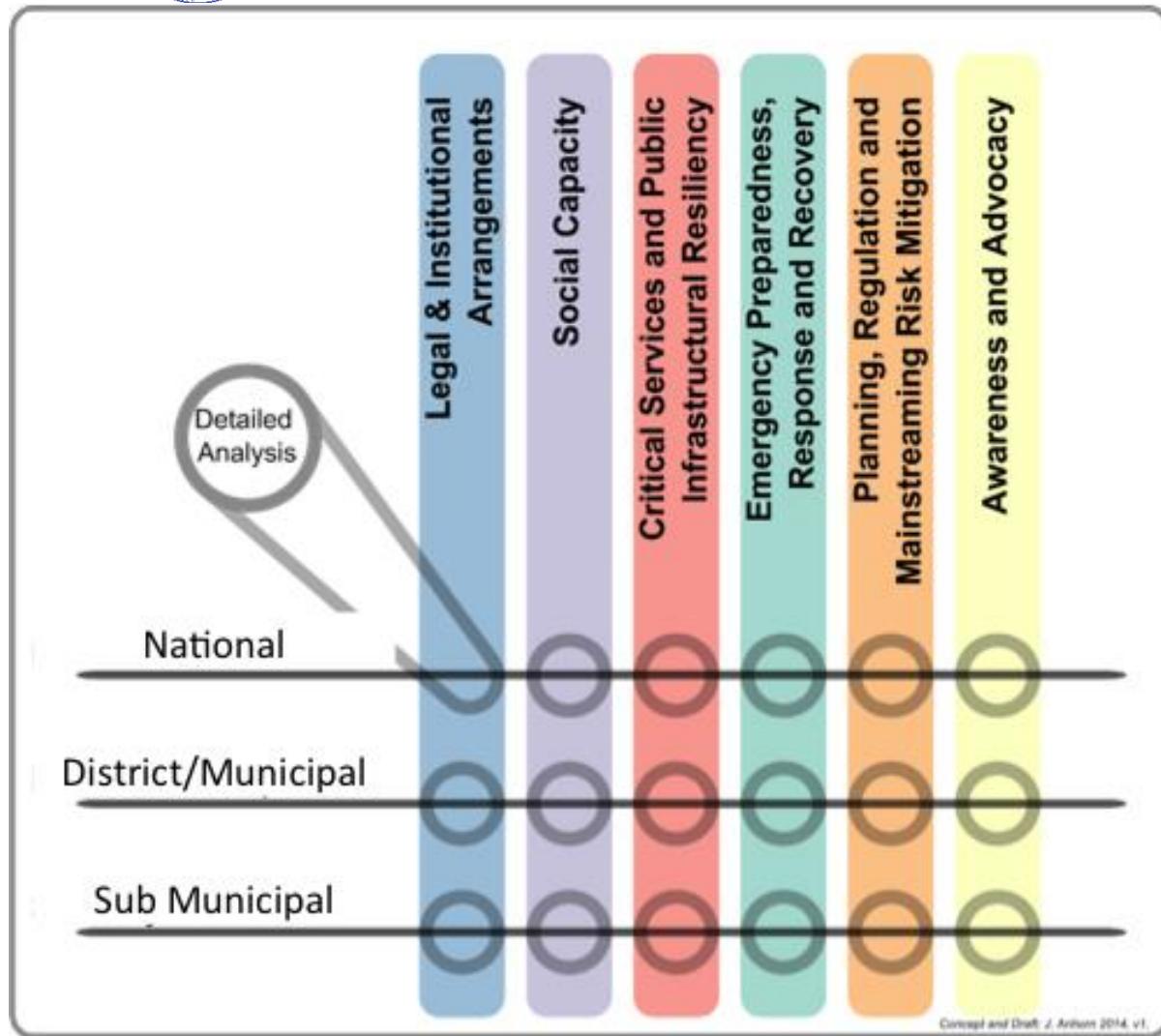
Identify Stakeholders

Analysis

Indicator Development

Benchmark

Assess



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Legal & Institutional Arrangements

Social Capacity

Critical Services and Public Infrastructural Resiliency

Emergency Preparedness, Response and Recovery

Planning, Regulation and Mainstreaming Risk Mitigation

Awareness and Advocacy

Issues / Categories / Indicators

are legal regulations and directives effective
do clearly defined roles and responsibilities exist for DRR
how much confidence exists in governmental and non-governmental institutions
is there coordination and cooperation among relevant groups

how strong are social networks
are special programs to protect cultural heritage in place
do social assistance programs exist
how integrative are social networks
are healthcare services available
are people heard in decision making

are hospitals and schools resilient
are transportation systems resilient
is water and sanitation infrastructure resilient
are electric and gas networks resilient?
are privat dwellings resilient
do business continuity plans exist

do people stockpile emergency supplies
are contingency plans and personnel with clear responsibilities for emergency services available
do you have a local emergency center
are funds for emergency preparedness, response and recovery available

is DRR incorporated into development planning
is reinforcement and retrofitting of private infrastructure carried out
are risk sensitive construction codes and standards in place
are insurances and disaster funds utilized

are people aware of the risk
are trainings and capacity building programs for professionals in place
do public outreach activities exist
what kind of information mechanisms exist

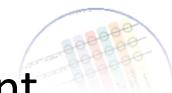
Identify Stakeholders

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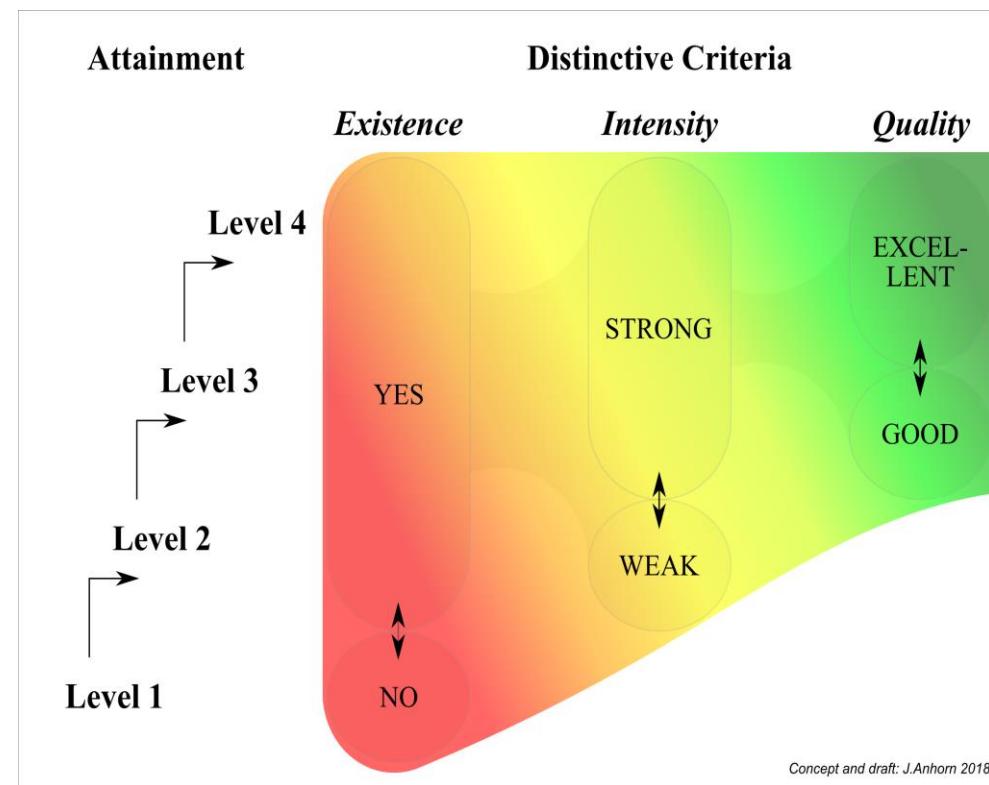
■ Questions are **multiple choice** and measure **level of achievement**

1 = Highest level of Achievement

2 = Engagement and Solution Development

3 = Awareness of Needs

4 = Little or No Awareness



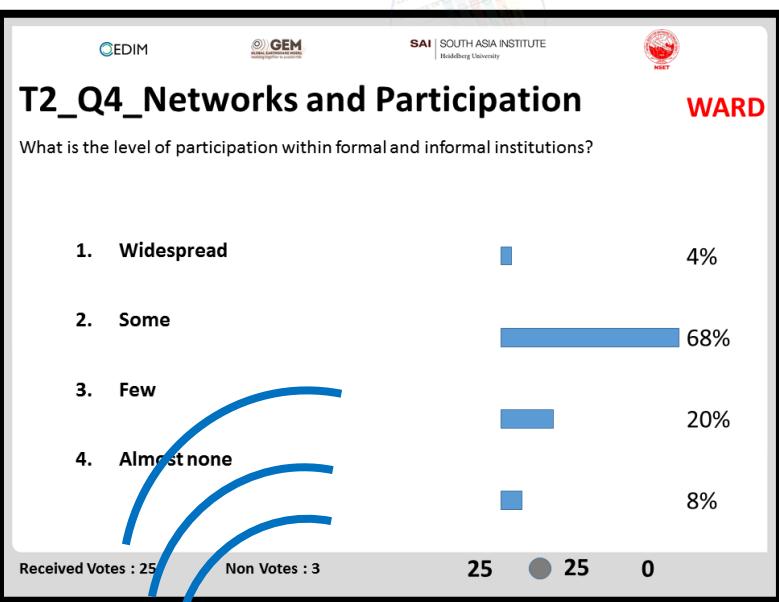
Identify Stakeholders

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Assess



Case Study: Lalitpur, Nepal (2014-2015)

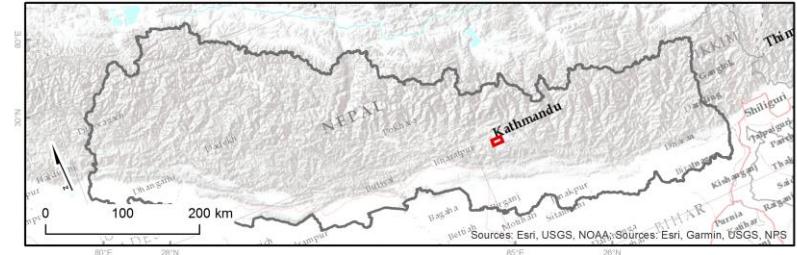
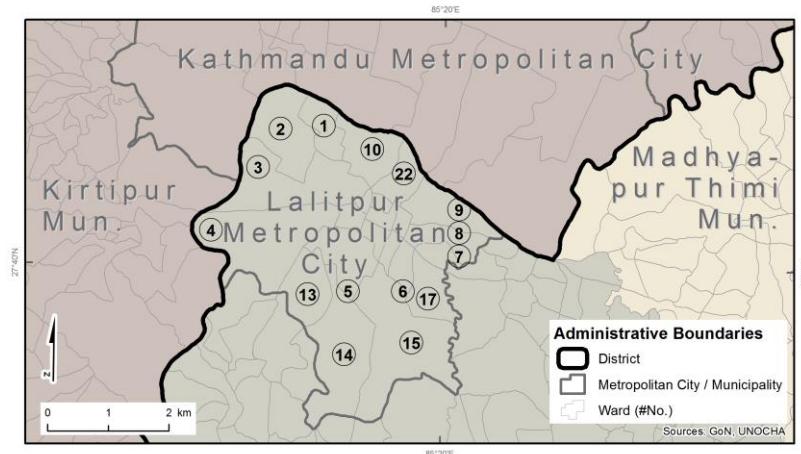


Focus Group

25 Ward representatives

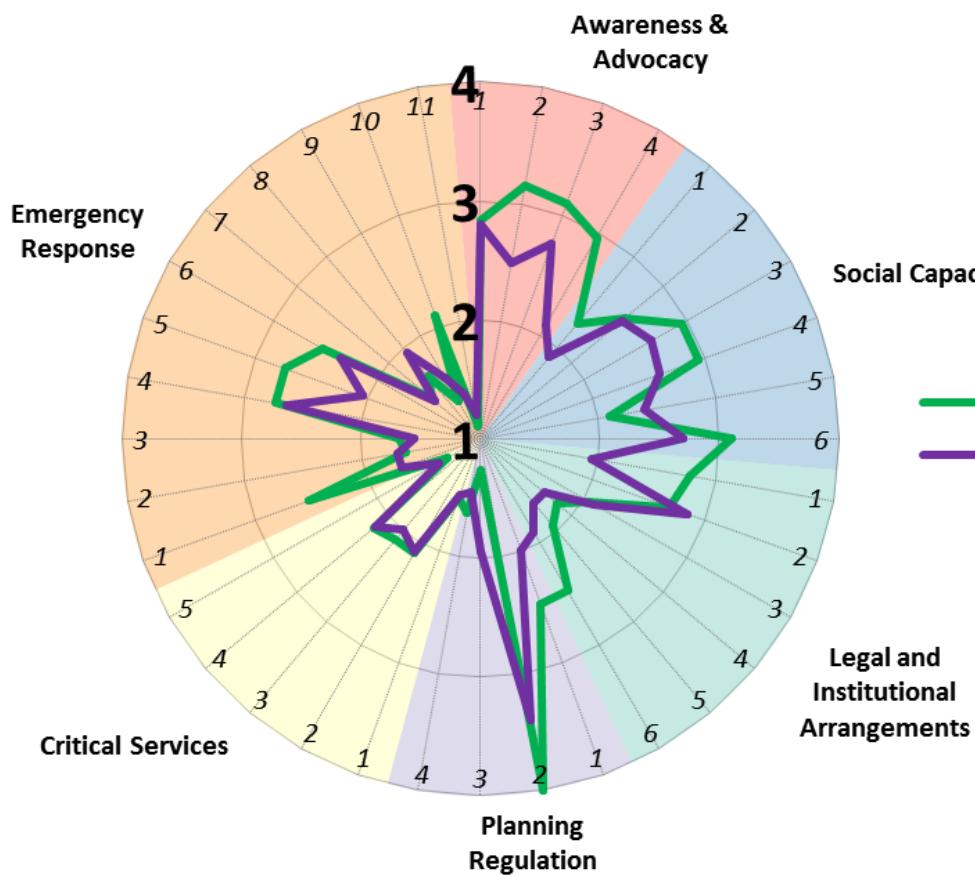
20 Municipal Representatives

Administration, Community Development, Conservation, Accounting, Law, Public Works, Revenue, City Police, Urban Development



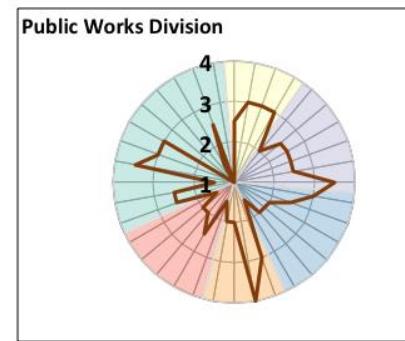
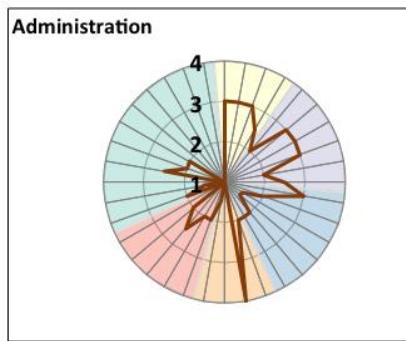
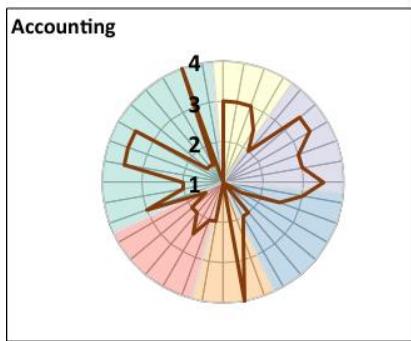
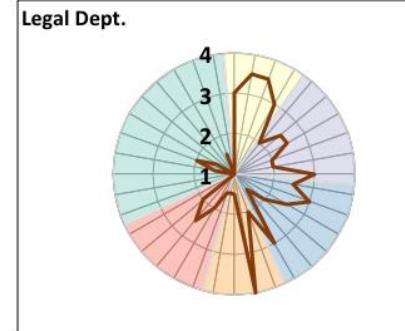
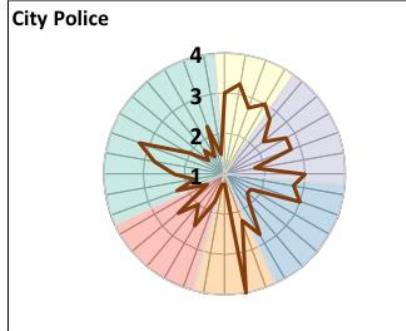
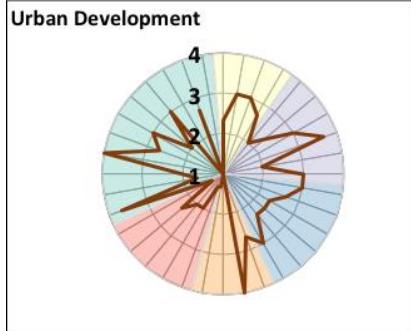
Draft & Cartography: J.Anhorn 2018

Municipal vs. Sub-Municipal Stakeholders

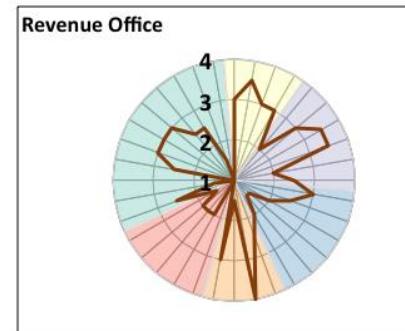
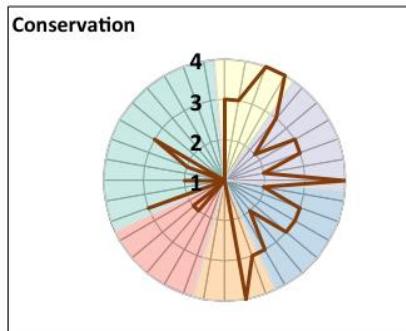
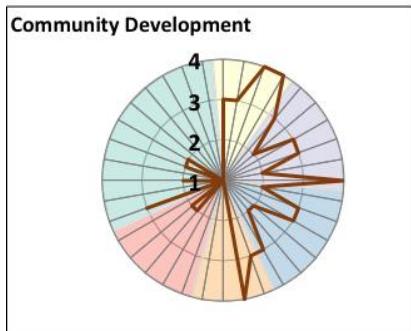


- 4 Highest level of Achievement
- 3 Engagement and Solution Development
- 2 Awareness of Needs
- 1 Little or No Awareness

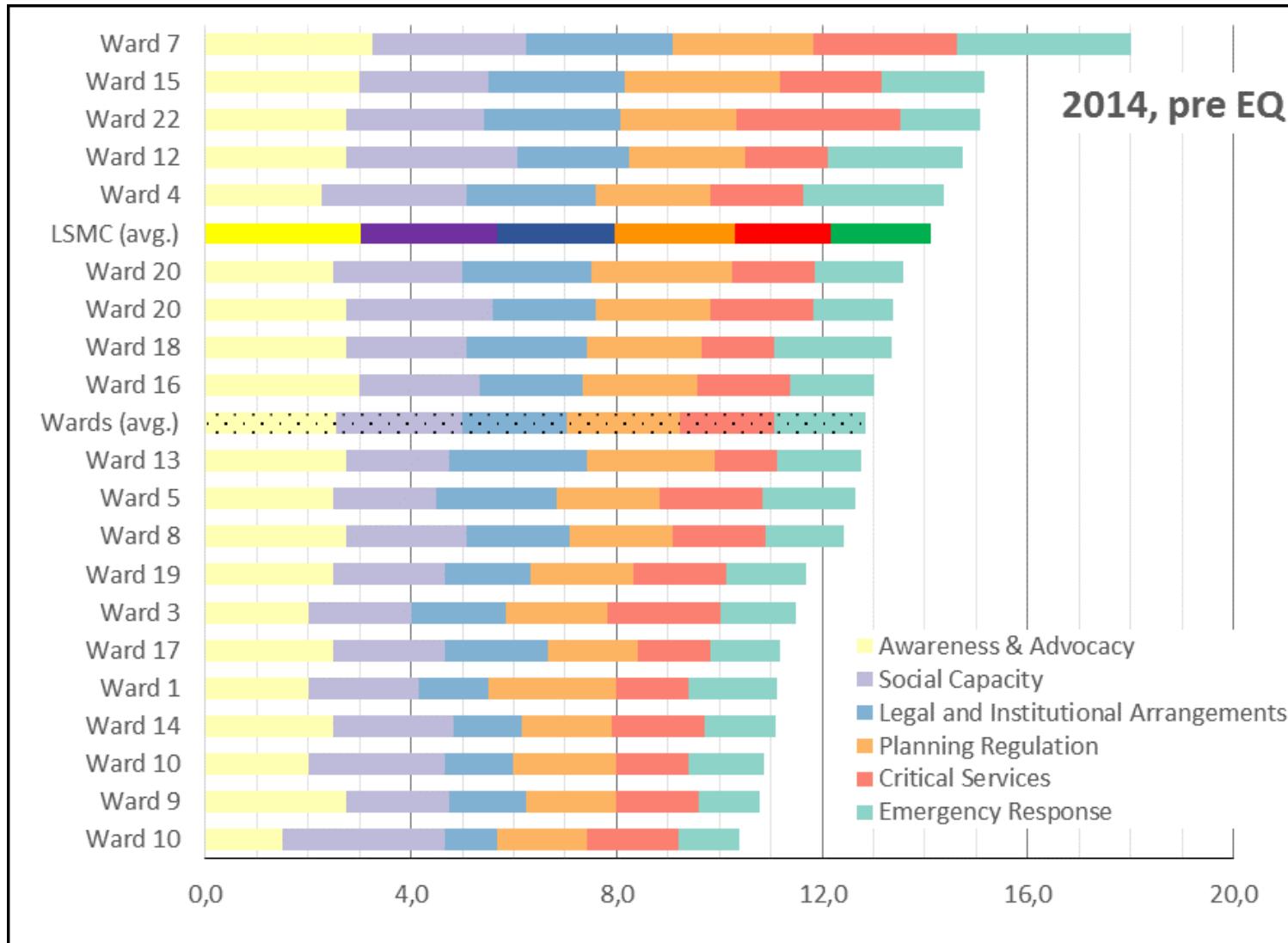
Scoring by Focus Group



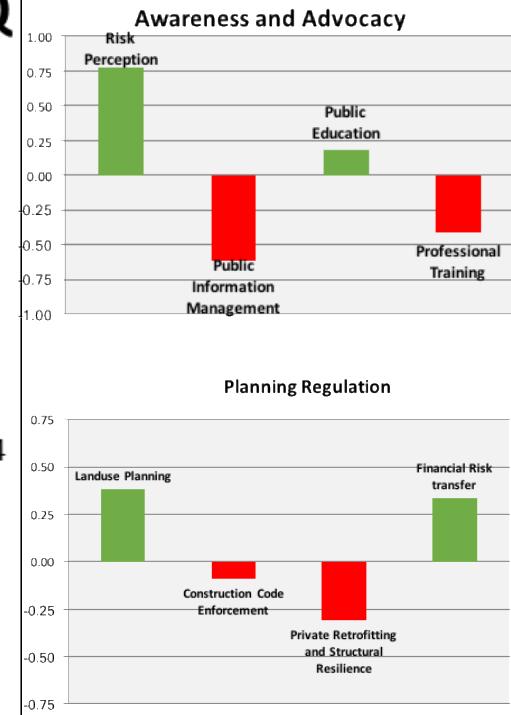
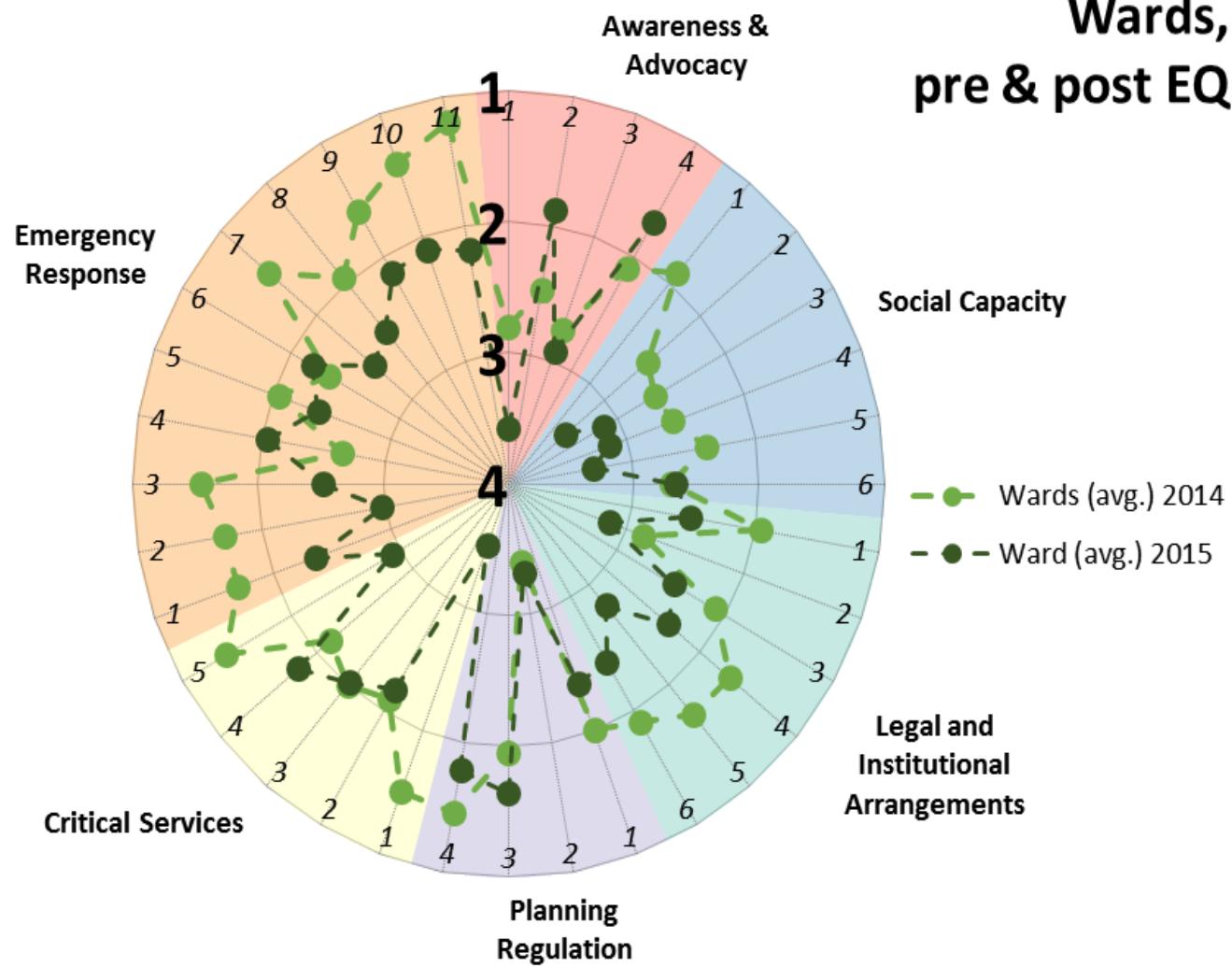
4 Highest level of Achievement
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2014 Scoring by Ward Representatives



Scoring before (2014) and after (2015) the 2015 Ghorka earthquake



Summary

- **Integrated Risk Index (IRI)**

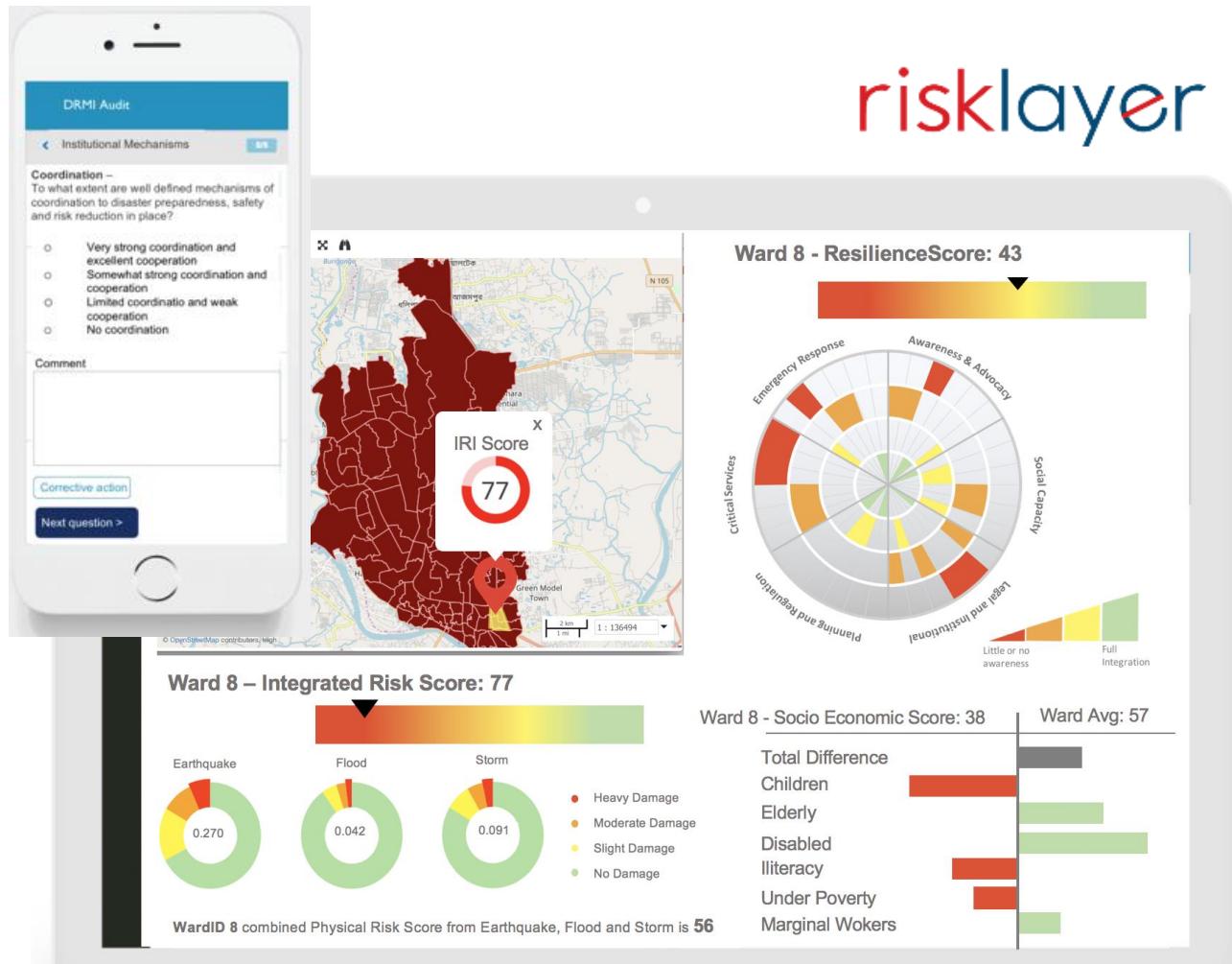
- A risk communication tool with a holistic view of urban disaster risk
- Captures direct physical damages of buildings and infrastructure and considers social vulnerability and lack of resilience that can aggravate the physical effects
- *Quantitative analysis*, requires publically available surveys

- **Resilience Performance Scorecard (RPS)**

- A monitoring and evaluation tool for benchmarking and measuring progress of city's risk management performance
- Captures multiple dimensions of resilience including organizational and operational processes
- *Qualitative analysis*, based on target surveys and a self-assessment process

Urban Disaster Risk and Resilience Performance Web-based Application

- Calculate integrated risk profiles for sub-city districts
- Measure and Compare resilience performance rating
- Track risk and resilience performance over time



Conclusions

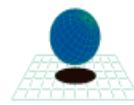
- **Framing indicators in a participatory process** is critical to promoting the institutionalization of indicators.
- **Who defines what is important, relevant; whose knowledge counts?**
- **Participatory processes** ensure relevant indicators and targets are based on local knowledge and context are developed.
- **Leveling off Understanding:** robustness of the methodology, requires supporting evidence and key prior findings along each of the dimensions are produced and shared with the stakeholders.

Acknowledgements

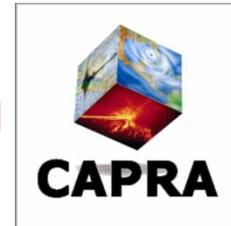


Earthquake and Megacities Initiative

- Fouad Bendimerad
- Jerome Zayas



CIMNE^R



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- Alex Barbat



GEM

- Christopher Burton

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- Johannes Anhorn

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Thank You!

Questions

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