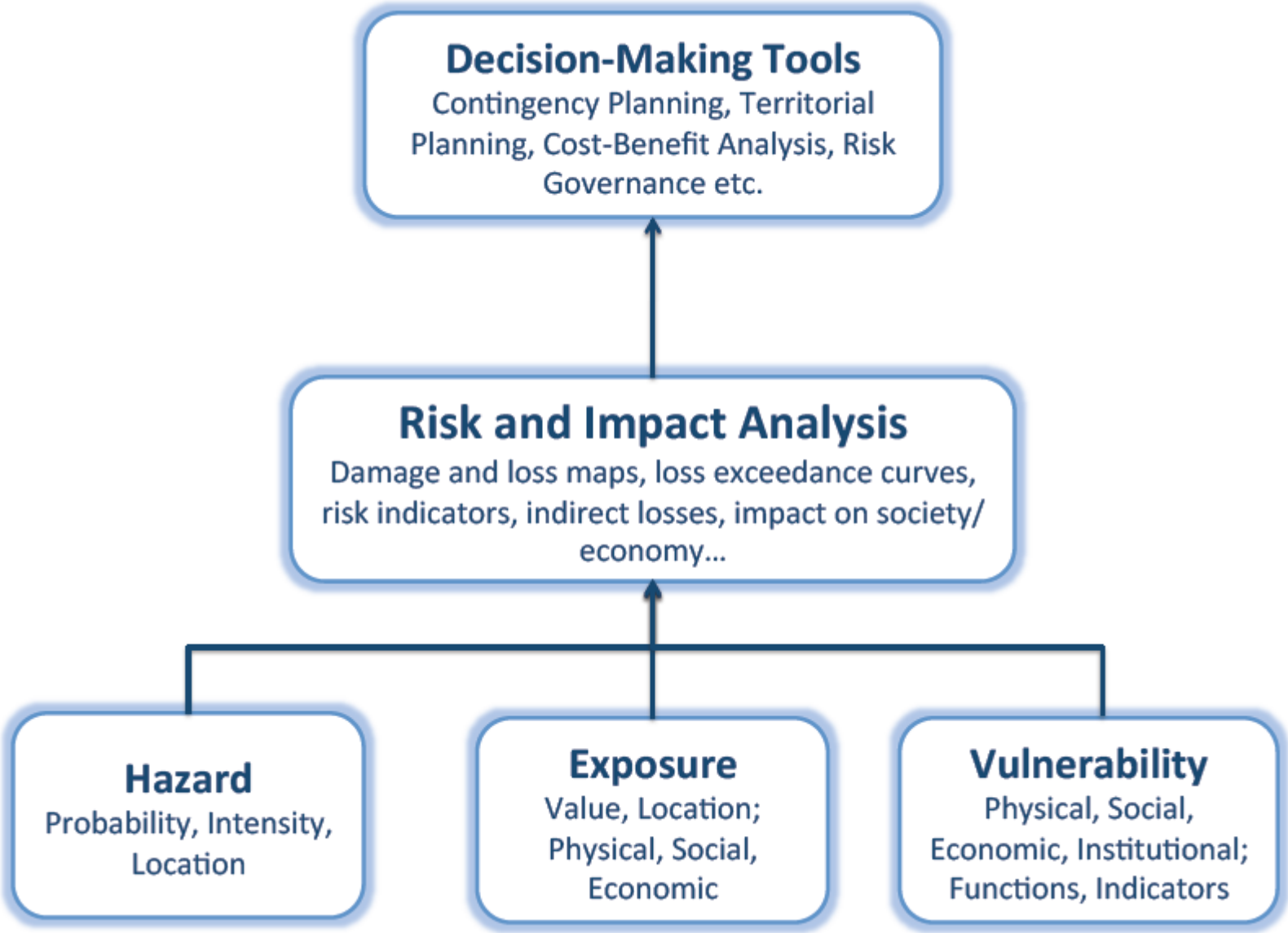
Social Vulnerability and Resilience

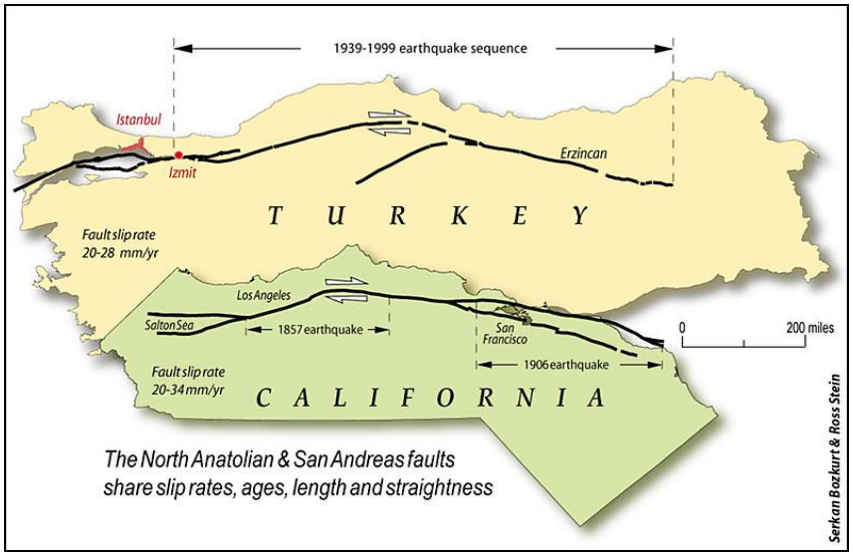
Scope of Work

Christopher G. Burton (GEM Secretariat)

Revised GEM Framework



Same Event Type Different Impacts



earthquake.usgs.gov

eol.jsc.nasa.gov

Societal factors intersect with natural systems and the built environment to redistribute risk before an event and after an event in the distribution of losses.

earthquake.usgs.gov

GEM

Driving Questions:

Impact and Consequences

- What is the magnitude and scale of consequences of earthquake losses beyond physical damage modeled in GEM?
- Where are the risk hotspots? What are the relative differences within a country or between countries?
- What is the variability in the underlying factors that contribute to earthquake risk and losses worldwide?
- What are the global interdependencies, systemic risk?

Decision Making

- Where should we prioritize allocation of limited resources?
- Where should we invest in risk mitigation, hedging and insurance?
- How do we engage stakeholders in the risk integration and reduction process?

Purpose

The development and implementation of methods, metrics, and tools for the integrated evaluation of earthquake risk worldwide

- Development of indices
  - Social vulnerability index and database
  - Disaster resilience index and database
  - Indirect loss index and database
- Interactive tool development
  - Indicator toolkit
  - Integrated risk toolkit
- Social vulnerability knowledge and meta-database integration portal

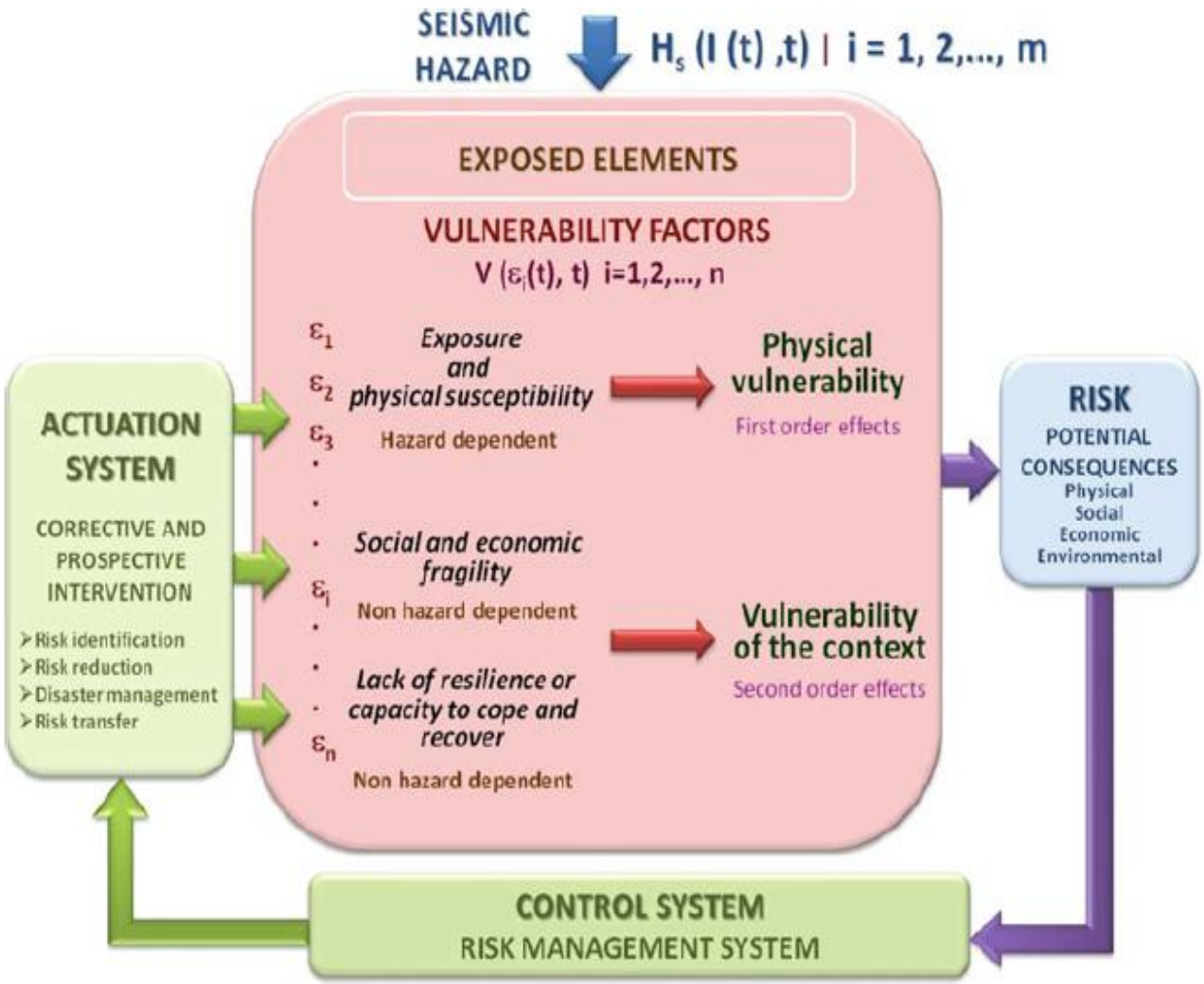
Multiple Benefits of an Integrated Approach

- Allows for a direct comparison of risk and consequences
  - inherent social conditions, awareness, perceptions
- Allows assessing systemic risk, locally, regionally, and globally
  - Local context, regional, global trade, supply chain and Infrastructure, global interdependencies
- Risk factors can be assessed independently
  - Increases awareness of the range of components upon which earthquake disaster risk depends
- Benchmarking and focused risk monitoring
  - Monitoring development of main risk factors over time

Development of Indices

- Social Vulnerability
  - Social Vulnerability Index (SoVI), ISDR/GAR (2009, 2011), Urban Seismic Risk (CIMNE), Prevalent Vulnerability Index (PVI)
- Disaster Resilience
  - Social, Economic, Institutional, Infrastructure, Community capital
- Economic Vulnerability (Indirect Loss)
  - Capital dependency, labor dependency, supply chain dependency, infrastructure dependency, production loss, loss of public services, tourism receipt losses, regional and global interdependencies
  - Disaster Deficit Index (DDI)

Urban Seismic Risk from a Holistic Perspective



Moncho's Equation:

$$R_I = R_F(1+F)$$

F : Depends on the weighted sum of a set of aggravating factors related to economic fragility and lack of resilience

$$\sum_{i=1}^{m} w_{FSi} F_{FSi} + \sum_{j=1}^{m} w_{FRj} F_{FRj}$$

Carreño, M-L, Cardona, O.D. and Barbat, A.H. (2012). "New methodology for urban seismic risk assessment from a holistic perspective". *Bulletin of Earthquake Engineering*. 40: 137-172.

Integrated Risk Toolkit

Exposure Data

Analytical Area – National Level with deterministic or probabilistic earthquake

Selected Hazard

GEM Risk Module
Loss Estimates (Buildings, Deaths, Injuries, etc.)

R_P

Index of impact or indirect factors aggravating the impact of the direct losses

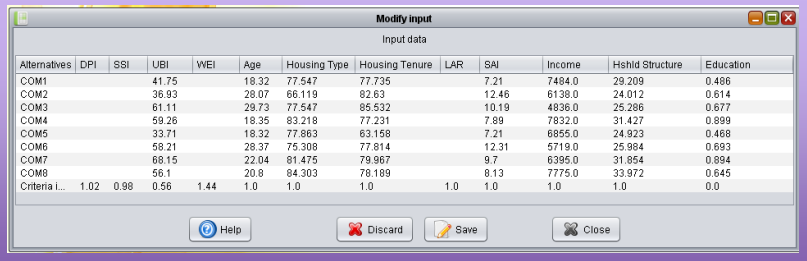
$\sum SVI, RI, EVI$

F

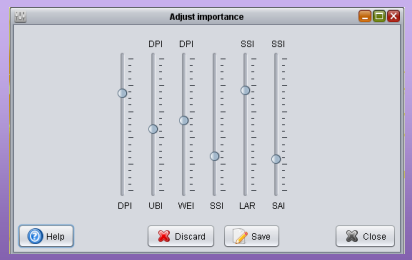
INTEGRATED RISK INDEX

$R_T = R_P (1 + F)$

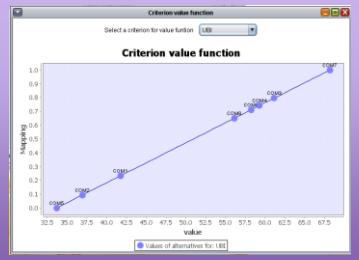
Indicator Toolbox



Socio Economic Indicator Databases (LEVEL 1, 2, 3)



Visual Weight Definition



User Defined Settings

Indicator Toolbox and Database

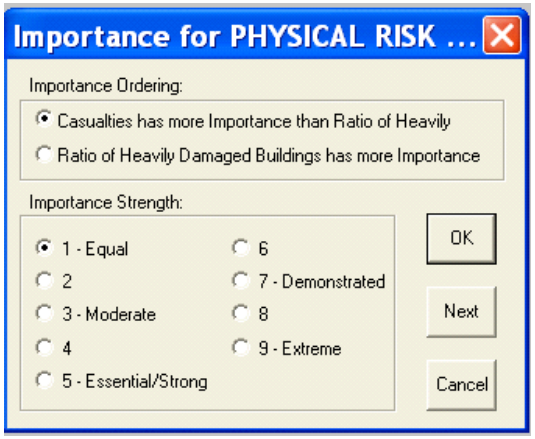
Open source indicator tool box and database

Software tool guides user through:

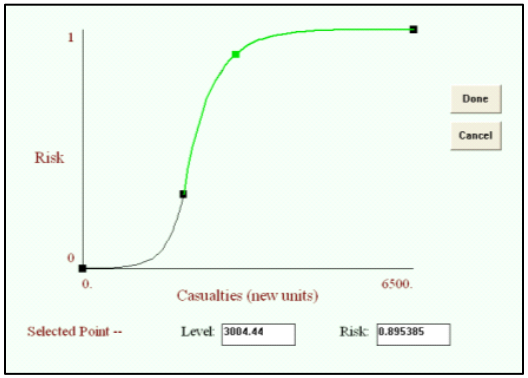
- Methodological approach for structuring composite indicators and obtaining *integrated risk rankings*
- Assigning importance weights to indicators
- Interactively changing weights and evaluating effect on rankings (Dynamic Sensitivity Analysis)
- Various output and interactive visualization tools

Database includes all variables used in constructing composite indices

Dynamic sensitivity and uncertainty analysis



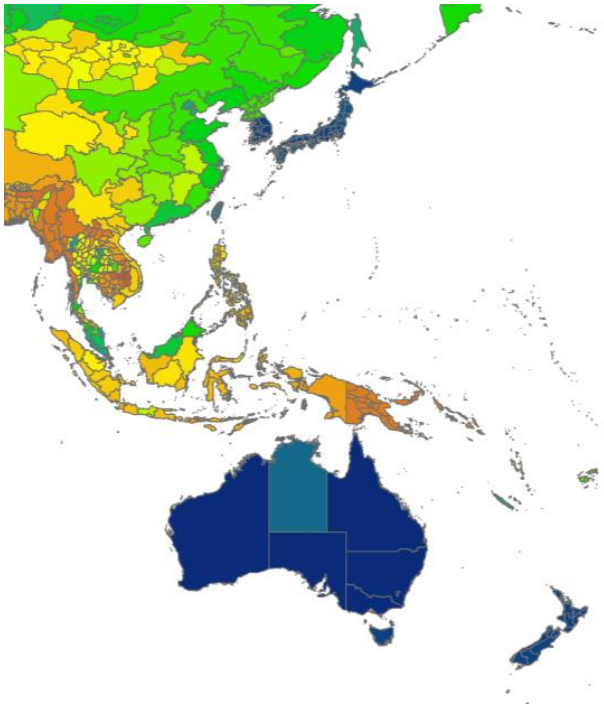
Interactive visualization tools and functions



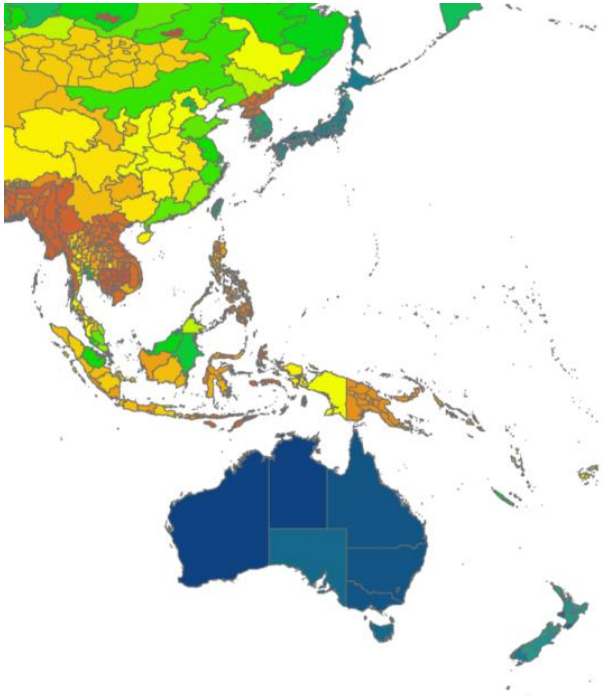
Extending GEM Social Vulnerability Indicators Initiative Beyond First Year

- Downscale to sub-country and sub-regional levels of analysis where possible
- Database development for Japan and Philippines (Municipalities and Barangays)
- **Reality Check**: Validation of indicator structure in developing country and developed country; data-rich vs. data-scarce context
- Also informed by existing case studies (e.g. CIMNE: Barcelona, Bogota)

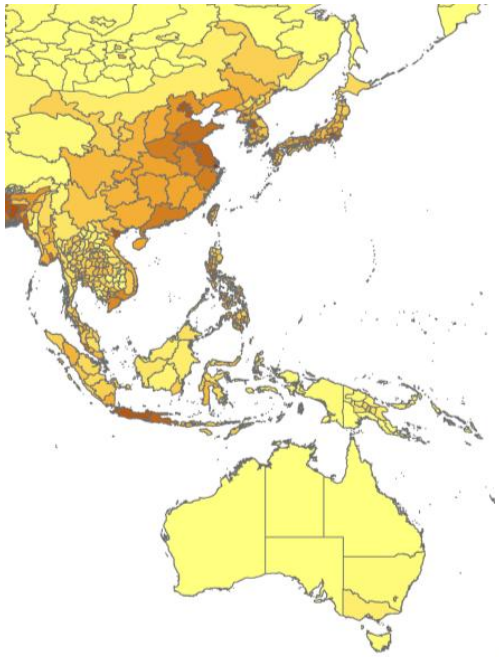
HDI



GDP Nominal (international $/Capita)



Population Density



Vulnerability and Resilience Groups towards a Network

- Hazards and Vulnerability Research Institute (University of South Carolina)
- Community & Regional Resilience Institute (Oak Ridge National Laboratory)
- Centre Internacional de Mètodes Numèrics en Enginyeria (Technical University of Catalonia) (CIMNE)
- Universidad Nacional de Colombia, Manizales, Colombia
- UN/ISDR (Global Assessment Report Initiative)
- IRDR (Integrated Research on Disaster Risk)
- WRN (Willis Research Network), Willis
- Center for Disaster Management and Risk Reduction Technology (Karlsruhe Institute of Technology)

IRDR Integrated Research on Disaster Risk

CEDIM

Willis Research Network

UNIVERSIDAD NACIONAL DE COLOMBIA

HVRI

UPC UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Community & Regional RESILIENCE Institute

UNISDR

GEM

Data Discovery, Meta-database, and Information Sharing Platform

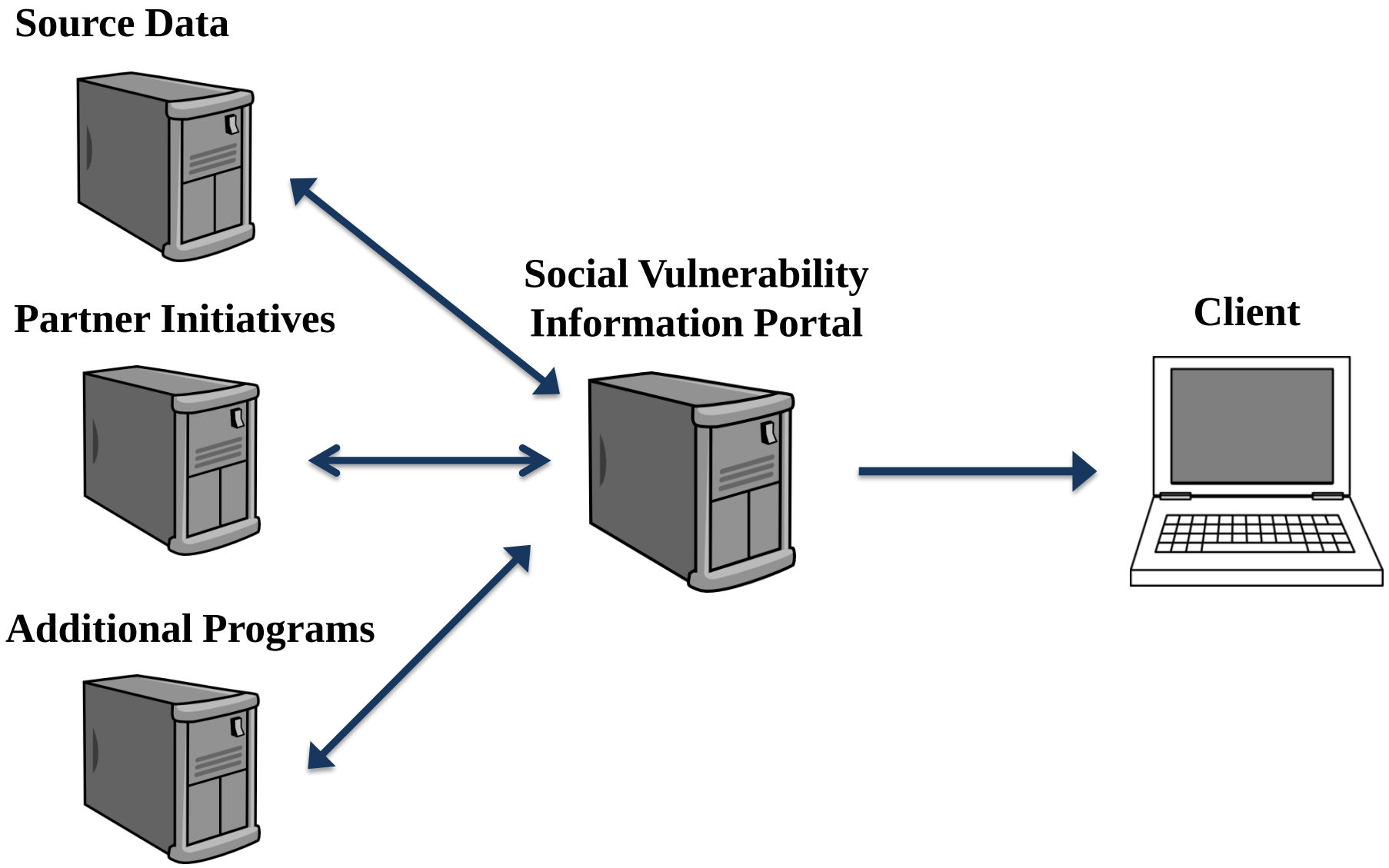
Objective:

- Development of a portal and information system with meta-database focusing on population-based natural hazards vulnerability assessment.
- To build on GEM's capacities to develop a common platform of information pertaining to social vulnerability assessment.

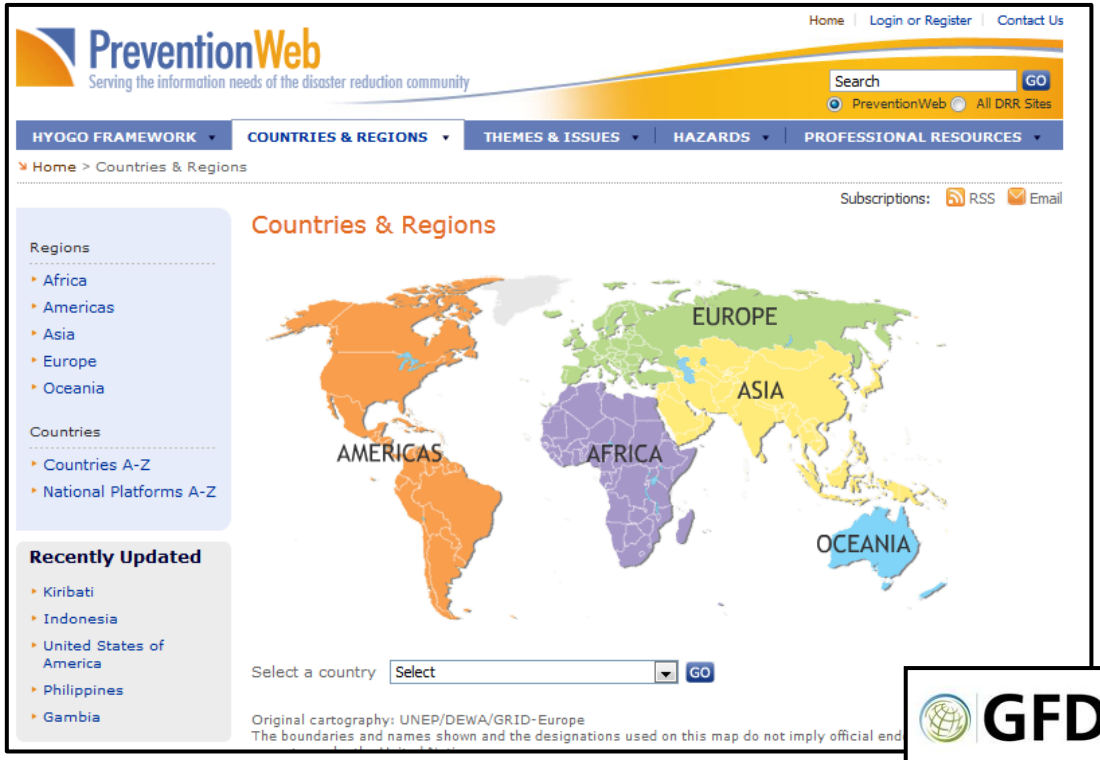
Rationale:

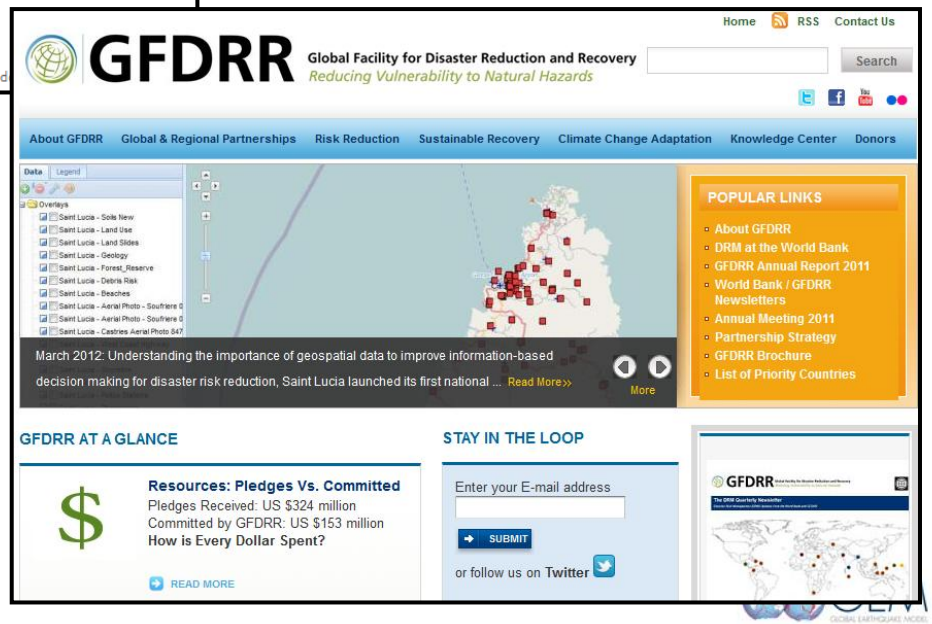
- Access to relevant data on vulnerability supports DRR.
- Data is difficult to collect globally.
- Support of bottom-up vulnerability assessments.
- Complements OpenQuake framework

GEM Social Vulnerability and Resilience Data Discovery and Sharing Program



Database Design





Potential GEM Contribution

- International Strategy for Disaster Reduction (ISDR) (United Nations)
- Integrated Research on Disaster Risk (IRDR) (ICSU)
- Global Facility for Disaster Reduction and Recovery (GFDRR) (World Bank)
- Global Network for Disaster Reduction (GNDR)
- Others (UNEP, UNESCO, ????)

IRDR
Integrated Research on Disaster Risk

ISDR

GFDRR

Global Network
of Civil Society Organisations
for Disaster Reduction

Potential Contributors

- Hazards and Vulnerability Research Institute (HVRI) (South Carolina)
- Center for Disaster Management and Risk Reduction Technology (CEDIM) (Karlsruhe)
- Willis Research Network (WRN) (London)
- International Center for Numerical Methods in Engineering (CIMNE) (Barcelona)
- Others ????

CEDIM

Willis Research Network

CIMNE

HVRI

GEM

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