ENSURE

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Scientific partners and roles in ENSURE

BRGM	➔ Coordination, multi-risks (seismic), Physical & systemic aspects
Harokopio University of Athens	➔ Systemic, territorial, forest fires
International Institute for Geo-Information Science and Earth Observation	➔ Drought, Socio-economic aspects
Middlesex University Higher Education Corporation	➔ Floods , Socio-economic aspects
Politecnico di Milano **Scira Menoni**	➔ Scientific coord., Urban, multi-risks
Potsdam Insitut fuer Klimafolgenforschung	➔ Climate change, forest fires
T6 Ecosystems srl	➔ Multi-risks (landslides), CH
Tel Aviv University	➔ Drought, data mining
Università degli Studi di Napoli Federico II	➔ Urban, Na-tech
Université de Genève **Adriana Galderisi**	➔ Volcanoes

Main objectives

- Analyze the relationship between the concept of vulnerability and other concepts such as “risk”, “damage”, “exposure”, “**resilience**” and “**adaptation**”;
- Develop a methodological framework to integrate and connect different types of vulnerability (i.e. physical, economic, cultural, social and systemic), at different spatial scales aiming at:
  - **bridge the gap between quantitative and qualitative approaches**
  - **be tested in 3 specific case studies: Vulcano Island (multi-risks), Ilia Prefecture in Peloponese (seismic + wild fires) and Neguev desert (drought).**
- Investigate the temporal and spatial variability of the relations between different types of vulnerability and different types of damage;

Vulnerability conceptualization

- Vulnerability has many different connotations, depending on the research orientation and perspective (Cutter, 1996)
- The term is used to mean different things by different authors (Adger, 1999).
- Weichselgartner (2001) - 23 different definitions; Cutter (1996) citing 18 definitions. Thywissen (2006) presents an comprehensive review of the “Babel-like confusion” with 37 different definitions
- The vulnerability is seen differently by Climate Change and Natural Risks communities

a “shift in thinking”

The increasing complexity of modern disasters asks for a **shift in thinking** in the field of risk analysis and management, which implies:

- A **less sectoral approach to hazard analysis** and a larger attention to the development over time and in space of a given hazard and of the likely **chains of natural and technological events**.
- A **different approach to vulnerability analysis**, focused not only on the different vulnerabilities to each hazard of exposed systems and/or their elements but, also, on the relationships among different targets which may induce new hazards and/or vulnerabilities.
- A better **understanding of the resilience concept**

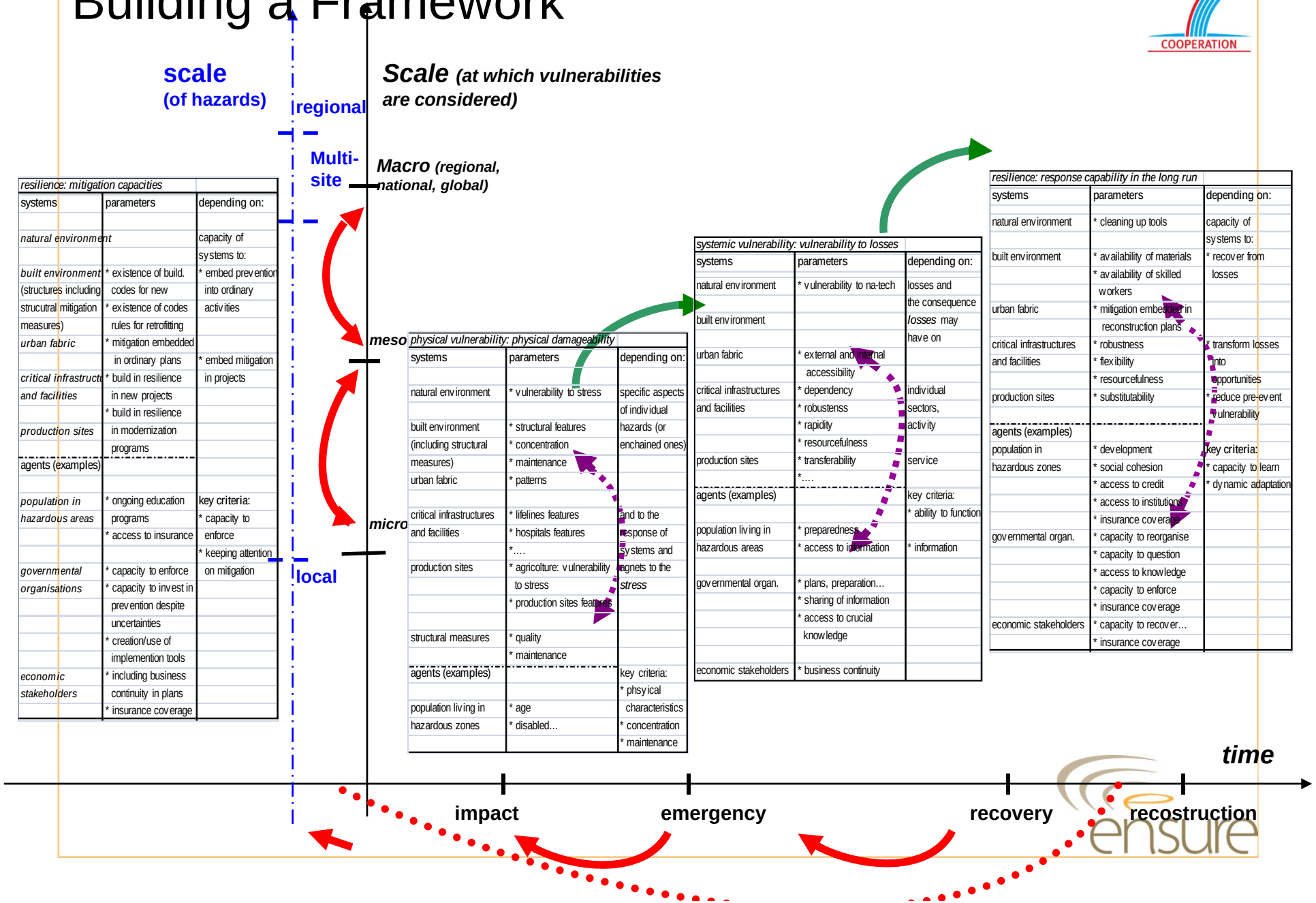
Dealing with complex Disasters

- Having **uncertainty** as one of its main premises, Resilience might allow a shift from policies addressed to "control change" toward policies addressed to cope with, to adapt to change;

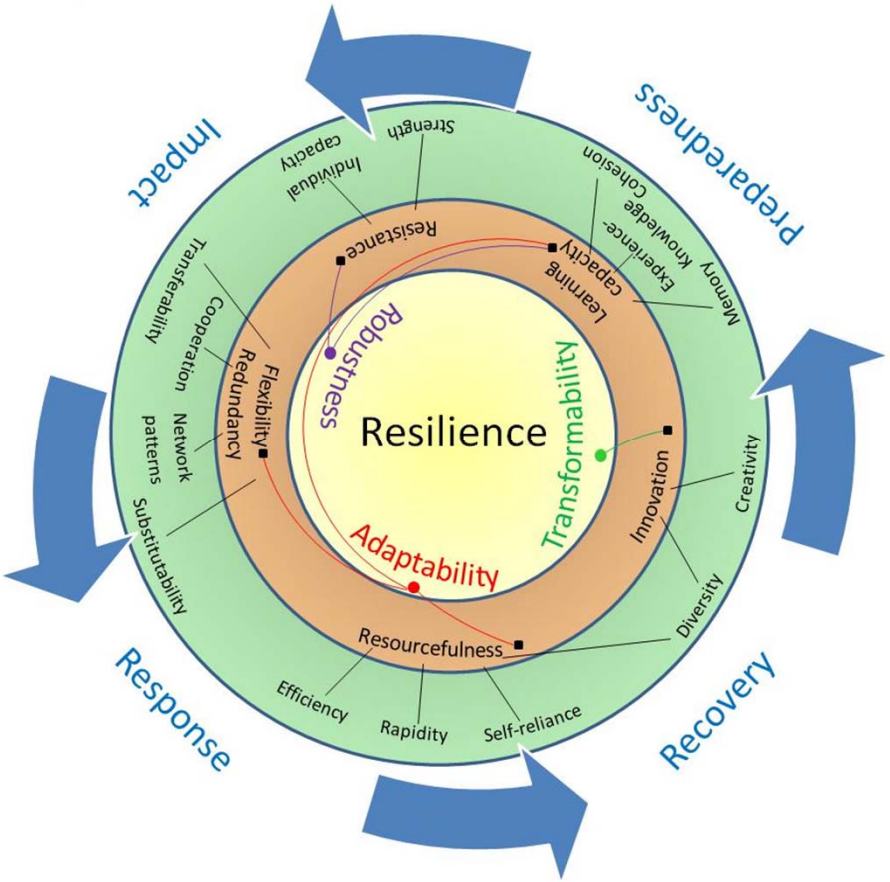
- Embodying the concept of **adaptive** and **learning capacity**, typical of complex systems, Resilience may promote proactive responses to disasters;

- Focusing on the arising of new configurations of a system after a disturbance, as a result of the **self-organization capacity,** Resilience takes into account the opportunity for change and transformation after a hazardous event.

Building a Framework

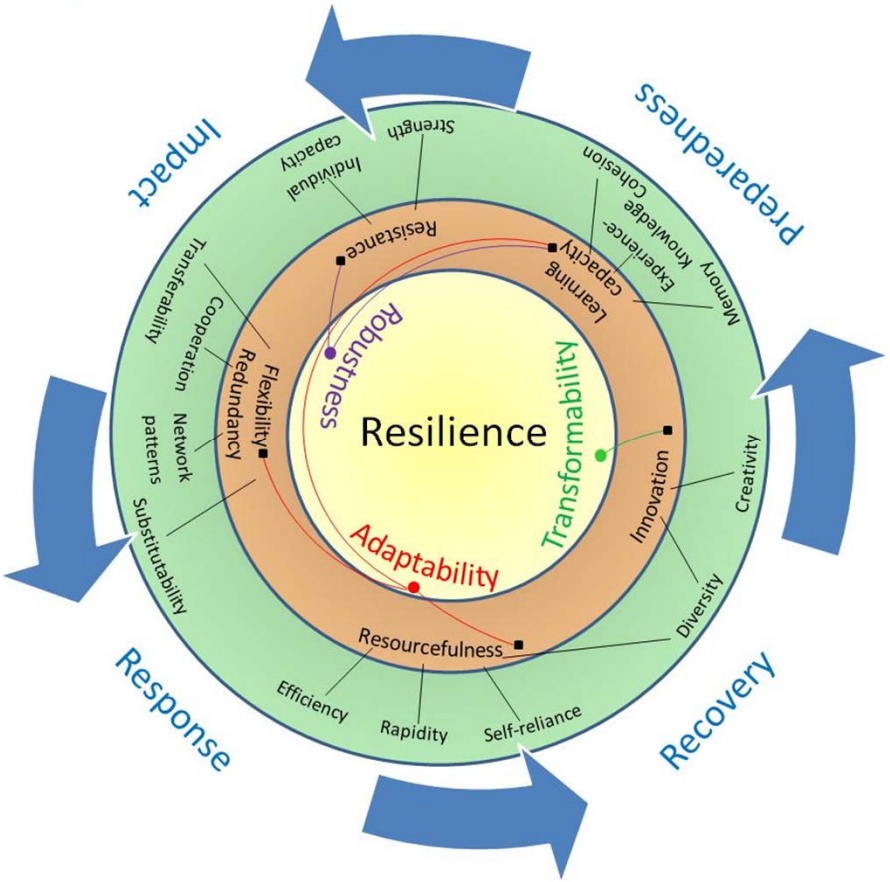


The ring model of Resilience



- The distribution of capacities into the three rings (inner, intermediate and outer ring) follows a hierarchical structure, largely applied in planning, linking goals, objectives and actions.
- The inner ring includes robustness, adaptability and transformability, recognized as the key aspects of resilience. They represent three distinct sides of resilience, gaining relevance in different stages of the disaster cycle, and also the main goals to be pursued for making a system resilient in relation to a wide variety of external stresses.

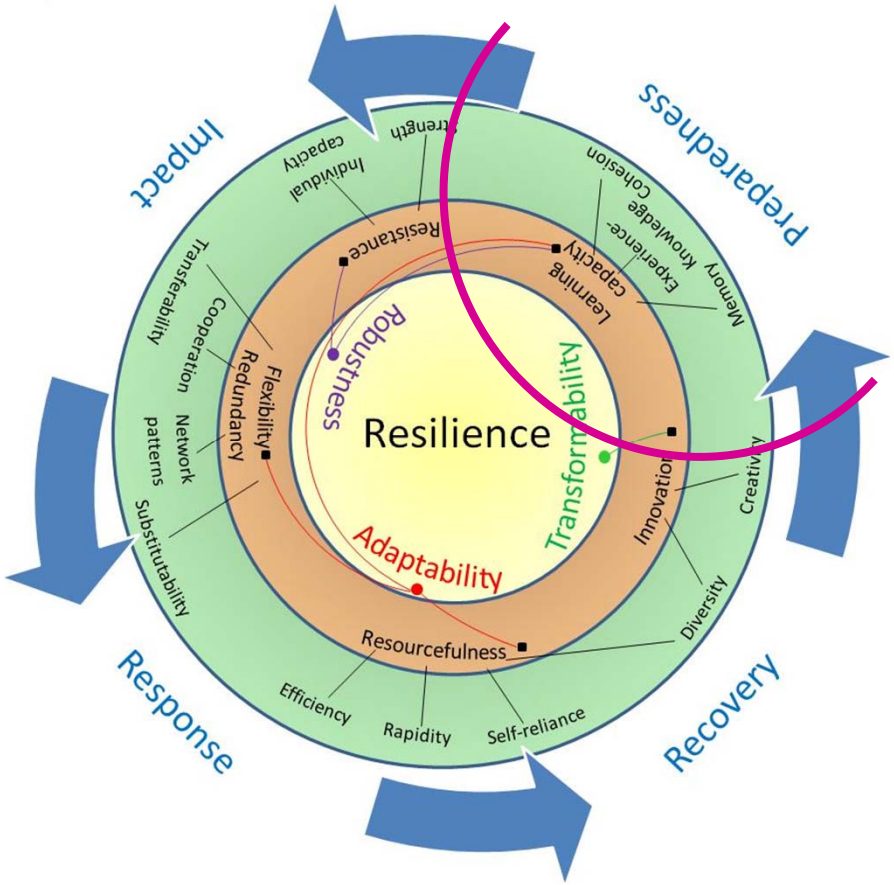
The ring model of Resilience



> The intermediate ring includes the capacities which have to be preserved and strengthen in order to enhance the three main components of resilience; for example, the learning capacity which plays an important role in the phase of preparedness and largely influences both robustness and adaptability.

> The outer ring includes those capacities on which acting through specific policies in order to positively contribute to enhance resilience.

From the conceptual model to the integrated framework

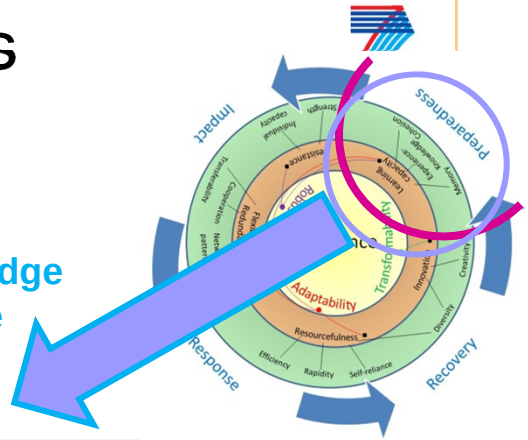


> In detail, the capacities coming on stage in the pre-disaster phase (PREPAREDNESS) have been taken into account in a first set of matrices. These capacities refer to the potential of a system to built up an effective knowledge base, grounding on experience, on memory of past events, which is crucial for an effective learning process and, consequently, for developing effective anticipation strategies. These capacities are generally neglected in traditional vulnerability analysis although relevant to increase both robustness and adaptability.

Criteria for developing operational tools (preparedness)

System	Aspect	Key topic	Parameters	Criteria for assessment
Natural environment	*Natural Hazards Knowledge*	Is seismic hazards known and mapped?	Seismic Hazard map availability	binary scale based on data collection
			Scale of hazad maps adequate to support prevention and mitigation measures	qualitative scale based on expert judgement
			Map for potentially fault rupturing at the ground surface	binary scale based on collection
			Site amplification map	binary scale based on collection
		Are hazards monitored?	availability of seismographs and accelerometers networks	binary scale based on collection
			Density of monitoring system	qualitative scale base collection
		Are induced/triggered hazards known and controlled?	Availability of maps of landslides and estimation of their potential movement consequent to earthquakes	binary scale based on collection
			Map of potential liquefaction zones	binary scale based on collection
				quantitative scale bas collection
			Map of tsunami hazard	binary scale based on

Area of knowledge and experience



System	Aspect	Key topic	Parameters	Criteria for assessment
Built environment	*Knowledge of exposure and vulnerability of built environment*	Is exposure and vulnerability considered and acted upon in plans?	Risk maps and scenarios, including enchained events	binary scale based on data collection
			Vulnerability assessment of exposed built stock	binary scale based on data collection
			Frequency of update	qualitative scale based on data collection
			Vulnerability and exposure assessment considered in ordinary plans (e.g. land use plans)	binary scale based on data collection
	Rules and tools for risk mitigation	Do rules for mitigation exist? What is their expected efficacy/quality?	Building codes/rules availability	binary scale based on data collection
			Quality and update of building codes	qualitative scale based on expert judgement
			Traditional building practice based on hazard knowledge	binary scale based on expert judgment
				Expert judgement about the capacity to conform to the "code of practice"
			Maintenance level of built stock	qualitative scale based on data collection and expert judgement
			Specific provisons for retrofitting	binary scale based on data collection
			Indirect incentives for retrofitting	binary scale based on data collection
			Land use plans embedding risk mitigation measures	binary scale based on data collection

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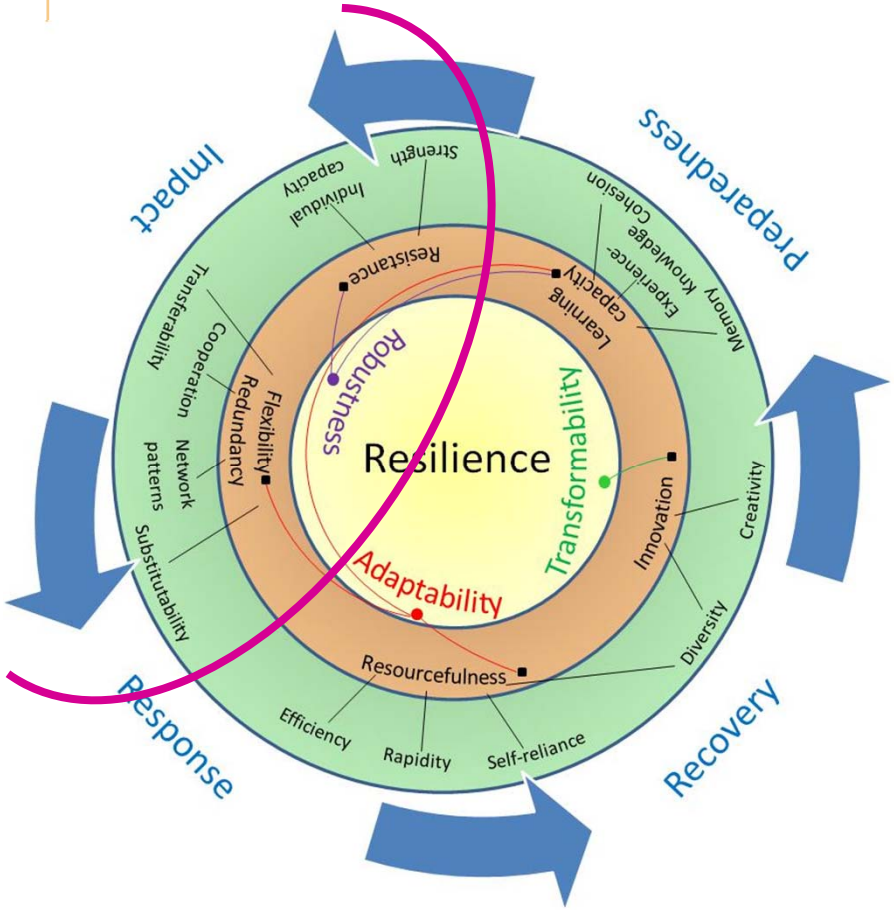
From the conceptual model to the integrated framework



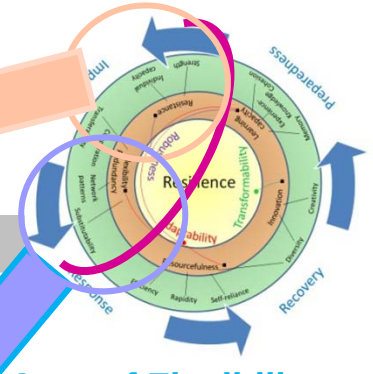
> Other capacities, coming on stage in the IMPACT and response phases, refer to the potential of a system to withstand the impact of a hazardous event, in terms both of preventing or mitigating damage (robustness) and of reducing losses through an effective management of the emergency phase (coping capacity which is part of the wider concept of adaptation).

> Therefore, they have been largely considered in the matrices specifically focused on physical and systemic vulnerability of the different exposed systems.

Criteria for developing operational tools (Impact)

Area of Resistance

System	Aspect	Key topic	Parameters	Criteria for assessment
Built environment	*Exposure and vulnerability of built environment*	What are the factors that make buildings, the urban fabric and public facilities vulnerable to the stress?	Vulnerability assessment of residential buildings	hazard specific (though generally considering material, age of construction, structural features, maintenance conditions
			Vulnerability assessment of public facilities	hazard specific, considering also content (machinery, documents, etc.)
			Vulnerability of the urban fabric	hazard specific (though generally considering building density, height o

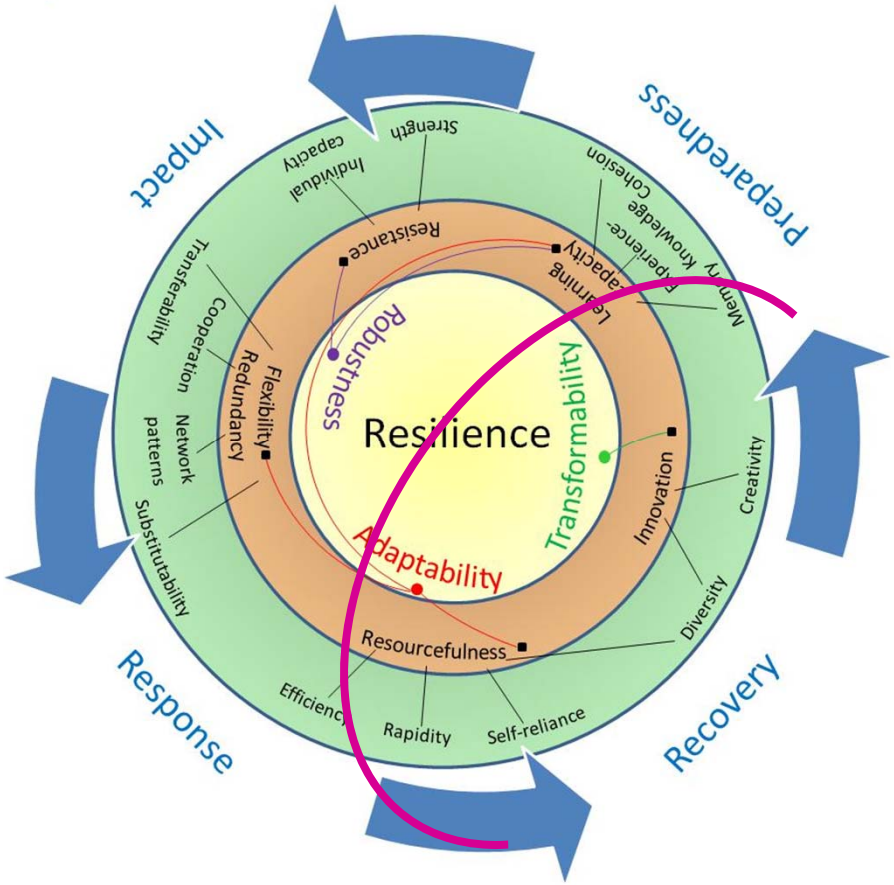


Area of Flexibility and Redundancy

System	Aspect	Key topic	Parameters	Criteria for assessmer
Built environment	*Exposure and vulnerability of built environment*	What are the factors that make buildings, the urban fabric and public facilities vulnerable to losses?	Existance of public facilities and resources to face the emergency	yes/no; a scoring system can be developed depending on a hierachical assessment of resources relevance for emergency management
			Accessibility to vulnerable areas	redundancy; quality of roads; usability; expected travel time
			Accessibility to public facilities	existance in the area, redundancy; quality of roads; usability; expected travel time

Infrastructure and production sites			
Critical infrastructures	What are the factors that make critical infrastructures stop functioning?	Existance of lifelines	yes/no
		Degree of interdependance among lifelines	redundancy; emergency devices; autonomous capacity
		Continuity plan for lifelines, individually and in a coordinated fashion	yes/no; considers all potential threats/does not
		Degree of dependance of critical public facilities from lifelines	redundancy; emergency devices; autonomous capacity
Production sites	What are the factors that may lead to halting production?	Degree of dependance of production sites from lifelines	redundancy; emergency devices; autonomous capacity
		Accessibility to the plant and to markets	redundancy; quality of roads; usability; expected increase in travel time
		Contingency plan for na-tech	yes/no; considers all potential threats/does not
		Business continuity plan	Yes/no

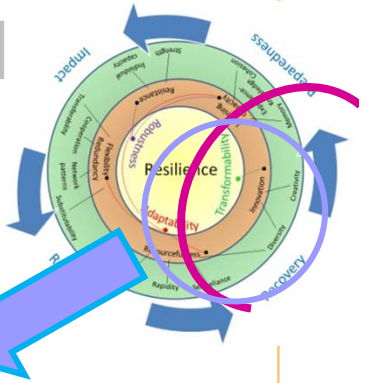
From the conceptual model to the integrated framework



> The third set of capacities, coming on stage in the RECOVERY phase, has been taken into account in a last set of matrices, focused on the features of systems and/or their elements, which make them more or less capable of rebuilding themselves after a calamitous event and of improving their capacity to withstand or cope with future ones (Vale and Campanella, 2005).

Criteria for developing operational tools (Recovery)

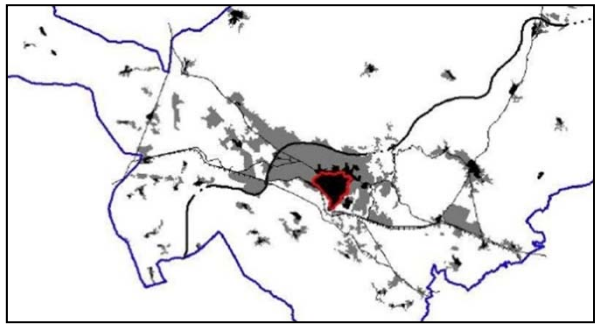
System	Aspect	Key topic	Parameters	Criteria for assessment	
Social system (agents)	*People/individuals*	Are people in the position to be resilient in the face of a catastrophe?	Availability of private resources to resettle/repair	binary; support by public agencies; rapidity of compensation process	yes/no; available/not available; rapid/slow
			Access to insurance	binary and coverage	yes/no; percentage of coverage
	Community	Is the affected community resilient to the consequences of a catastrophe?	Age structure	Areas vitality	Aging population; low fertility rates
			Local condition of aged population	binary	autonomous/not autonomou relatively healthy/not health
			Employment rate	degree	high/medium/low
			Annual population growth rate (over the last five years)	degree	high/medium/low/negative
			Immigration index	degree	high/medium/low/negative
			Social networking	degree	high/medium/low/negative
			Criminality rate	degree	high/medium/low
			Conflict among social/ethnic groups	degree	high/medium/low
	Institutions	Are institutions in charge of reconstruction transparent, reliable and trustable?	Degree of trust in institutions	degree	high/medium/low (from sociological surveys when available)
			Transparency in funds allocation	Existance of public information and independent control mechanisms	yes/no
			Long term vision	Existance of strategic development/land use plans	yes/no
	Economic stakeholders	Are economic stakeholders capable/wishing to reinvest in affected areas?	Insurance coverage	binary and coverage	Yes/no;percentage
			Construction industry	level of development and modernization	high/average/low



Area of resourcefulness and innovation

Aspects emerging : TIME

- Vulnerability dynamics according to the disaster cycle;
- How cities' history shapes vulnerability of places
- How technological and economic changes shape vulnerability resilience of places and communities
- Vulnerability and resilience with respect to fast/slow onset events (drought, earthquake)



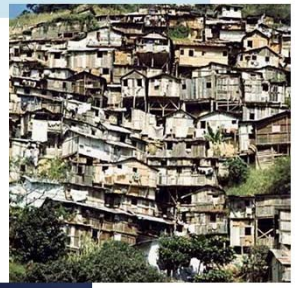
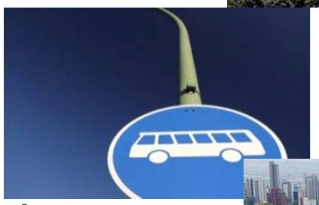
Historical center of L'Aquila

Settlements 1954
Settlements 1975

***Source*: Comitatus Aquilanus, 2009**

Aspects emerging : SPATIAL FACTORS

- Importance of the concept of scale and relations among scales (context);
- Accessibility to resources and to potentially damaged areas
- Accessiblity to markets, main access routes
- Spatial relationships shaping the potential links between core and periphery of events
- Morphology of an area (island, mountain, plain…)

Conclusion

The fragmentation of approaches should not be an obstacle to the integration of common concepts