SEISMIC RISK MANAGEMENT AND EMERGENCY PREPAREDNESS IN ITALY

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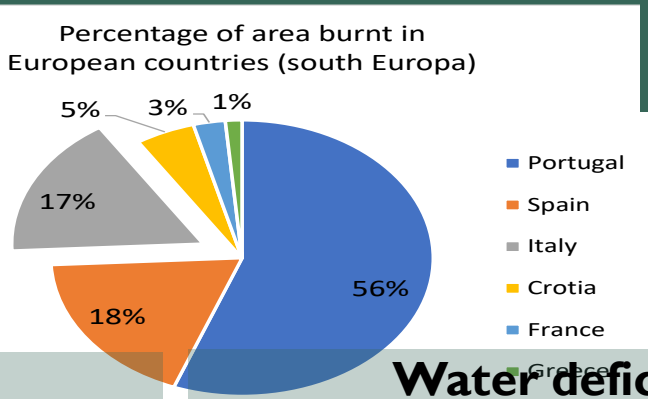
RISK OF CATATROPHIC EVENTS

Forest fire

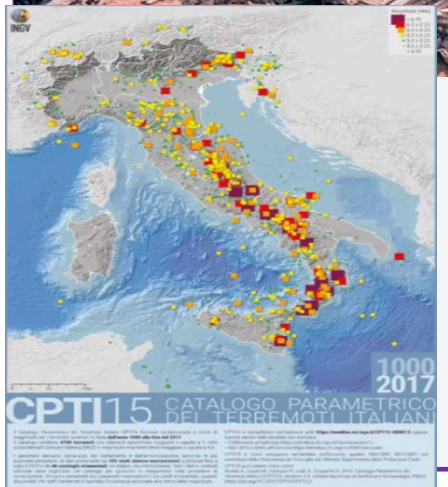


Volcanic

Landslide

Water deficit

Earthquake



Floods

Seaquake

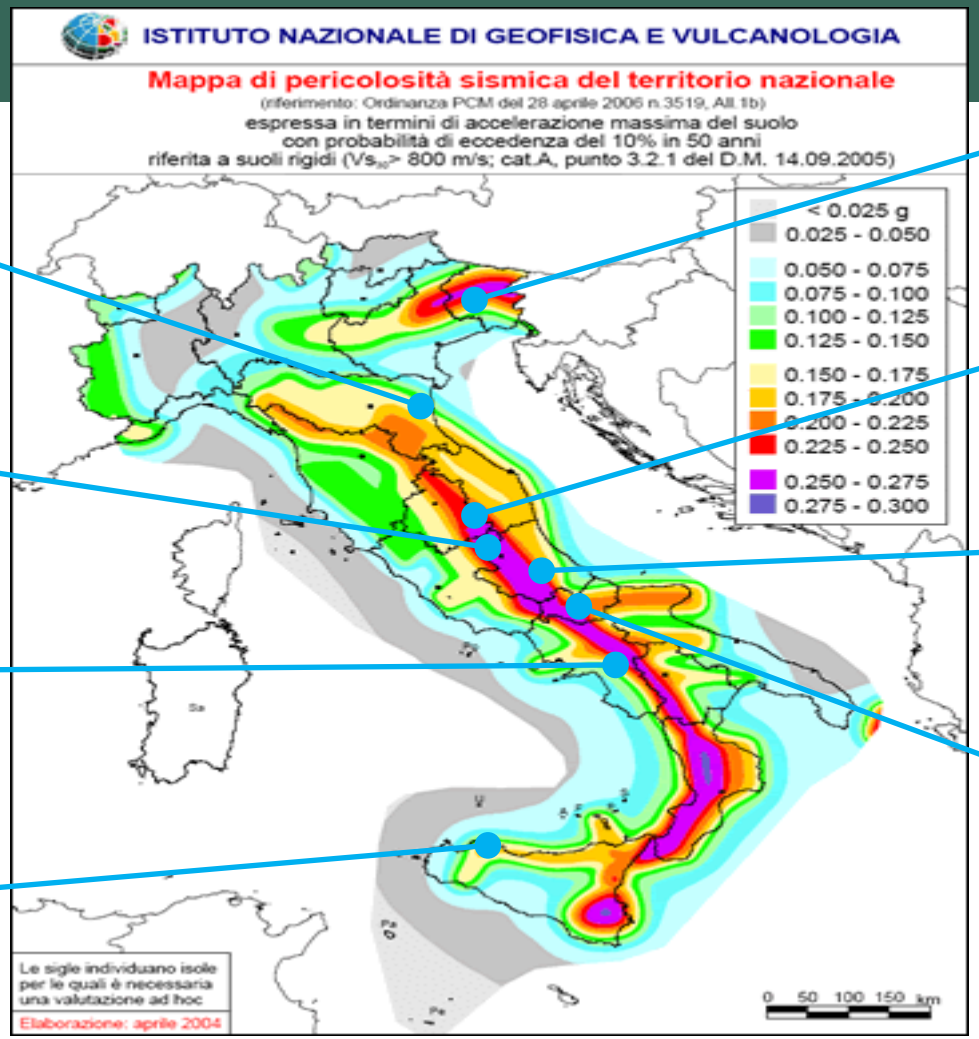
IN ITALY MANY EARTHQUAKES OCCURRED IN THE LAST 50 YEARS

Friuli - **2012**
Mw 5.9
27 victims, **13.300 M€**

Italia Centrale - **2016-17**
Mw 6.5
299 victims, **23.500 M€**

Campania-Basilicata - **1980**
Mw 6.9
2700 victims, **52.000 M€**

Belice - **1968**
Mw 6.1
296 victims, **9.200 M€**



Friuli - **1976**
Mw 6.4
989 victims, **18.500 M€**

Umbria Marche - **1997**
Mw 6.1
11 victims, **13.400 M€**

Abruzzo - **2009**
Mw 6.3
309 victims, **13.700 M€**

Molise - **2002**
Mw 5.7
989 victims, **18.000 M€**

from 1968 to 2017
more than 5000 victims
~ 150.000 M€

> 3.000 M€ / year

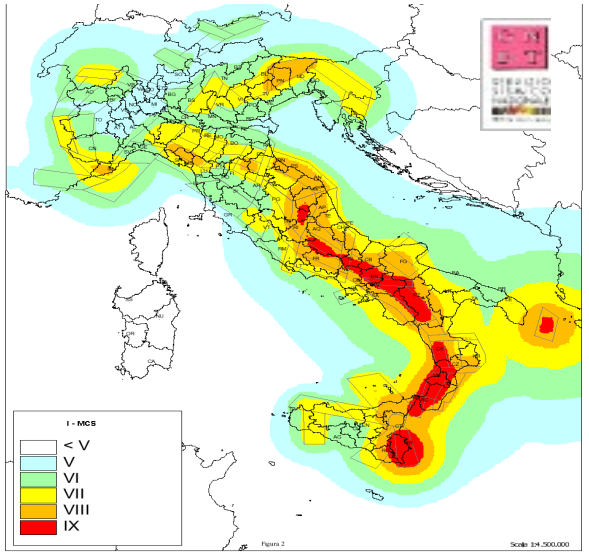
THE SEISMIC RISK

Probabilistic measure of the effects

(human losses, injuries, property damage, and disruption to economic activities)
that earthquakes cause on exposed elements in each area during a given period

RISK

HAZARDS x **VULNERABILITY** x **EXPOSURE**



Currently measure of hazard is Peak Ground Acceleration

Weakness of structure response against sesmic actions

Amount of consequences as victims and economical losses depending on the use destination

EVOLUTION OF HAZARD: FROM OBSERVATION… TO THE PEAK GROUND ACCELERATION

Up until the '70s, a region was considered to be seismically prone **only after the occurrence** of a seismic event:

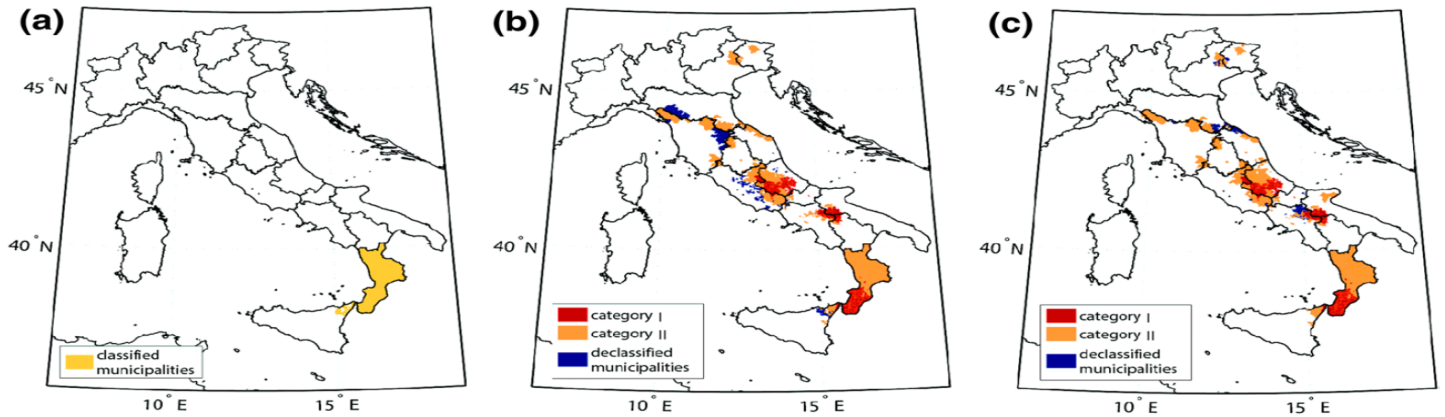


Fig. 3 Italian seismicity map after year 1909 (**a**), 1937 (**b**), 1962 (**c**)

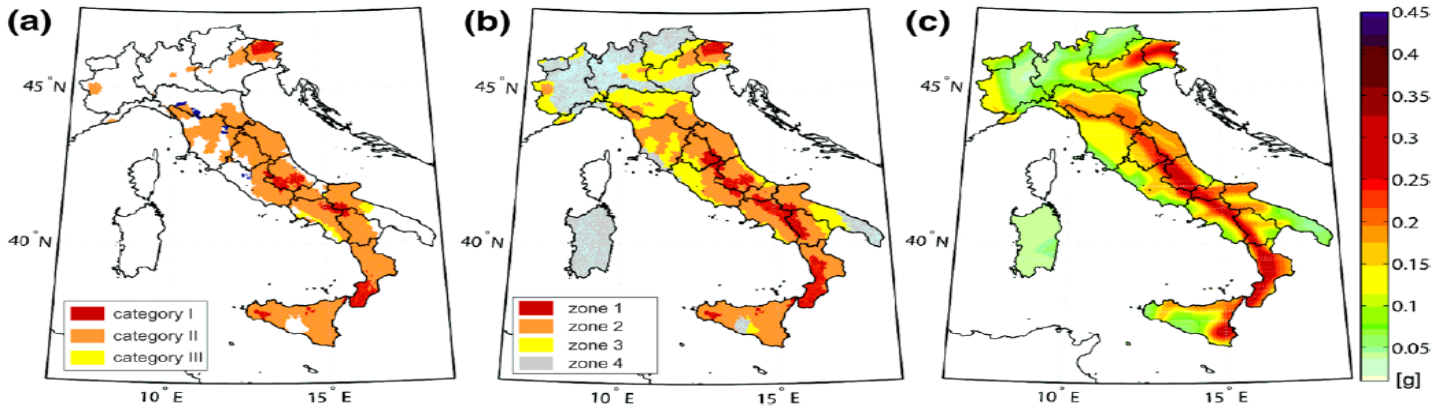


Fig. 4 Italian seismicity map after year 1984 (**a**), after 2003 (**b**) and NIBC08-18 map of PGA with 475 years exceedance return period (**c**)

1909 to 1962 maps reflect the distribution of **observed earthquakes through the territory (!)**

After '80s several areas with **high intensity hazard**:

1982: design code for seismic construction was adopted and new hazards were considered

Few building constructed after 1982:

- 5% - masonry
- 15% - reinforced concrete

HIGH VULNERABILITY OF CONSTRUCTED HERITAGE

Petruzzelli, Ievolino (2021). NODE: a large-scale seismic risk prioritization tool for Italy based on nominal structural performance. Bulletin of Earthquake Engineering, 19:2763–279

THE CIVIL PROTECTION DEPARTMENT FOR THE DISASTER RISK MANAGEMENT

The Civil Protection in Italy developed and improved its organization when catastrophic events occurred and highlighted deficiencies

The watershed moment

Irpinia earthquake 23 November 1980

Approximately **3000 deaths** and 9000 injured,
36 cities destroyed, landslide, bridges, …

"GO FAST" was the cry of pain of people


IL MATTINO

CRESCE IN MANIERA CATASTROFICA IL NUMERO DEI MORTI (SONO 10.000?) E DEI RIMASTI SENZA TETTO (250.000?)

FATE PRESTO

per salvare chi è ancora vivo
per aiutare chi non ha più nulla

SOCCORSI LENTI SULLE MACERIE

NAPOLI DEVE TORNARE A VIVERE

14 pagine sulla catastrofe

before

A law of 1970 defined that "natural disaster" are events that "induce severe damage to persons and things and need to be approached with extraordinary technical methods and machines."

Human resources were police and military

after

Definition of "High commissioner" and Minister to organize the new "Civil Protection"

The first Minister was Zamberletti that has been managed the Irpinia earthquake. **In 1982 the Department of Civil Protection was born** (directed by a Minister without economic power)

A law was prepared to regulate the National Service of Civil Protection.

The new law was finally approved in 1992.

During the earthquake many alive persons remained under the ruins but the rescue did not arrive fast.
The High Commissioner was nomined but only 10 days after earthquake massive rescue arrived.

THE PILLARS OF THE CIVIL PROTECTION

Law no.225/1992 became the first civil protection law (*unanimous approval was reached!*):
Great decentralization of intervention functions, involving territorial authorities (in particular the Mayors).

Phase 1 – Forecasting
Study of the risks of the territory

Phase 3 – Rescue
Response to the critical phase of emergencies

Phase 2 – Prevention
Daily prevention activities

Phase 4 – Post Emergency
Return to normal activities, promptly re-establish acceptable living conditions after a disaster

The concept of civil protection as a mere initiative of effective public rescue was surpassed, in favor of the broader and more comprehensive concept of **«all-round citizen protection»**.

Three fundamental insights that still drive the civil protection system today:

- An **effective civil protection system must pre-exist the event and cannot be improvised** in an emergency context on the basis of news arriving from an affected area.
- The need for a **civil protection presidium previously identified and located in all Italian municipalities**, which, according to the principle of subsidiarity, are responsibly called upon to work every day for the safety of their citizens
- **Organized volunteerism should be involved** to ensure the necessary capacity for intervention during the most serious events

EVOLUTION OF THE CIVIL PROTECTION DEPARTMENT

Irpinia Earthquake (1980)

✓ First organization of Civil Protection coordinated by a Minister (but without economic power. The risk management is centralized (country Government)

Umbria-Marche Earthquake (1997) + Sarno flood (1998)

✓ Decentralization (Regional government)

Molise Earthquake (2002)

a school collapsed - 23 children died

✓ Ordinanza OPCM 3274

Civil Protection law providing technical guidance

Initiating the development of new technical regulations for construction
(will be published on January 14, 2008 with a 2-year transition period)

L'Aquila Earthquake (2009)

✓ **Strategical choises for Building reconstruction** (seismic insulated systems)
✓ New Technical Regulations 2008 take effect early on July 1, 2009
✓ 965 M€ is allocated over 7 years

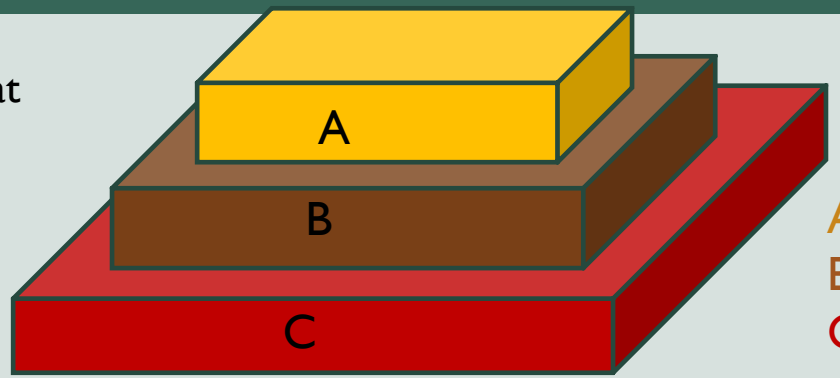
Emilia Earthquake (2012)

✓ Industrial buildings

VERTICAL SUBSIDIARITY

The national civil protection service operates at the local, regional and central levels.

The Govern intervenes only where and when territorial authorities fail to cope with the emergency.



A - local
B - regional
C - national or international

Type A emergencies can be dealt with through interventions and measures put in place at the local level, therefore of individual municipalities
Type B emergencies, by nature or extent, require the coordinated intervention of several agencies or administrations and are managed at the territorial level by the regions
Type C emergencies require the immediate intervention of the national level of the civil protection system because the resources available on the territory are not sufficient and adequate.

Emergency condition allows the use of means, power and/or extraordinary human or financial resources for a specific period of time, for a specific territory and disaster.
For type A the muicipalities defines the emergency
For type B the regional emergency condition is defined by the Region
For type C the national emergency condition is defined by the Council of Ministers

CIVIL PROTECTION ACTIONS ADDRESS THE PROBLEM IN 360 DEGREES

1. Actions for knowledge improvement

Technical-scientific knowledge.

- Promotion and funding of applied research programs (seismological, geological, engineering)
- Competence center (INGV, ReLUIS, EUCENTRE ...)

Knowledge of the land and the built environment *

- promotion and funding of land studies for:
  - public and private built heritage knowledge
  - seismic micro zonation

2. Actions to reduce vulnerability and exposure

Indirect actions - Improvement of tools

- For design:
  - Hazard, Classification, Regulations
  - Training and continuing education
- For planning:
  - Seismic micro zonation
  - Land use planning
  - Emergency plans

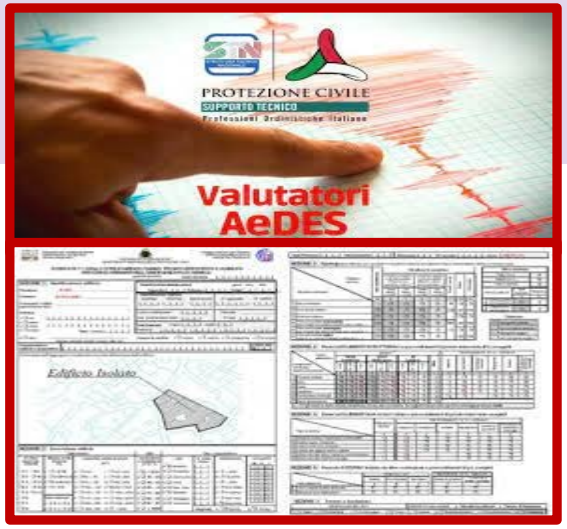
Direct actions - Reducing the vulnerability of the built environment

- Interventions on built heritage and infrastructure: strategic and relevant buildings (hospitals, schools, etc.), infrastructure, cultural heritage
- Interventions on private building heritage

Civil protection actions address the problem in 360 degrees

3. Actions for effects mitigation

- Improving the organization of the civil protection system and civil protection plans for better system response
- **Dissemination of risk awareness and civil protection culture of the population** and public administrators, through communication and dissemination campaigns on proper behavior and prevention
- **Trainings for the verification** of civil protection
- Plans preparation of volunteers
- Improvement of seismic monitoring on the territory and construction



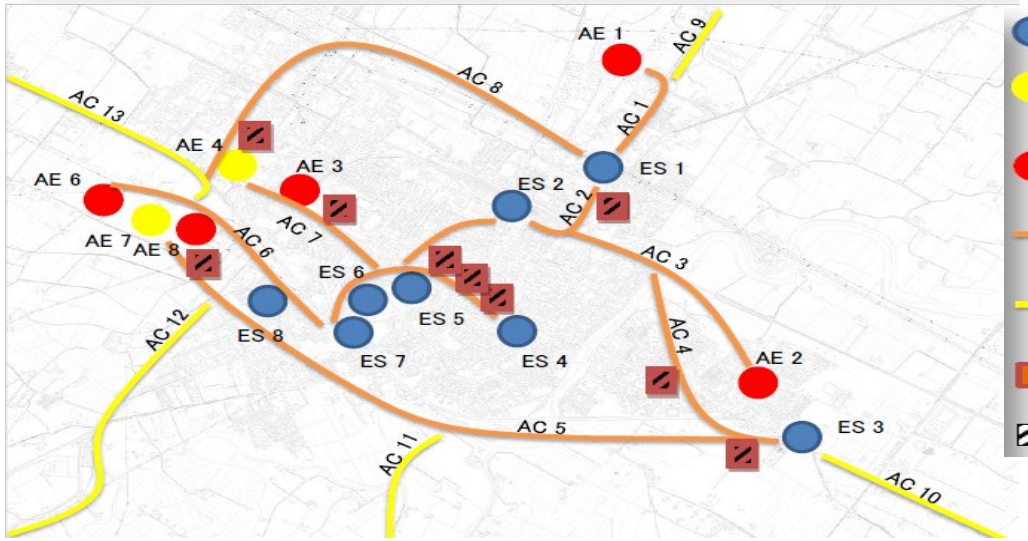
Actions for improving the Resilience

Limit Condition for Emergency (LCE)

Following the earthquake, the urban settlement, while suffering physical and functional damage such to lead interruption of almost all urban functions, including residence, preserves:

- ✓ The operability of most of the strategic functions for the emergency
- ✓ Their connectivity.
- ✓ Their accessibility with respect to the territorial context.

LCE analysis was first introduced in Ordinance 4007 (2011), as a voluntary application, with incentives.



ES - Strategic Buildings

AE - Emergency Areas

AE - Recovery areas

AC - Connection infrastructures

AC - Access infrastructures

AS - Structural aggregate

US - Structural Unit

FUNDING TO THE LOCAL ADIMISTRATIONS

Seismic microzonation and CLE mean contribution for each administration of 8500-15000€ starting from 2010

Most of national territory has microzonation

Further urgent interventions

Intervention on bridges and viaducts to improve the safety and resilience of the escape routes and rescue run during emergency .

The founds for territory with $a_g \geq 0.2g$

Interventions on public buildings and bridges

Economic contribution by the national government for:

Local strengthening

100 € /mc building

200 € mq bridge deck

Seismic upgrading

150 € /mc buildings

450 € mq bridge deck

Demolition and recostruction

200 € /mc buildings

600 € mq bridge deck

THE COMPETENCE CENTERS

Civil protection functions:

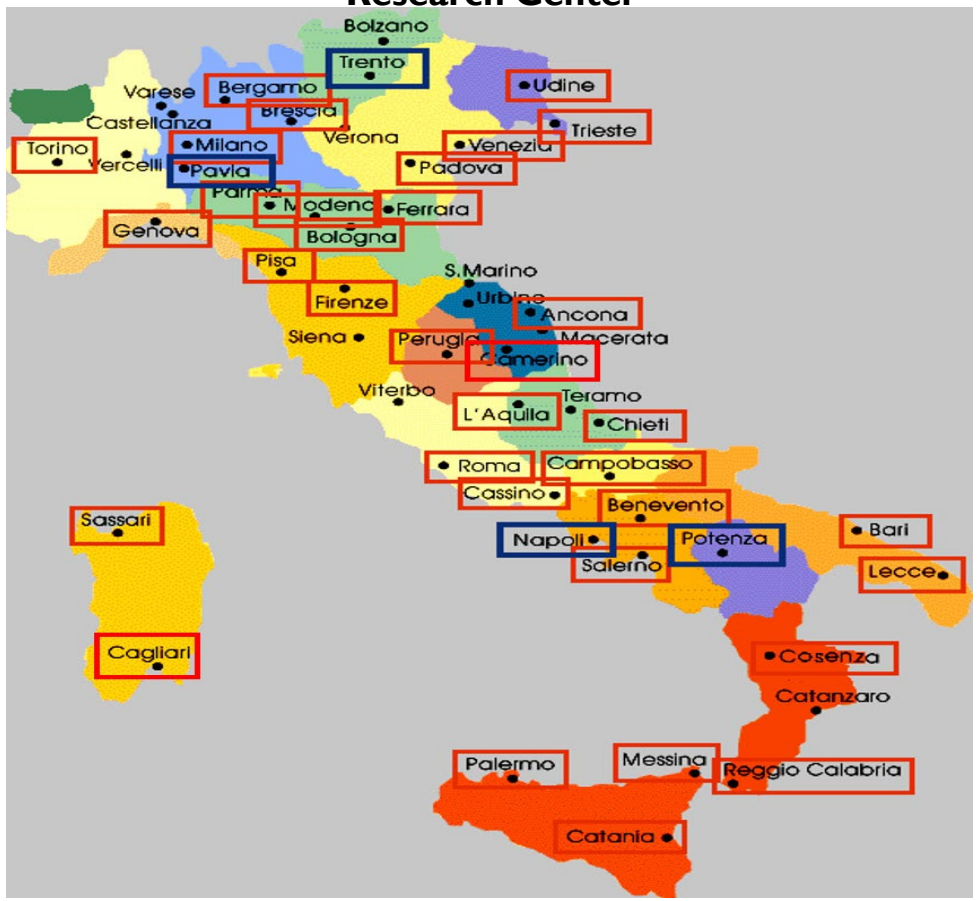
1) contributing to the overcoming of emergencies, through the **restoration of normal living conditions** of the populations and territories affected by calamitous events

2) the activities of **risk forecasting and prevention**, which continually need to be better and better developed, also due to the evolution of technology and **scientific knowledge**

THE CONSORTIUM RELUIS

In 2003 born reluis The of(Reluis)

The consortium Reluis involves many Italian University and Research Center



Reluis provide **scientific, organizational, technical and financial support to member Universities** and promoting their participation to scientific and technological activities in the field of Seismic and Structural Engineering in accordance with the specific national and international research programs

The Consortium is the scientific interlocutor of the various Bodies of the **National Government**, Districts, Provinces, Municipalities and **public and private institutions** in order to achieve concrete objectives in relation to the assessment and reduction of vulnerability and seismic risk, and is **one of the main Centres of Competence** of the Department of Civil Protection.

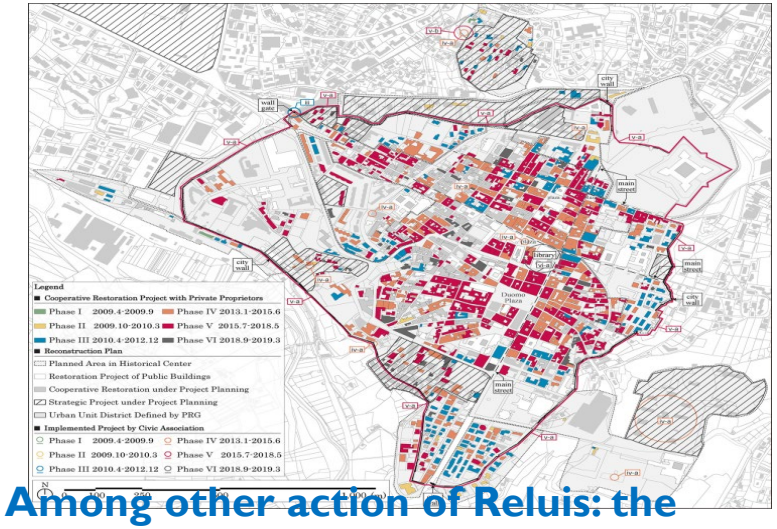
The consortium is **non-profit and based in Naples**, at the Department of Structures for Engineering and Architecture of the University Federico II.

THE CONSORTIUM RELUIS

Since 2003 to date

60 millions were given by the Civil Protection to Reluis to develop research for **prevention**, **mitigation**, **management** of seismic risk

Project ID	Project ID	Duration
DPC/ReLUIS 2005-2008	15'000'000.00	3 years
DPC/ReLUIS 2010-2013	10'500'000.00	2 years
DPC/ReLUIS 2014-2018	17'264'000.00	5 years
DPC/ReLUIS 2019-2021	10'609'000.00	3 years
DPC/ReLUIS 2022-2024	6'906'000.00	2 years

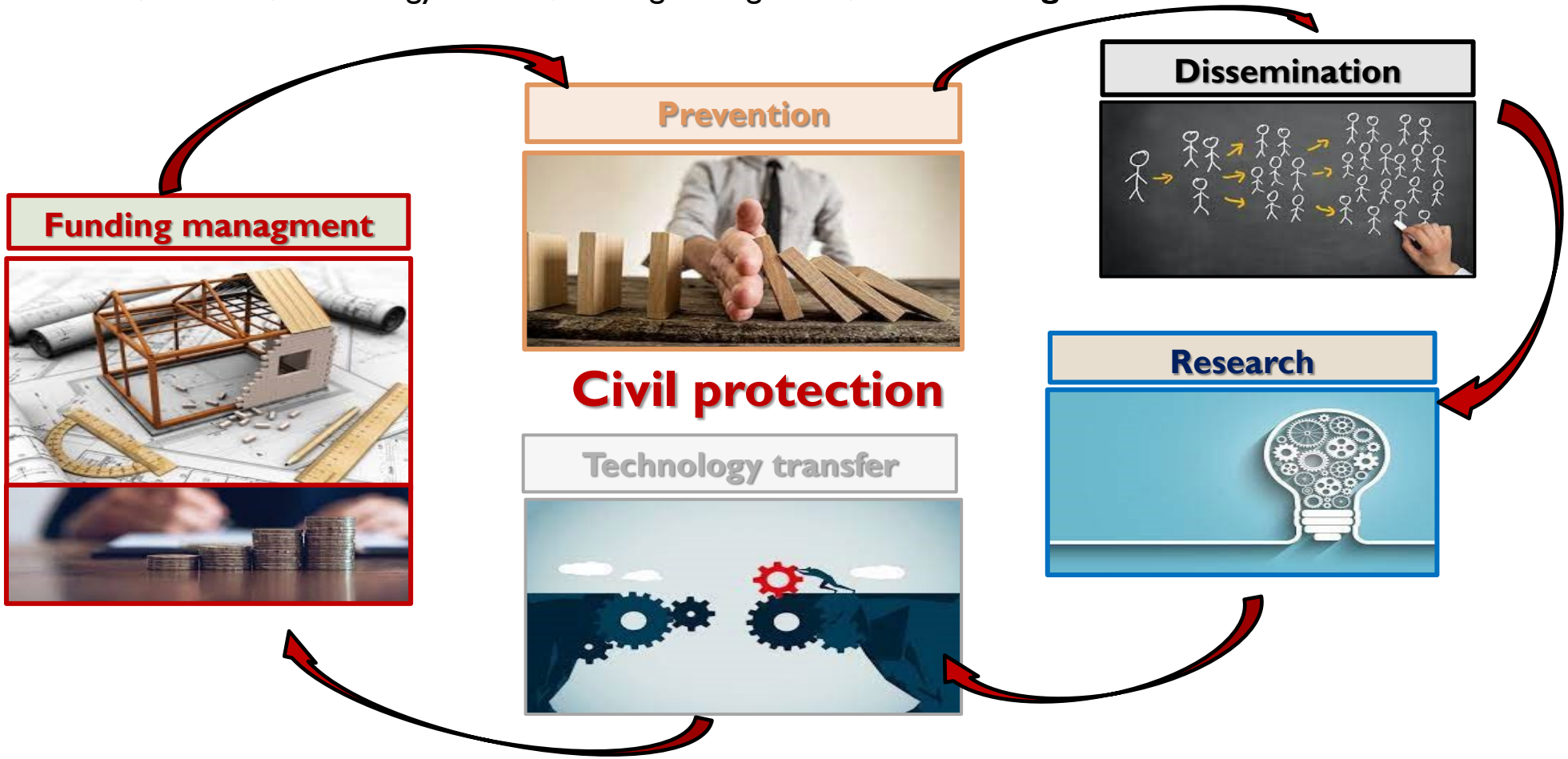


Among other action of Reluis: the participation to the management of the emercengy after the earthquakes of l'Aquila

In 2020, considering the developed skills and the obtained results, Reluis expanded its mission. The member Universities approved amendments to the statute of Reluis, that becomes the Network of University Laboratories of **Seismic and Structural** Engineering.

CONCLUSIONS

Civil Protection in Italy in 20 years has transformed from an emergency response system into one that deals with prevention, dissemination, research, technology transfer, funding management,... **Enhancing the Resilience to seismic events**



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THANK YOU FOR ATTENTION