# Costruire la resilienza delle Infrastrutture Critiche transfrontaliere

***Learn global to act local***

*Convegno internazionale del progetto SICt*

*Giovedì 1 e venerdì 2 ottobre 2020*

Regione Lombardia

Dipartimento del territorio

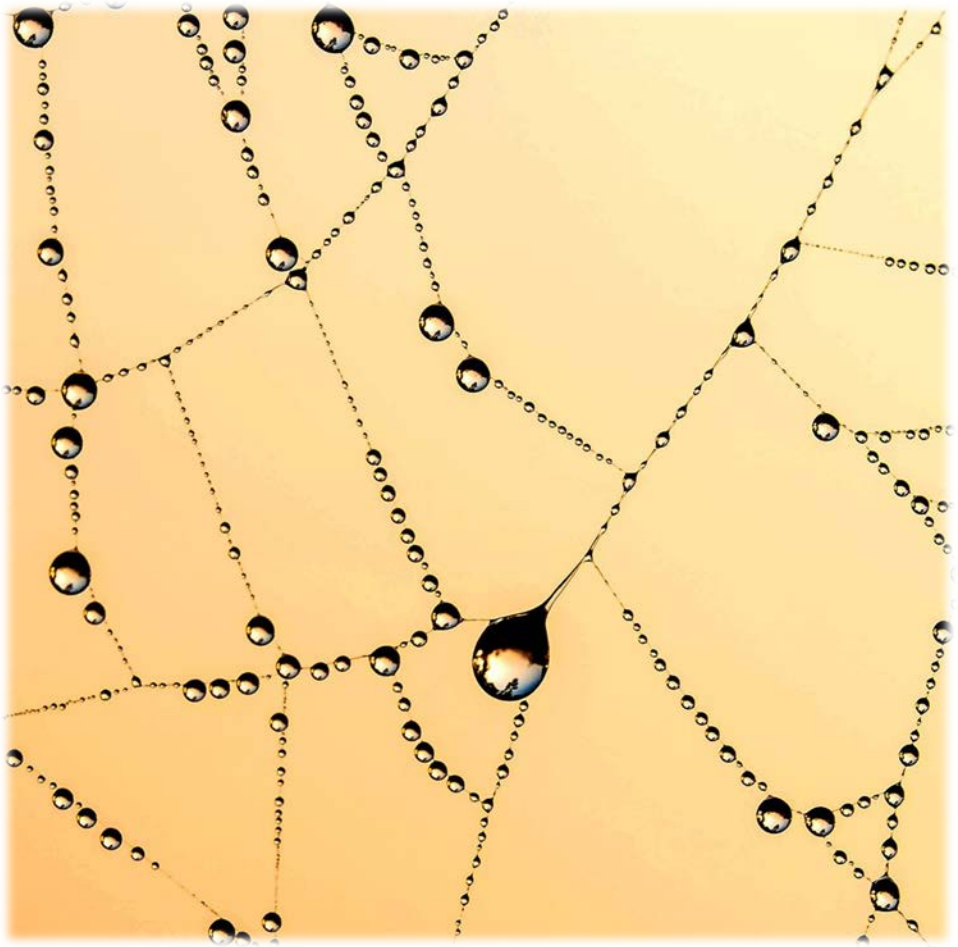
Scuola universitaria professionale della Svizzera italiana SUPSI

POLITECNICO MILANO 1863

# Resilience of Cross-Border Critical Infrastructure

Boris Petrenj

Politecnico di Milano
School of Management



# SICt – Resilience of Cross-Border Critical Infrastructures

Cooperation program Interreg V-A Italy-Switzerland

**Budget:** 1,440,744 € (Italian) + 551,184 CHF (Swiss)

**Partners:**

**Lombardy Region (Italian leader)**
- GD Civil Protection
- GD ICT

**Politecnico di Milano**
- Mobility and Transport Laboratory
- Department of Management, Economics and Industrial Engineering

**Polizia Cantonale Ticinese (Swiss leader)**

**SUPSI** - Scuola Universitaria Professionale della Svizzera Italiana

**Cantone Ticino Dipartimento del Territorio**

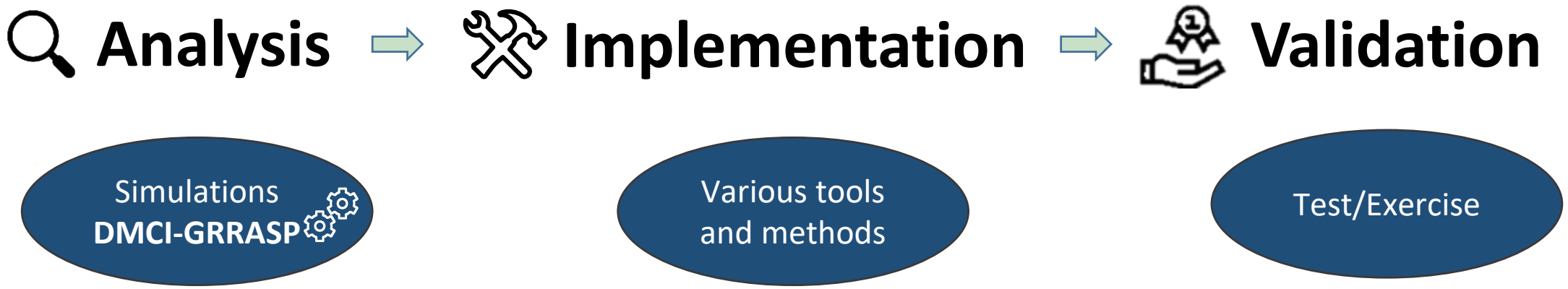
**Technical partners:** Lombardia Informatica S.p.A, Lombardi SA

**Duration:** 21 December 2018 - 20 December 2021 (36 months)

# SICt – Resilience of Cross-Border Critical Infrastructures

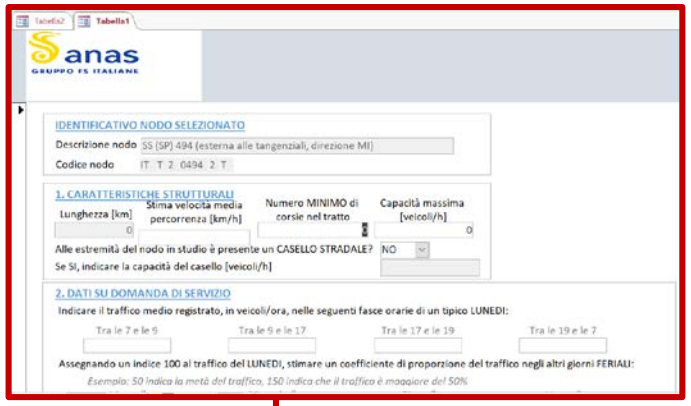
- Strengthening the joint resilience capacities between Italy (Lombardy Region) and Switzerland (Canton Ticino) linked to events that may disrupt the continuity of critical transport infrastructures service with cross-border relevance

- Establishing a collaborative alerting and response to disruption events, by means of new coordinated plans for critical scenarios and a dedicated information-sharing platform

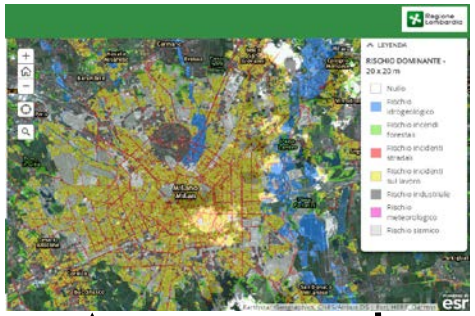


# Analysis phase

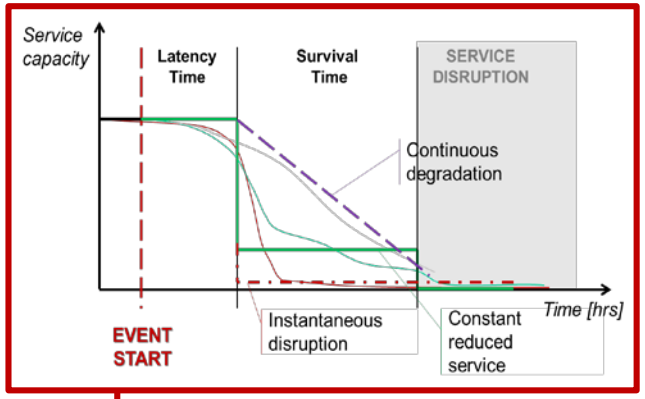
## First phase of data collection



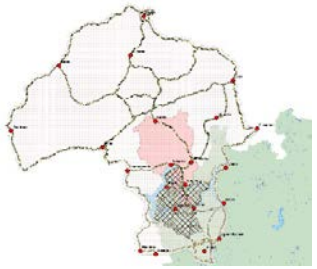

Mapping Threats
Vulnerability Analysis

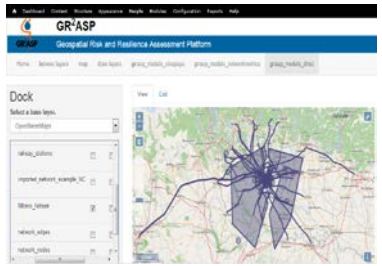


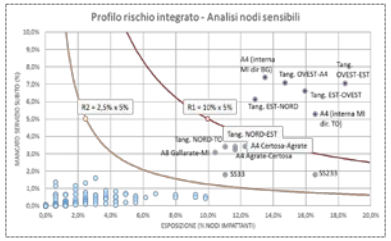
## Second phase of data collection




Project Area Definition → Mapping Nodes and Interdependencies → Vital Node Analysis → Analisys of Incident Scenarios on Critical Nodes → **Workshop** → Critical Events (scenarios)





# Area definition & Mapping of nodes

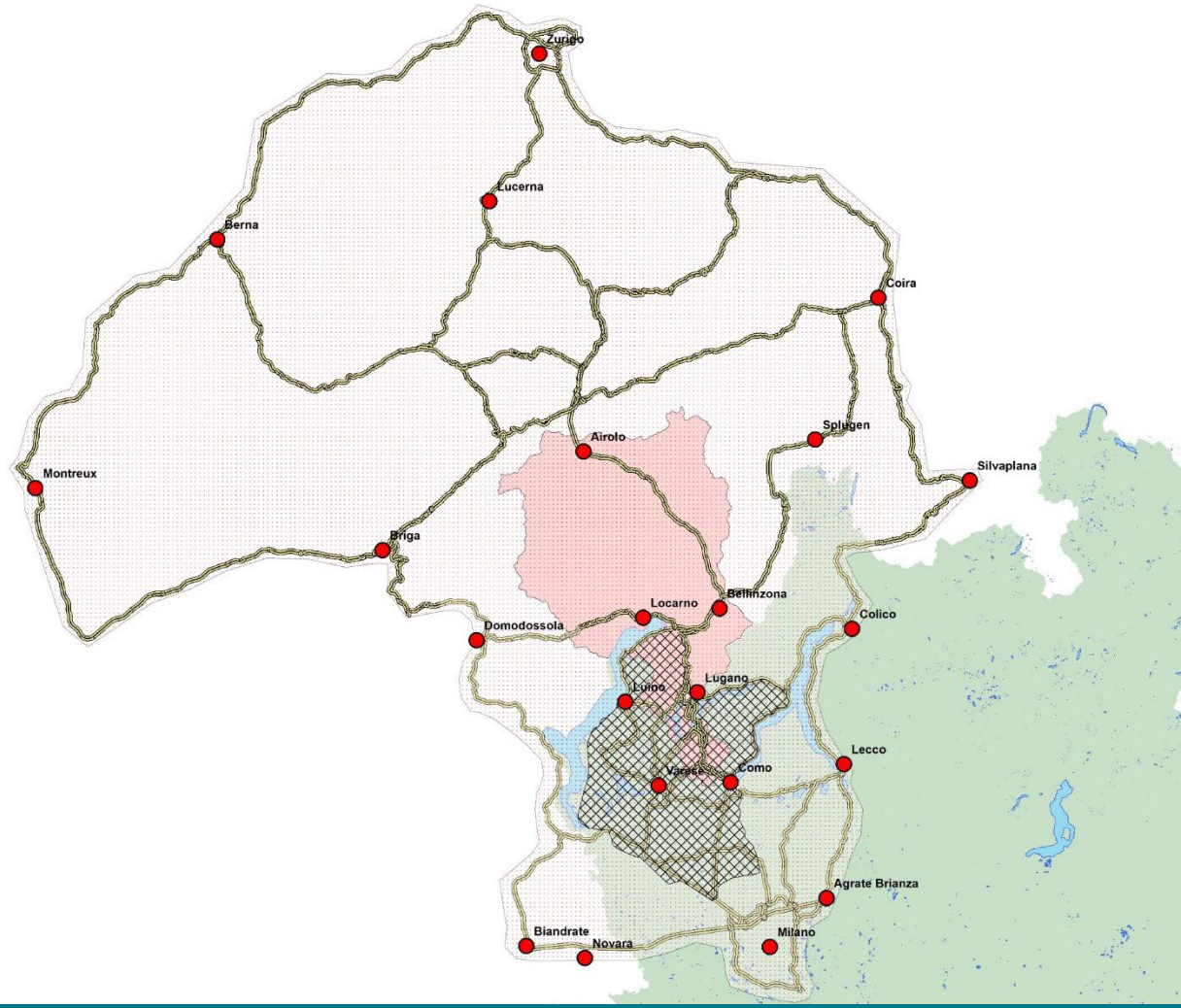
**322 Transportation nodes in Italy**

- 3 Airports
- 58 Highways and Beltways
- 94 National/Principal Roads
- 48 Provincial/Secondary Roads
- 6 City Roads
- 72 Railway segments
- 10 Stations
- 24 Metro segments
- 7 Metro depots

**10 Customs**

**122 Transportation nodes in Switzerland**

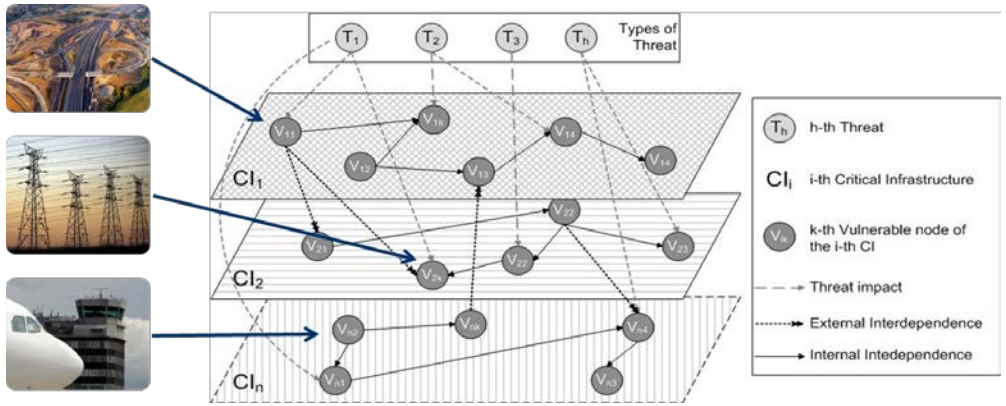
- 32 Highways and Tangentials
- 14 National/Principal Roads
- 26 Provincial/Secondary roads
- 30 Railway segments



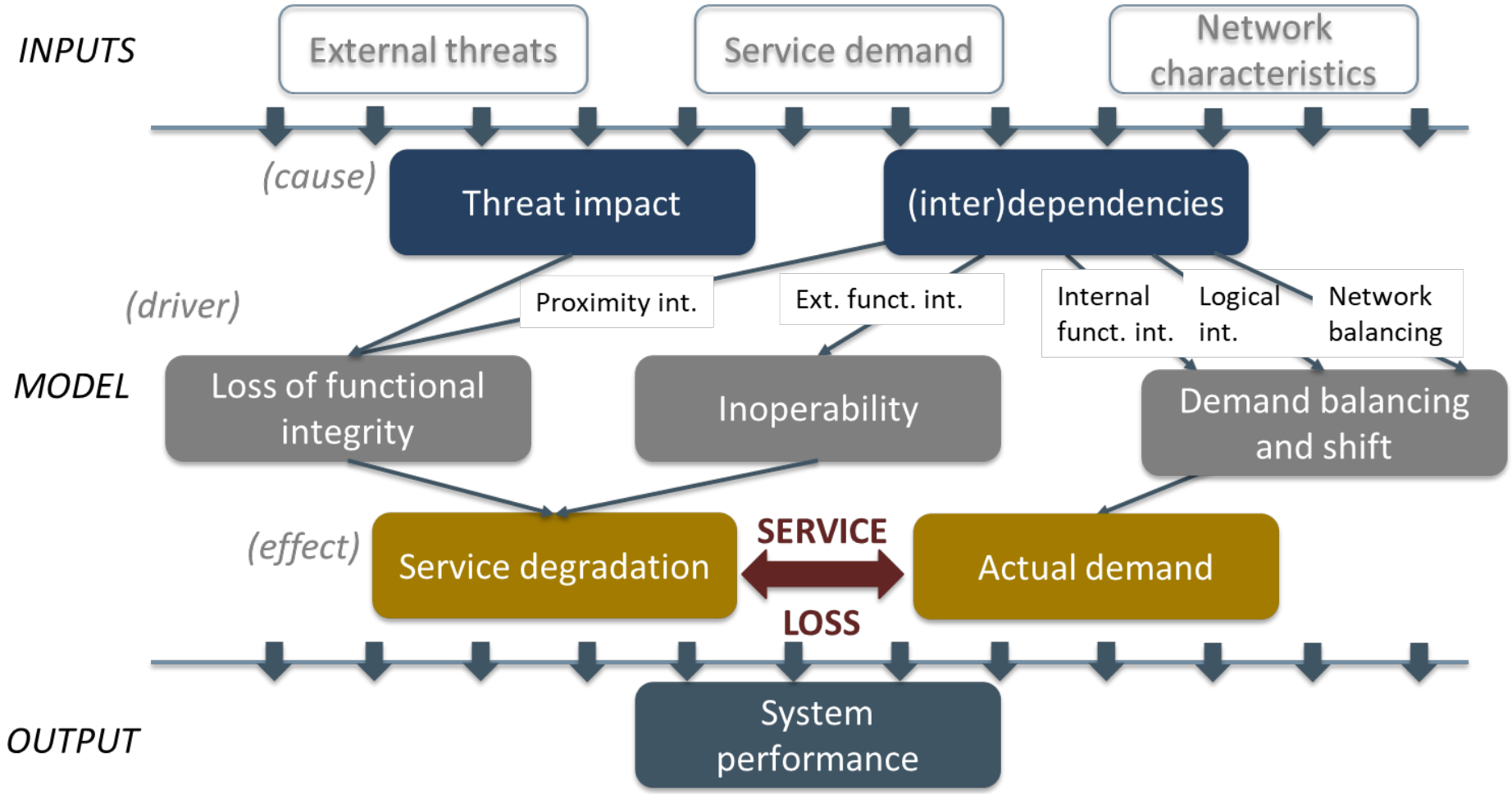
# Dynamic Functional Modelling of Vulnerability and Interdependencies of CIs (DMCI)

- **Vulnerable nodes** - susceptible to threats which can affect the node functionality (the service they provide);
- Threats that cause **missed service demand (MSD)** in vulnerable nodes
- **Functional and logical interdependencies** between vulnerable nodes
- **Propagation of inoperability** (disruption of node service due to cascading effects) and demand variations throughout the nodes of the same infrastructure and between interdependent CI

Developed by POLIMI, to understand how disruptive events on CIs could spread to the whole network due to different types of interdependencies



# DMCI Modelling Approach



# Data collection through collaboration with the operators

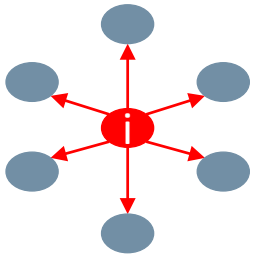
The PPC in Lombardy involves operators in the transportation sector

- Railways
- Metro lines
- Airports
- Highways
- National and regional road networks

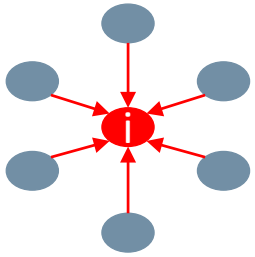
The Swiss partners are working closely with the operators in the region on the data collection

**Data**: Infrastructure type, name, geo-localisation, physical and functional characteristics, interdipendencies with other nodes and other infrastructures (es. energy, telecommunications), service type and capacity, standard service demand (including seasonality)...

# Vital Node Analysis (VNA)

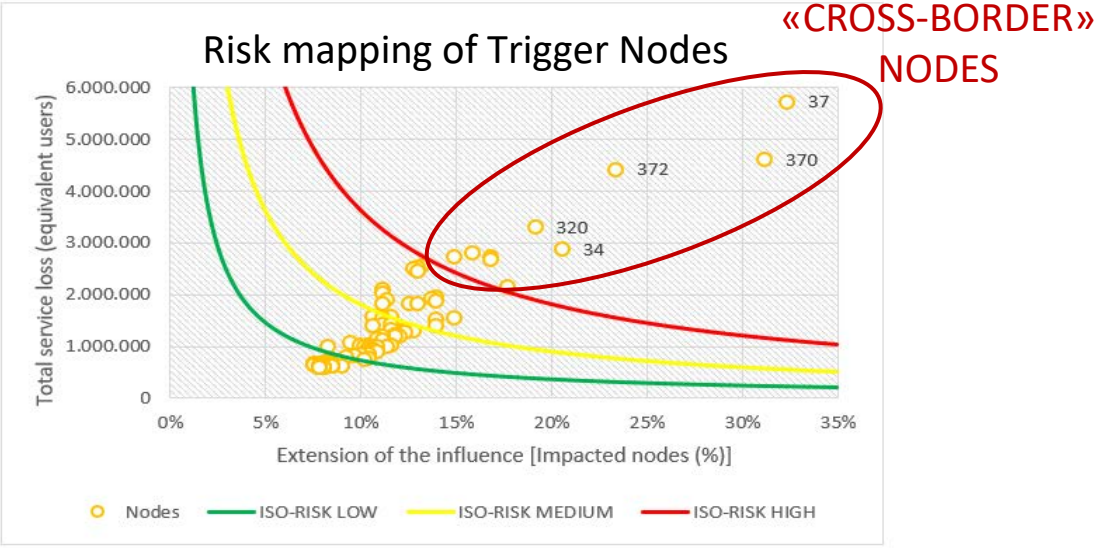


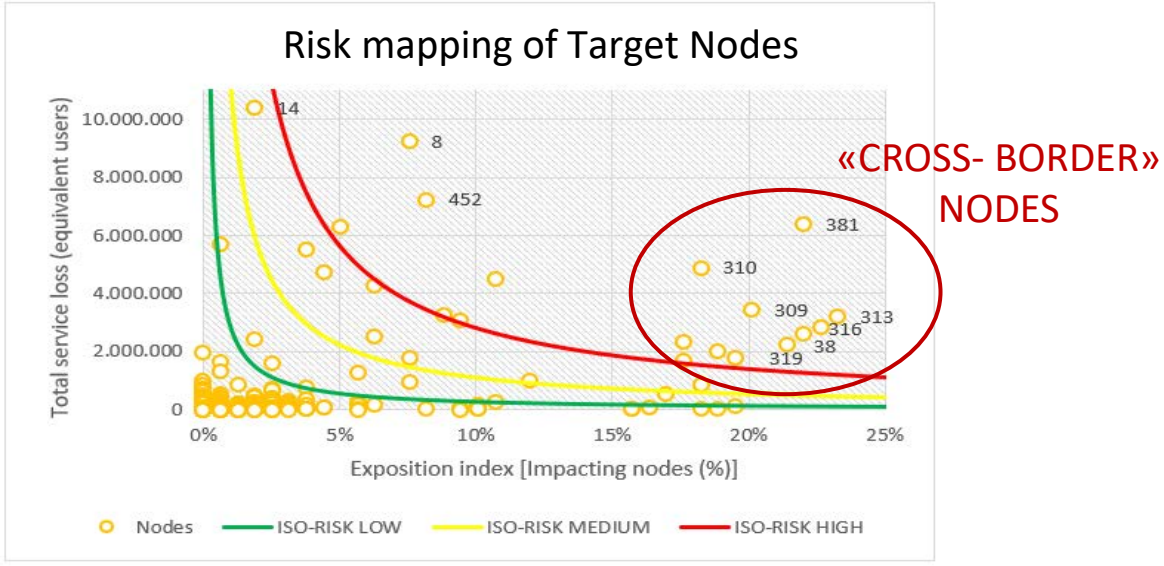
**Critical nodes** have the property to influence and degrade the service capacity of other nodes and the infrastructure system as a whole



**Sensible nodes** are susceptible to being disrupted by disturbances of other nodes in the system. They are dependent on the functionality of other nodes

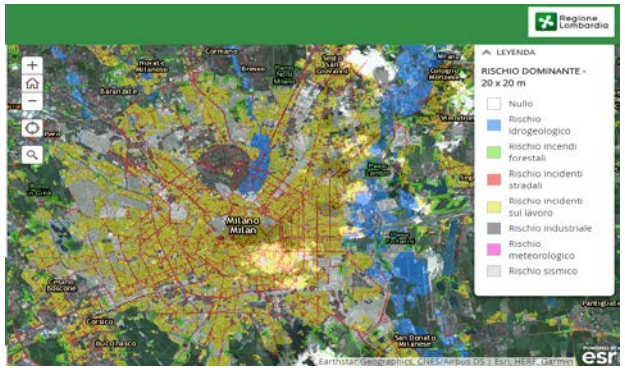
VNA is conducted through simulation campaigns in which each experiment assumes the total loss of functional integrity of one of the mapped nodes

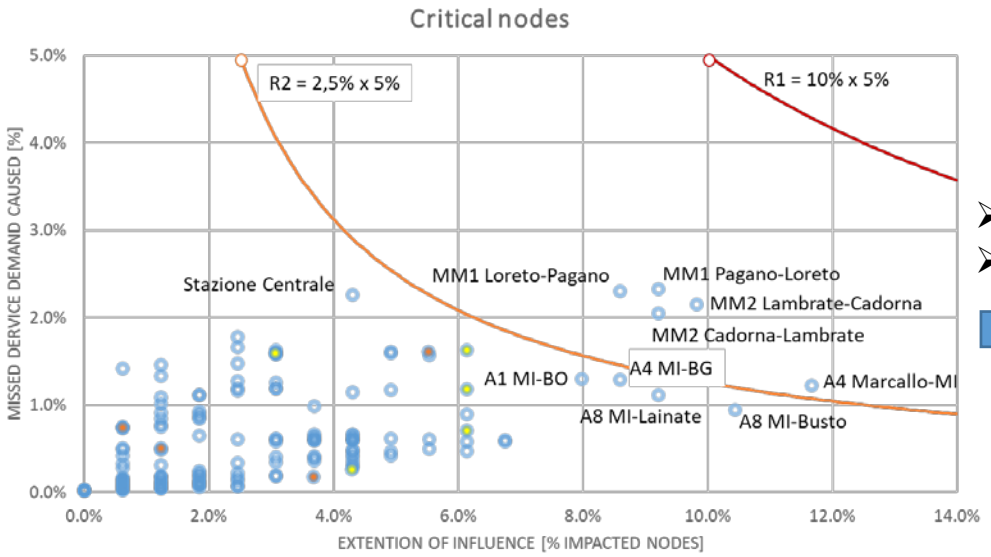


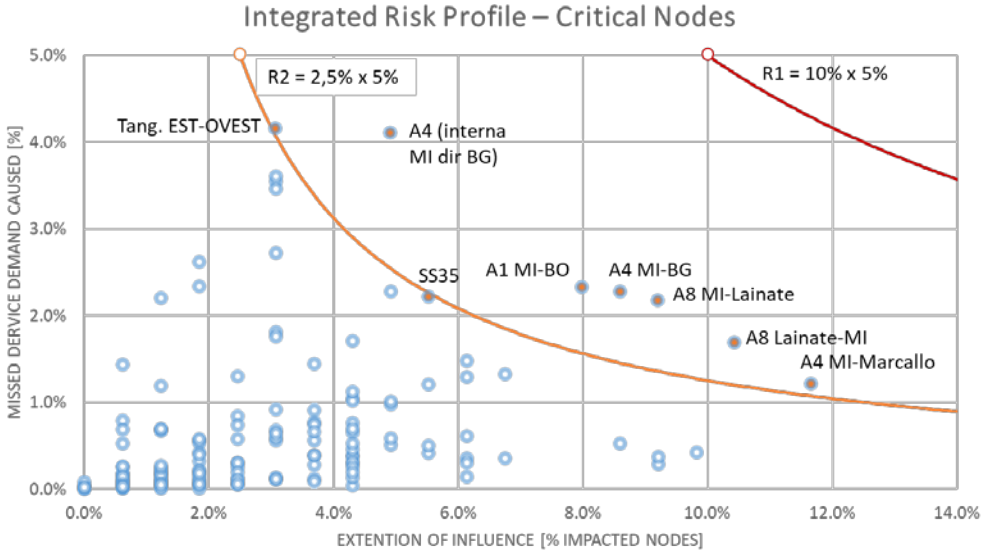
# Integrated risk analysis

- Risk exposure of individual infrastructure nodes
- Node vulnerability to such events
- Probabilities for specific hazards and threats




- Exposure to H&T
- Vulnerability



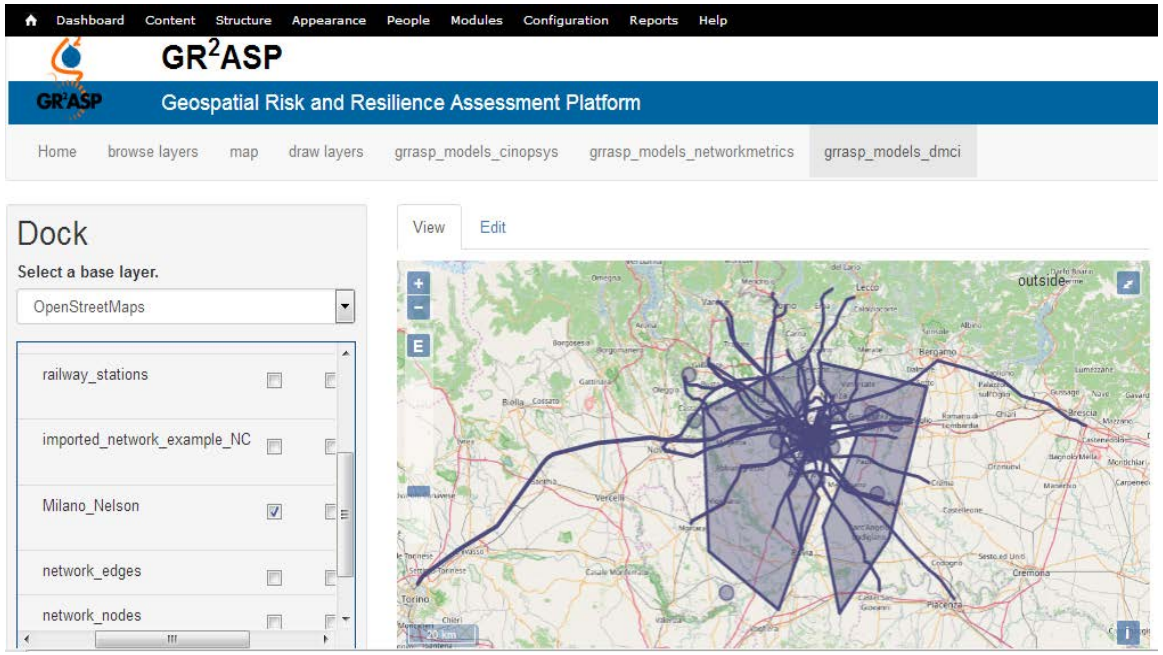
# DMCI implementation in the JRC GRRASP

GRRASP is a Web-oriented architecture developed by JRC (Ispra), bringing together geospatial technologies and computational tools for the analysis and simulation of CI

GRRASP-enabled enhancements

- Modular structure
- Web GUI, GIS integration
- Simplified data collection (all in single place)
- Combining other Risk Analysis tools

## GEOSPATIAL RISK AND RESILIENCE ASSESSMENT PLATFORM (GRRASP)




https://ec.europa.eu/jrc/en/grrasp

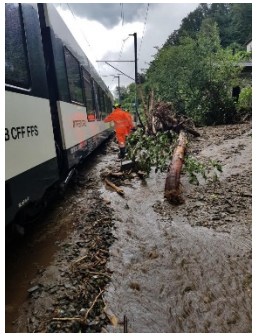
# Critical Scenarios

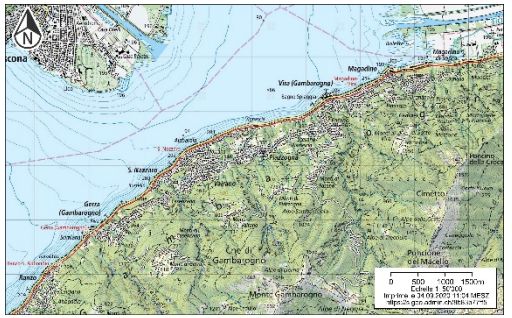
Involving transportation nodes in the border area whose disruption would cause a significant impact (MSD) on both sides (i.e. both countries), and might benefit the most from coordinated cross-border emergency management

**Scenario 1** – **Heavy Snowfall** in the area around **highway A36 connecting Como (IT) and Lugano (CH)**



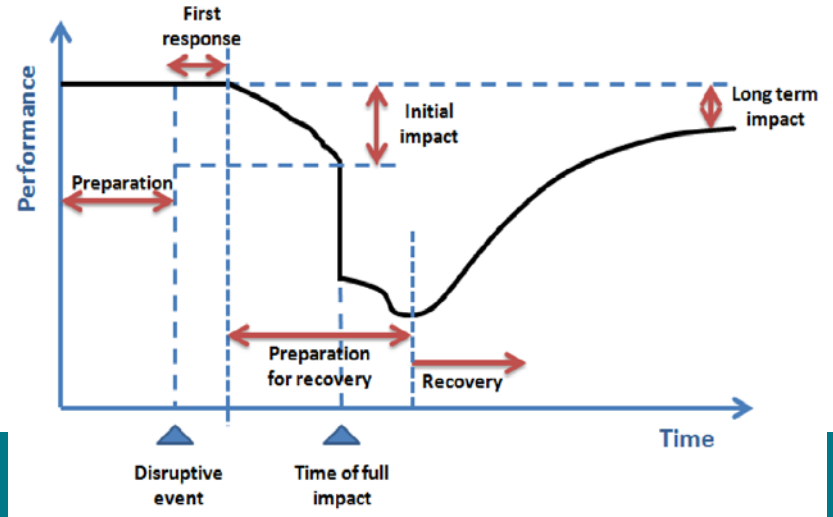

**Scenario 2** – **Train derailment** on the rail line **Varese – Luino – Bellinzona**





# Scenario Analysis and Collaborative Response Strategy

- Simulations of selected scenarios of interest
  - Evaluation of possible protection and resilience strategies by varying simulation parameters
- Intensive work with the regional stakeholders
  - to understand organisational arrangements and emergency procedures
  - to map existing information flows and find gaps
  - to understand the factors which would require a collaborative (cross-border) response
  - to indetify ways in which to improve the use and management of available resources
  - to collect requirements for the IT platform (PIC) which will support the collaborative activities

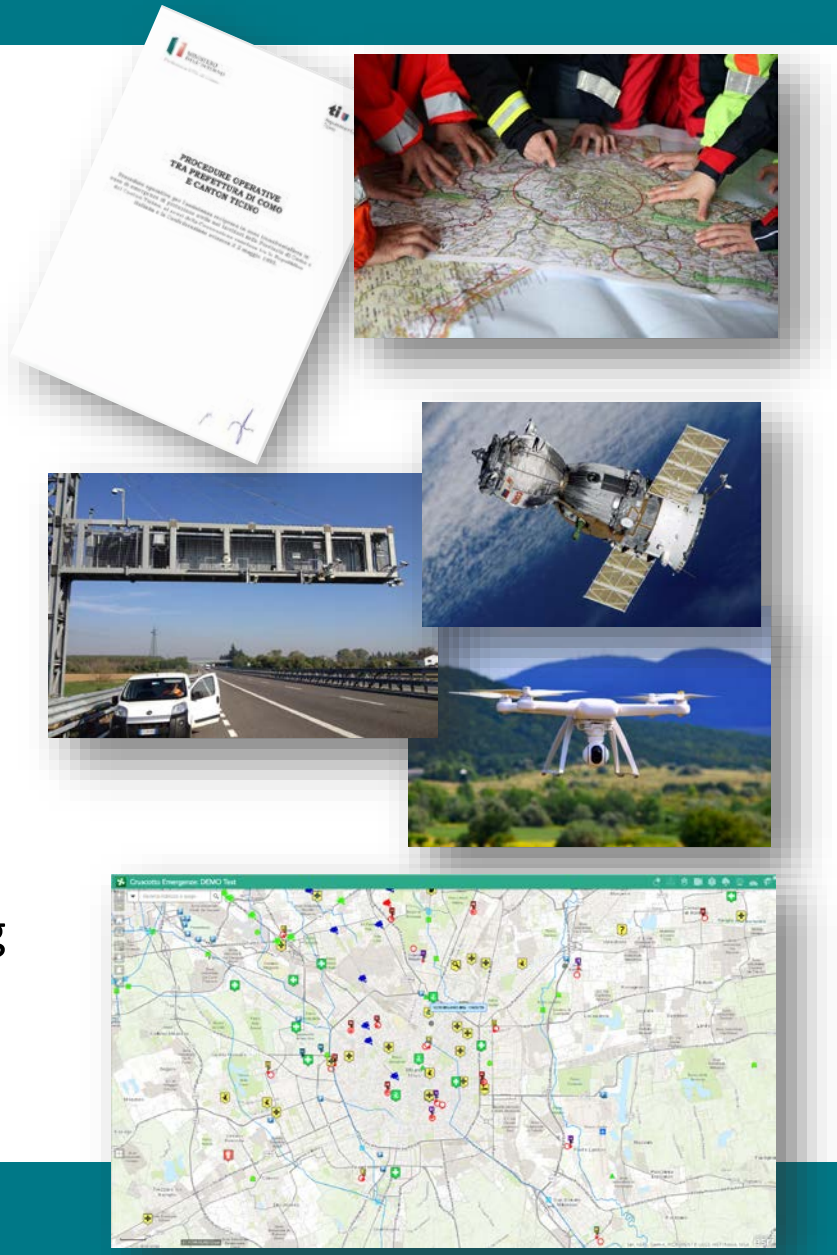


# Main expected outcomes

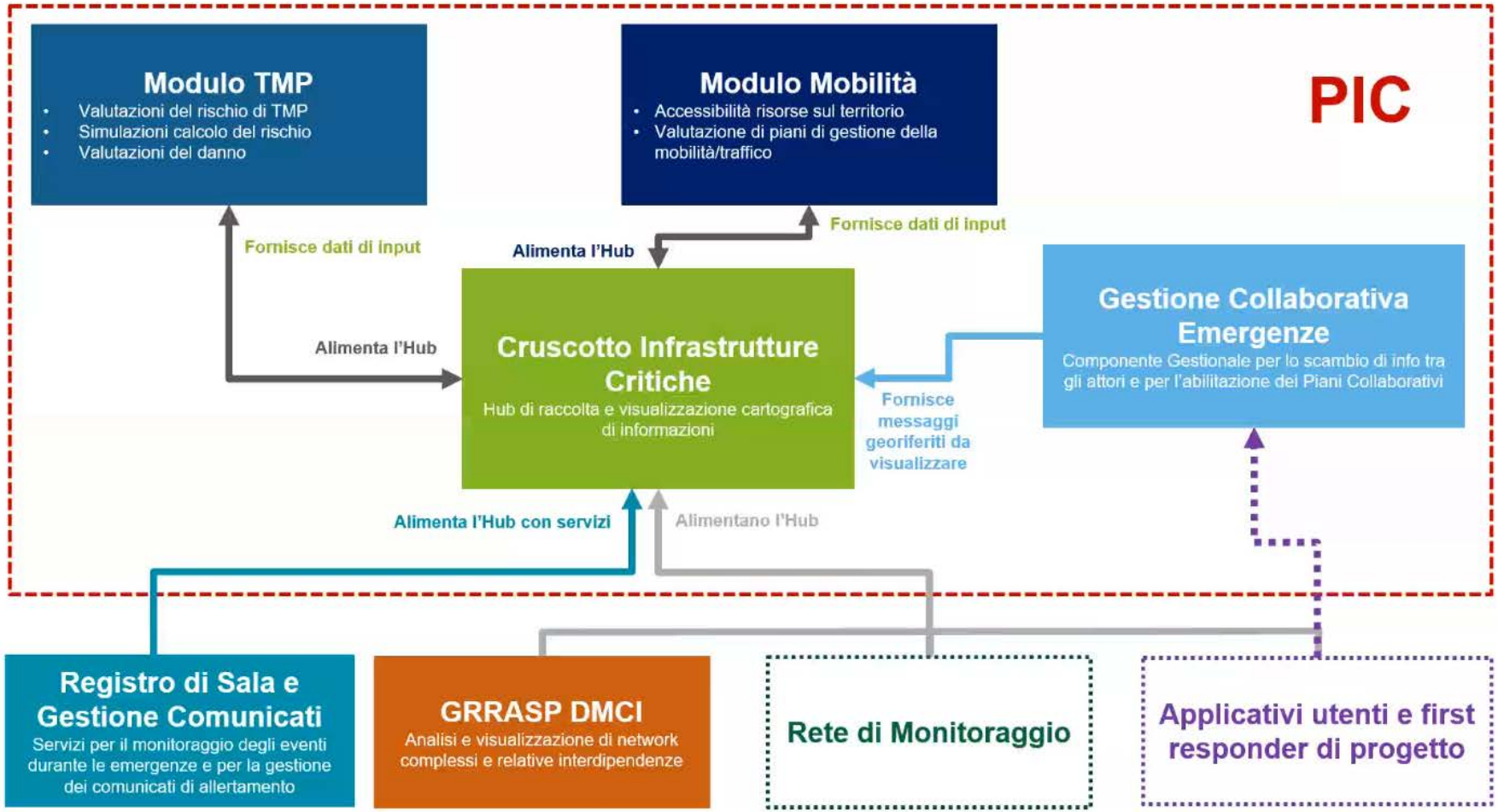
1) Shared rules (Agreements, Guidelines, documents) valid at cross-border level to harmonize the organizational and operational emergency response models

2) A fixed and mobile monitoring network for critical cross-border infrastructures

3) An IT platform for an effective monitoring, information sharing and operational coordination in critical situations



# Integrated platform - PIC



# THANK YOU

Regione Lombardia

Dipartimento del territorio

Polizia Cantonale

Scuola universitaria professionale della Svizzera italiana
SUPSI

POLITECNICO MILANO 1863