

Italy is often regarded as a beautiful «open-air» museum, named .... *Italy*

Matera

2 - 50 - 75 - 80



National Research Council of Italy



## But our nice and historical cities are fragile.

A number of reasons:

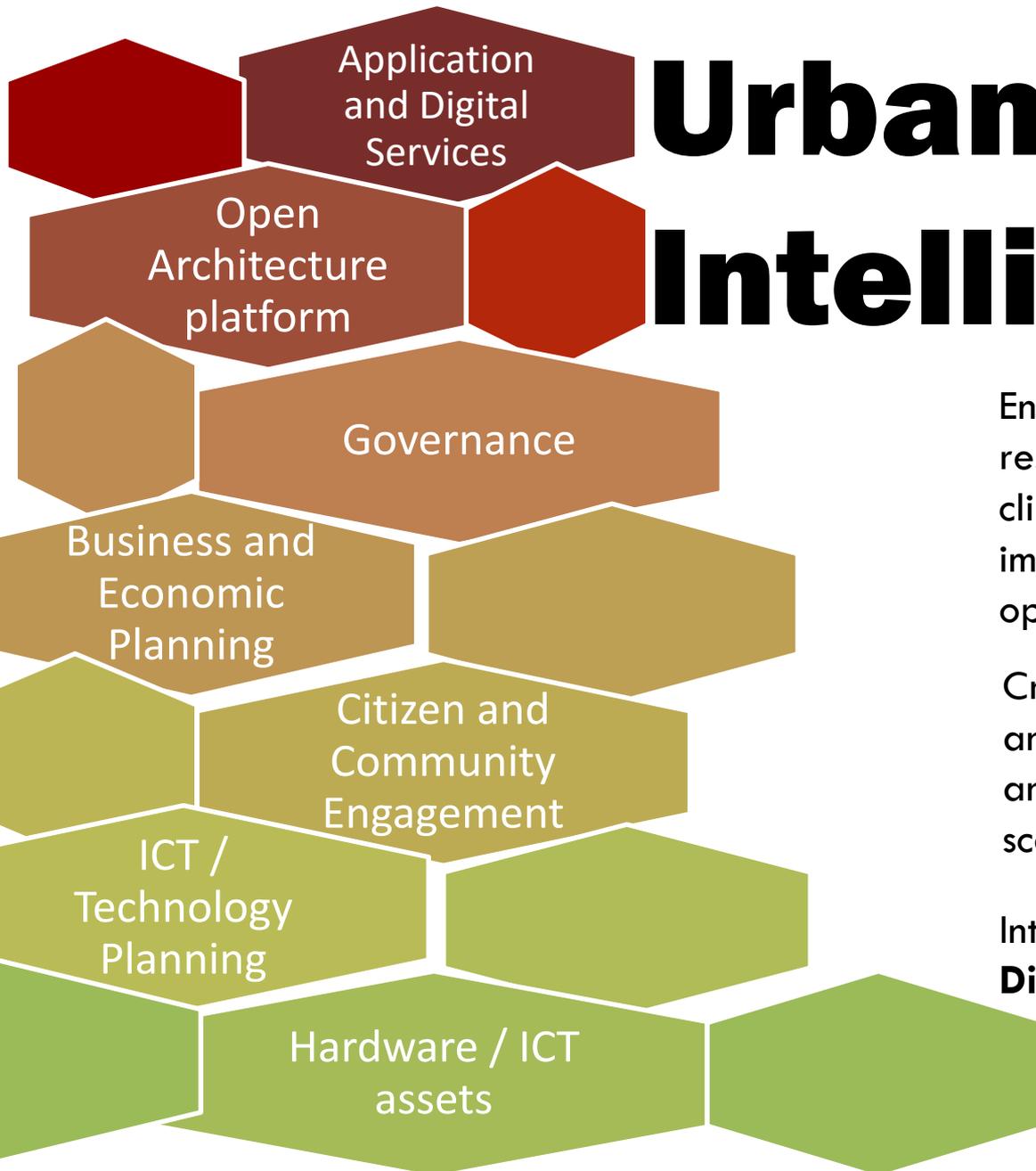
- **Natural hazards**: frequent earthquakes, landslide, flooding: Italy has been built, through centuries, on a fragile land
- **Large downtown historical areas**, not suited for contemporary traffic, energy consumption, life style, waste production, etc.
- **Impact of climate changes**

There is the urgent need to design and adapt our cities to cope with these future conditions.



Lab

A new



# Urban Intelligence

Enhance urban resilience, prepare for climate changes impacts, cyber attacks, optimize services, etc.

Create, validate and assess mitigations and contingency scenarios

Introducing the **Digital Twin City**



# DIGITAL TWINS

= AI + Machine Learning +  
Software Analytics + Data + ...  
+ IoT

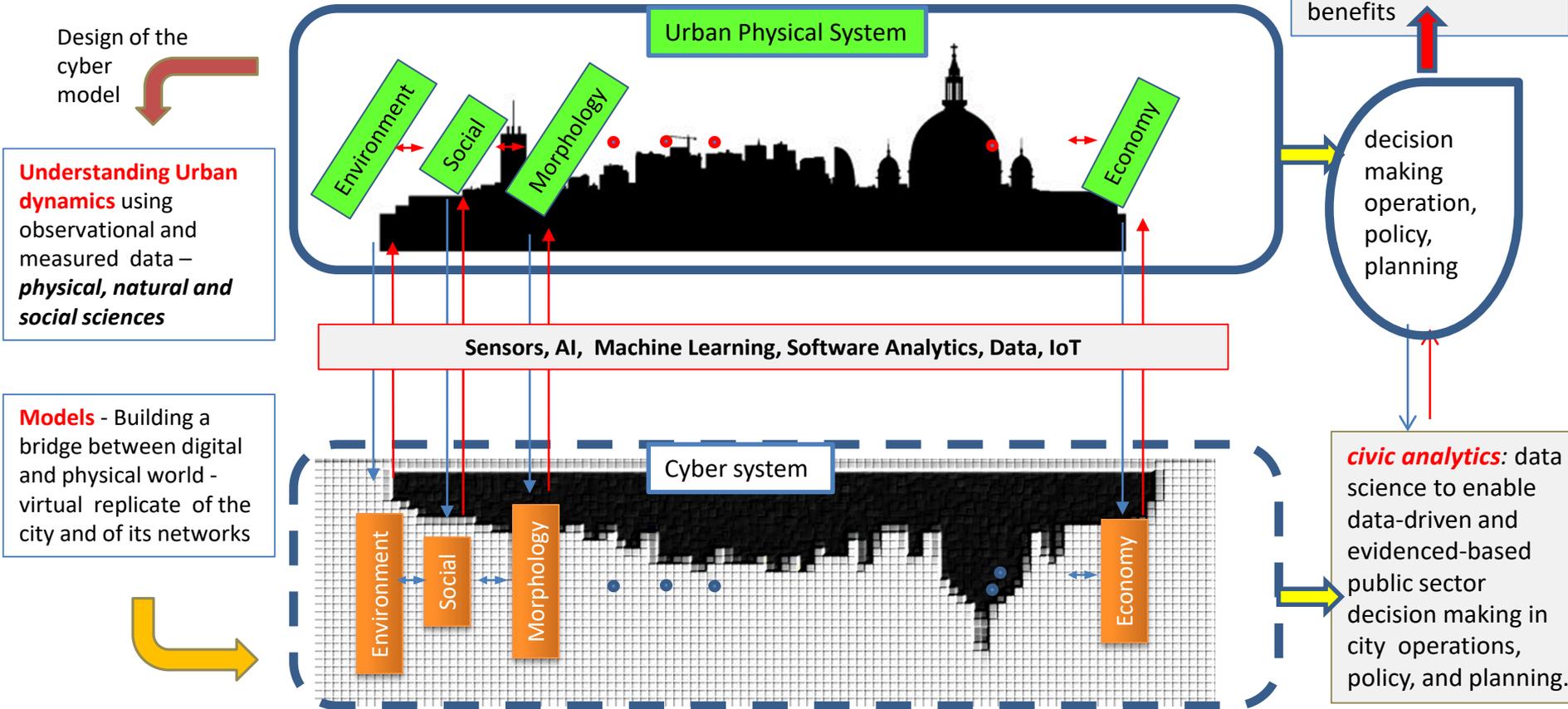
**DT:** living digital simulation models that update and change as their physical counterparts change.

- ❑ **Continuously learns and updates itself** from multiple sources to represent its near real-time status, working condition or position;
- ❑ **Learns from itself, using sensor** data that conveys various aspects of its operating condition from:
  - *human experts;*
  - *other similar machines;*
  - *other similar fleets of machines and;*
  - *the larger systems and environment in which it may be a part of.*
- ❑ **Integrates historical data from past** machine usage to factor into its digital model.

Industrial use - optimize the operation and maintenance of physical assets, systems and manufacturing processes.

**They are a formative technology for the industrial IoT, where physical objects can live and interact with other machines and people virtually.**

The **Digital twin** approach:  
*an architecture that senses and responds*



High Performance Computing

Predictive analytics technology

Study of urban phenomena through a **data science framework of urban sensing**, data mining and integration, modeling and analysis, and visualization to generate new insights that simultaneously advance methods in computational science and address domain-specific urban challenges.



# Controllo della qualità urbana e sostenibilità

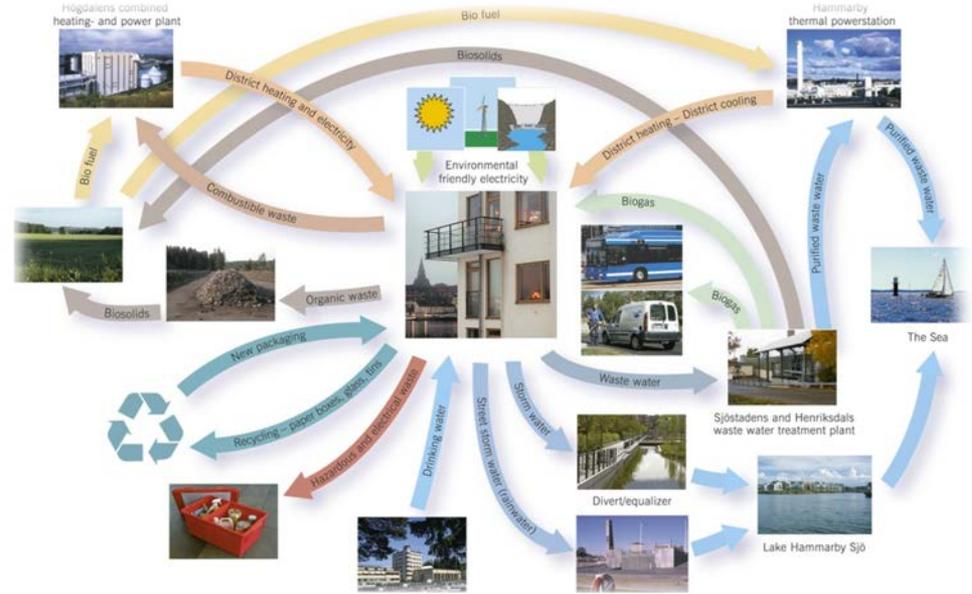
## Approccio

Multidimensionale

Integrato



Diagramma esplicativo del significato di sostenibilità



Modello di ciclo sostenibile delle risorse " di Hammarby

Qualità della vita



Innovazione tecnologica



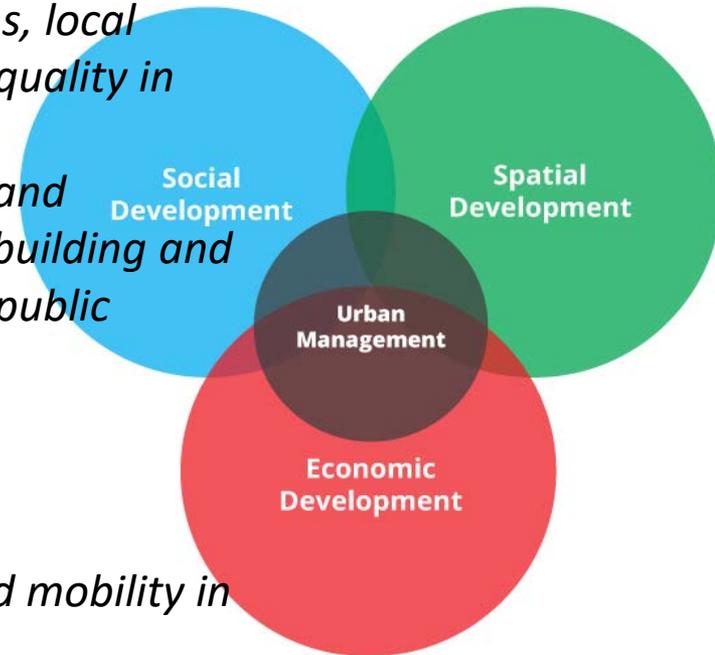
**WISH** - An interdisciplinary hub for CNR researchers working on Urban Complexity  
Expert in : Complex systems, ICT, City Planning, Sociology,  
Economy, Data Analysis, Environment, Cultural and Human sciences...

## Urban energy dynamics.

- *How do physical infrastructure, socio-economic conditions, local ecology, and human behavior impact energy use and air quality in cities?*
- *How can we utilize data-driven, evidenced-based design and planning strategies to maximize energy efficiency at the building and district scale, while reducing air pollution and improving public health?*

## Urban social-ecological-technical system dynamics.

- *What makes an urban place “successful”?*
- *Can we quantify the factors that drive human activity and mobility in diverse urban environments?*
- *Why and how does the environment in which you live affect your quality-of-life?*



# Secure Infrastructures



The tragedy of the Morandi Bridge: The bridge is part of the Polcevera viaduct on the A10 motorway connecting Italy to France.

The viaduct was built between 1963 and 1967, the bridge was named after its designer, Riccardo Morandi.

On 14 August 2018, the bridge partially collapsed, killing 43 people

# Secure infrastructures: how it works

Intelligent digital platform

*Initial results on*

**Administrative data:**  
type, drawings, age,  
materials, etc.

**Seismic hazard map**

**Hydrogeological  
hazard map**

**Satellite data:**  
Information about  
ground deformation

List of possible "critical"  
infrastructures

**Inspections check list  
standardization**

**In situ inspections:**  
maintenance,  
working conditions,  
current loads, etc.

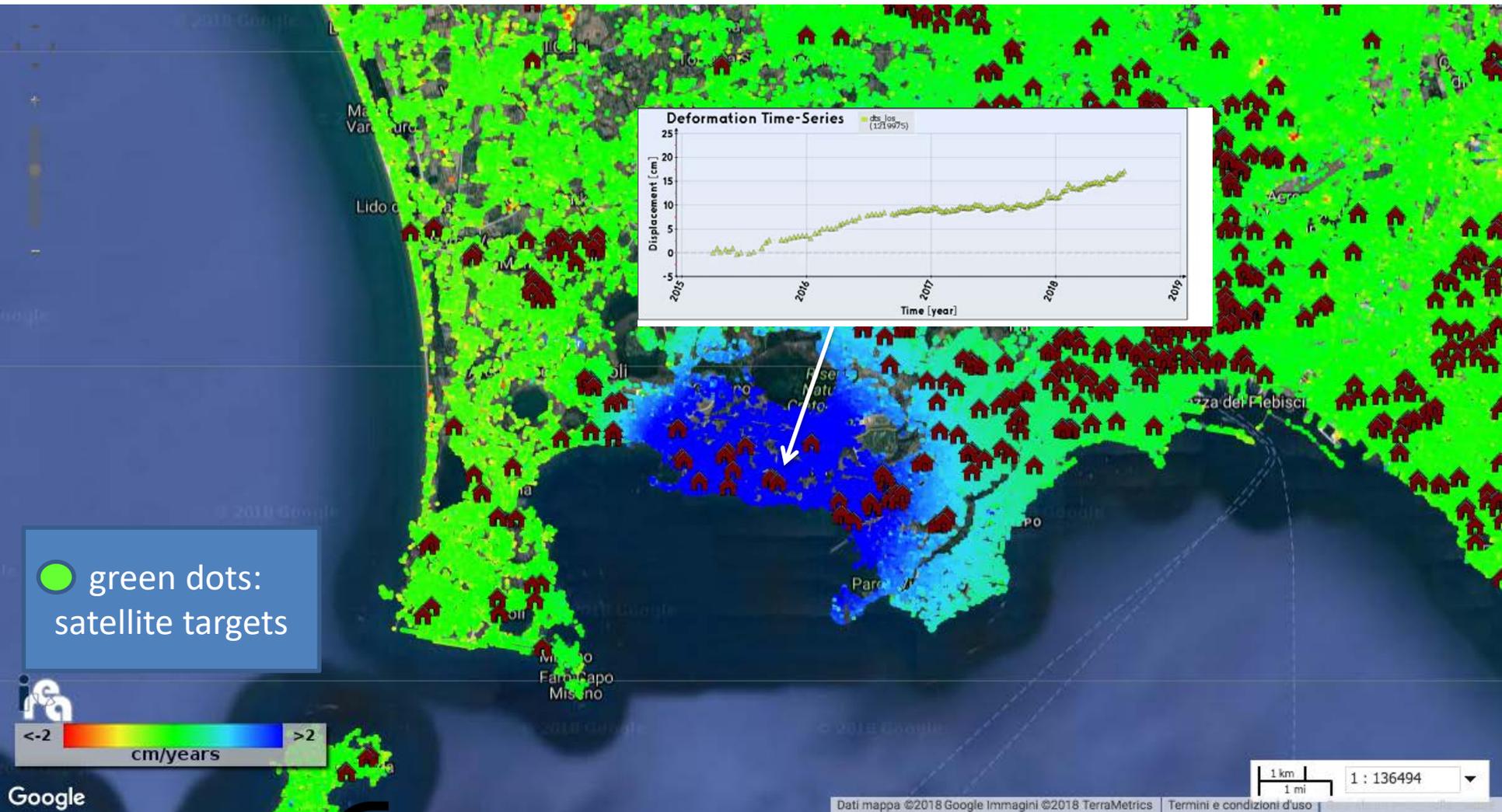
**Sensors distribution  
& data gathering**

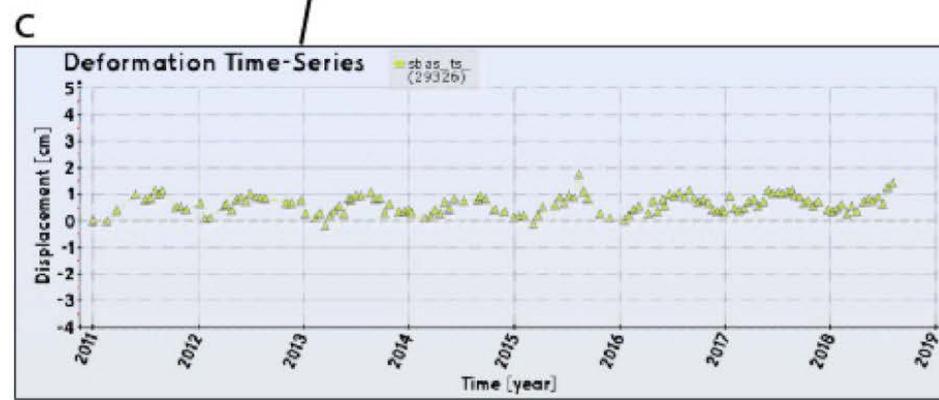
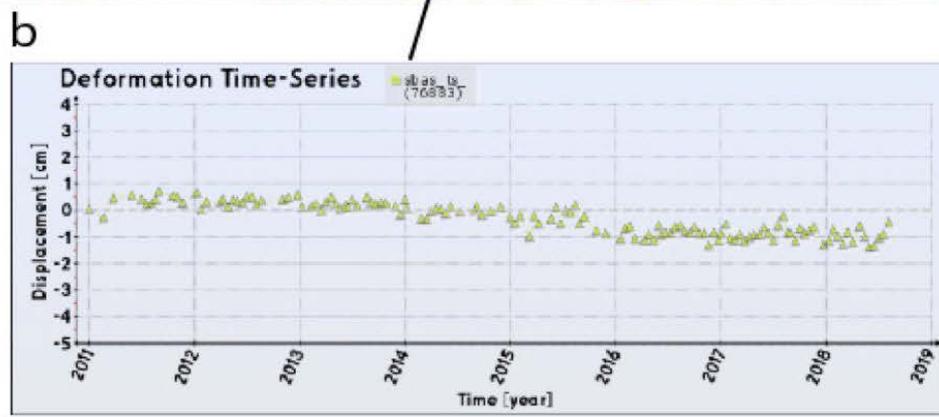


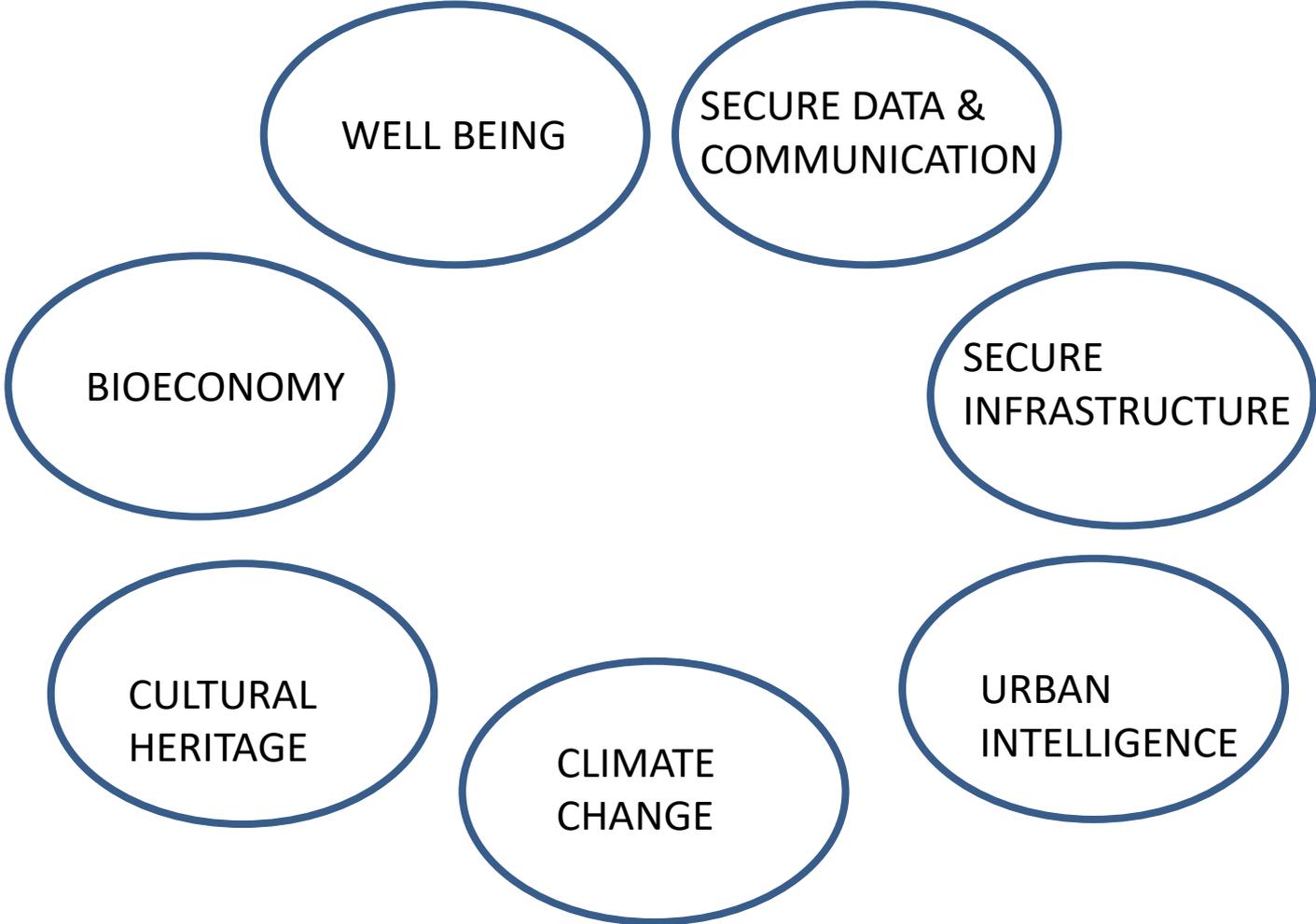
# Italy geocoded deformation velocity map with, superimposed, all the schools and educational buildings



# A zoom around the gulf of Pozzuoli







WELL BEING

SECURE DATA &  
COMMUNICATION

SECURE  
INFRASTRUCTURE

URBAN  
INTELLIGENCE

CLIMATE  
CHANGE

CULTURAL  
HERITAGE

BIOECONOMY