

INTERCONNECTED NORD-EST INNOVATION ECOSYSTEM 2023-2025

Spoke 4. City, Architecture and Sustainable Design
Task RT2.3 Heritage, Recovery, Conservation

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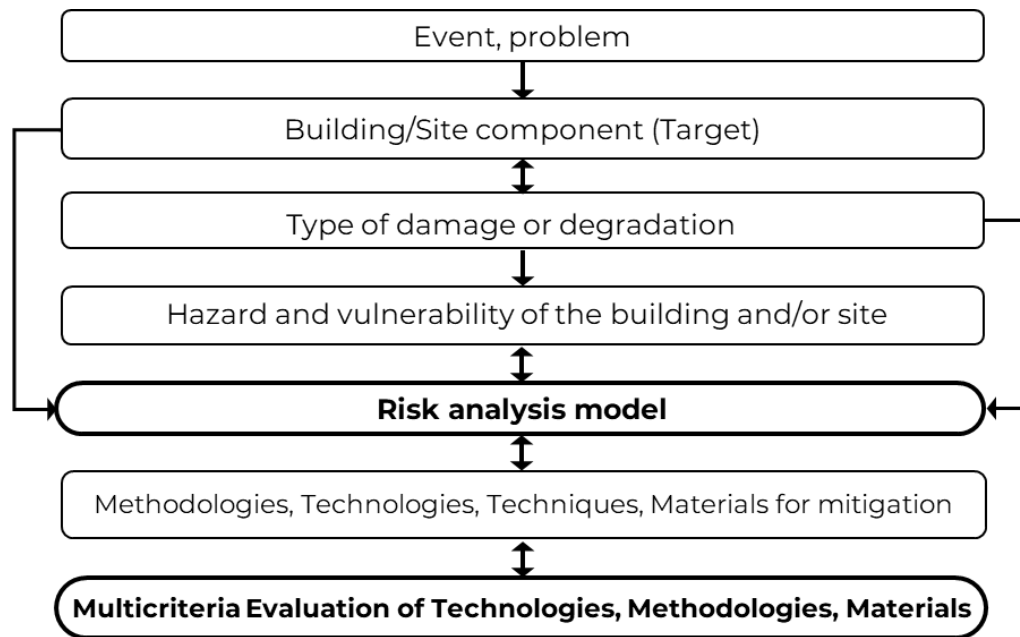
i NEST is a new model of **innovation ecosystem** that concerns areas of technological specialization consistent with the industrial and research vocations of the reference territory. It intends to promote and strengthen collaboration between the **research system**, the **production system** and **territorial institutions**, with a view to economic, social and environmental **sustainability**.

It is made up of **24 universities, foundations and research institutions**, with **9 Spokes and 44 affiliations**.

Spoke 4 City, Architecture and Sustainable Design is dedicated to sustainable design strategies for the care and maintenance of the built environment considering the **energy transition** and **resilience** towards **environmental risks**.

Task RT2.3 Heritage, Recovery, Conservation identifies the processes of safeguarding and restoring the **historical heritage**, considering the **energy and digital transition**, the **socio-cultural value and the use of the asset**.

Integrated risk analysis and mitigation system



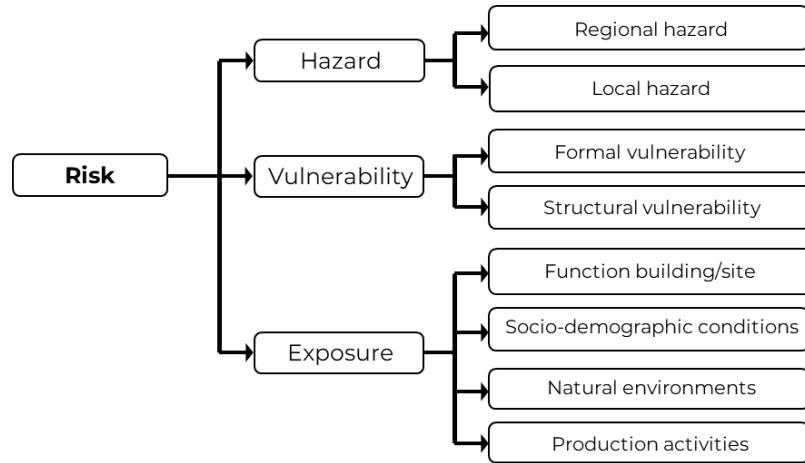
Task 2.3 **Heritage, Recovery, Conservation** has implemented an **integrated system** of risk and damage and degradation analysis, methodologies and technologies for the conservation and improvement/adaptation of the **historical, architectural and urban heritage**.

The system will be able to suggest prevention actions to **reduce vulnerability, improve resilience, energy performance** and use of buildings, also considering the **post-event emergency** phase.

The tools developed in the research concern **macro-events** (earthquakes, floods, urban heat islands - linked to the theme of energy efficiency of buildings, fires), and actions that cause localized **damage and degradation**.

Hazards and vulnerabilities are assessed using a **multi-risk analysis model** and are correlated with the most appropriate **methodologies and technologies**. The assessment of intervention options can be supported by decision-making aid tools such as **multi-criteria analysis**.

Multi-risk analysis model



A **multi-risk analysis model** has been developed to assess the *hazard of sites* and the **vulnerability of buildings**.

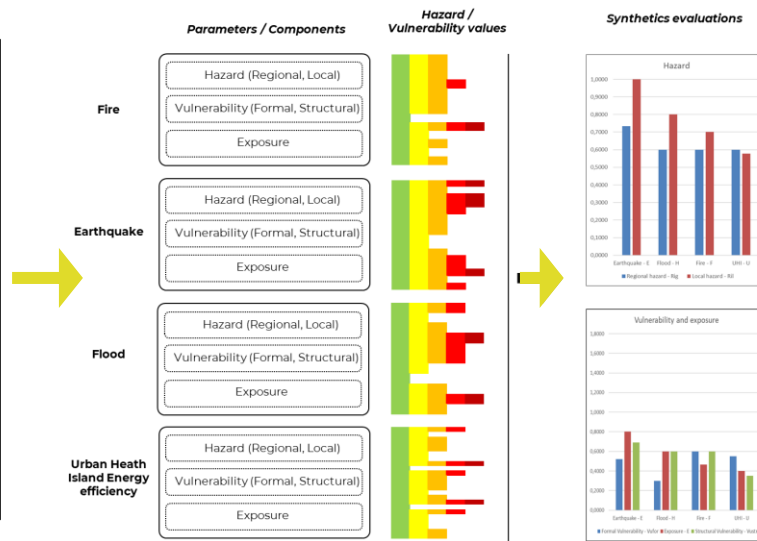
The model is based on **parameters and indicators** to measure:

- the **hazard** at regional and local scale;
- the **vulnerability** (formal and structural) of the building and its components;
- the **exposure**.

The model is implemented with :

Detection sheets, in which the characteristics of hazard and vulnerability are described, based on analysis of the building and the site, use of maps, models, etc.

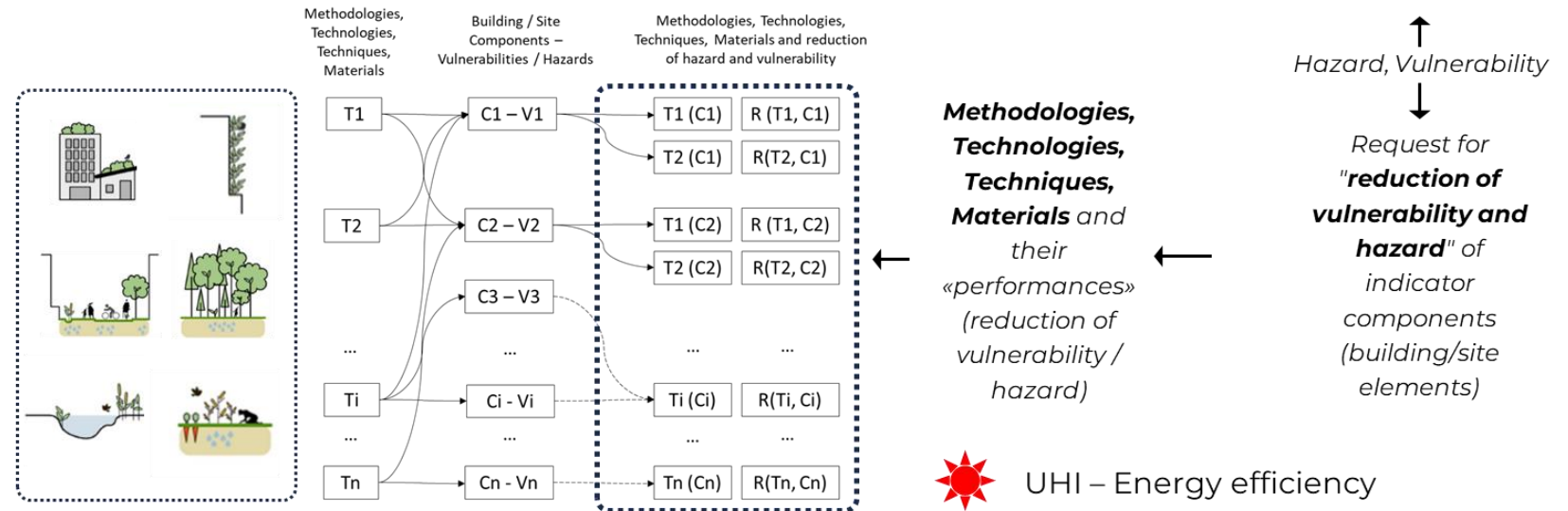
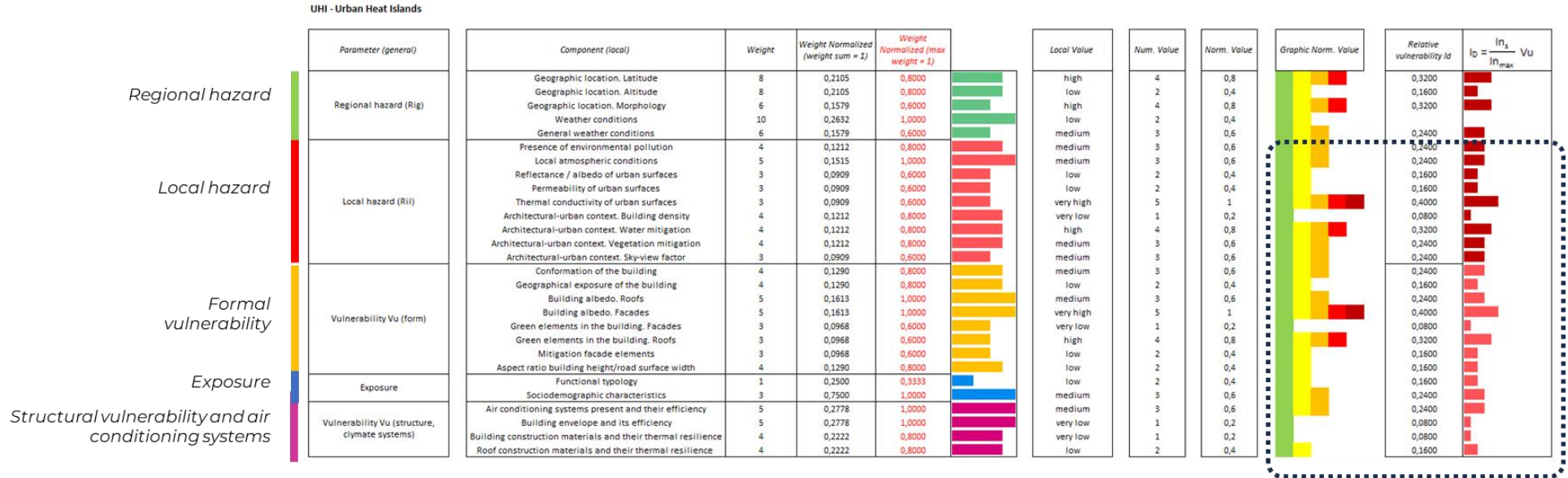
Information **processing platform** (implemented in EXCEL), in which the information from the cards is reported, and *relative hazards and vulnerabilities* are calculated (depending on the impacts of the events foreseeable on the site); *summary assessments* are also provided, by type of event



Risk analysis and mitigation techniques/methodologies

The **hazards and vulnerabilities** of the building and the site are related to the **methodologies and technologies** that allow the **mitigation** of impacts, damages and degradations.

The example concerns the problem of **UHI-heat islands and energy efficiency of buildings**.



The value of cultural heritage

For cultural heritage, **the value of the building is important in the decision-making process** of adaptation and maintenance.

- **Economic value** (reconstruction cost, etc.)
- **Social/cultural value** of the building/site



1. **Objective** aspect

- historical-artistic importance of the building and any artistic assets present.
- local/national/international recognition (e.g. UNESCO sites, etc.)
- function of the building (religious, civil, cultural, etc.)

2. **Subjective** aspect (perception of the **increase in the quality of the place** – «*residential satisfaction*»).



«**Environmental Psychology**», «**Restorative design**»

- **Buildings and historic centers**, equipped with effective function/use, are often places of "**social aggregation**" in which the inhabitants can recognize "**identifying elements**" and "**sense of belonging**" to a community and contribute to the consistency of its "**social organization**".
- **Historic buildings and sites** sometimes relate to a **significant environment** (system of squares, streets, etc.), or to «Green» and «Blue» (Green/water) elements, natural or artificial, which can increase the quality of their enjoyment.

Risk analysis and mitigation actions for macro-events

A system for the resilience of historical heritage.

Conclusions and future developments

The iNEST Project developed an integrated system to analyze risks and identify tailor-made solutions for the **adaptation, improvement and mitigation** of damage and degradation on buildings and historical sites with regard to natural events and those resulting from climate change.

The system integrates **technologies, context and sustainability**.

The tools are **adaptable on a building, urban and territorial scale**.

It is a **expeditious** but sufficiently in-depth, **replicable, scalable and flexible** model, designed for the challenges of **ecological transition** and **sustainable enhancement** of heritage.

Its potential can grow with **collaboration between institutions, technicians and local communities**.

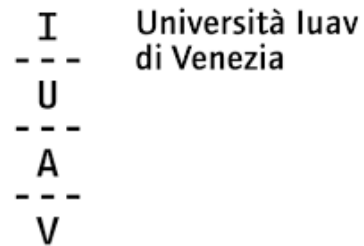
Tests on **case studies** and further developments of the tools are underway.

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