

/ CONTEXT AND GOAL

Context

Buildings and urban projects stakeholders must consider various challenges during the decision process, such as :

- ❖ Human security, health, well-being and affordability,
- ❖ Energy and materials consumption,
- ❖ Climate change mitigation and adaptation,
- ❖ Biodiversity conservation and restoration.



These challenges are interdependent: human activities have impacts on resource consumption, climate change and biodiversity while the latest are essential for human security, health, well-being and affordability.

Bottlenecks

Knowledge gaps on the integrated assessment that considers the various challenges and both impacts and benefits of the different solutions and scenarios.

Lack of operational science-based tools for urban stakeholders.

Keys

- Co-design of solutions involving all the concerned stakeholders.
- Support harmonisation and interoperability of decision tools, based on ontologies and data mesh approach.

Objective

The main objective of the **WILSON** project is to enable more efficient and sustainable data use in the built environment by leveraging cutting-edge technologies & innovative management practices.

Use Cases

The set of innovations developed during WILSON project will be tested via 8 representative use cases addressing different target groups and needs:

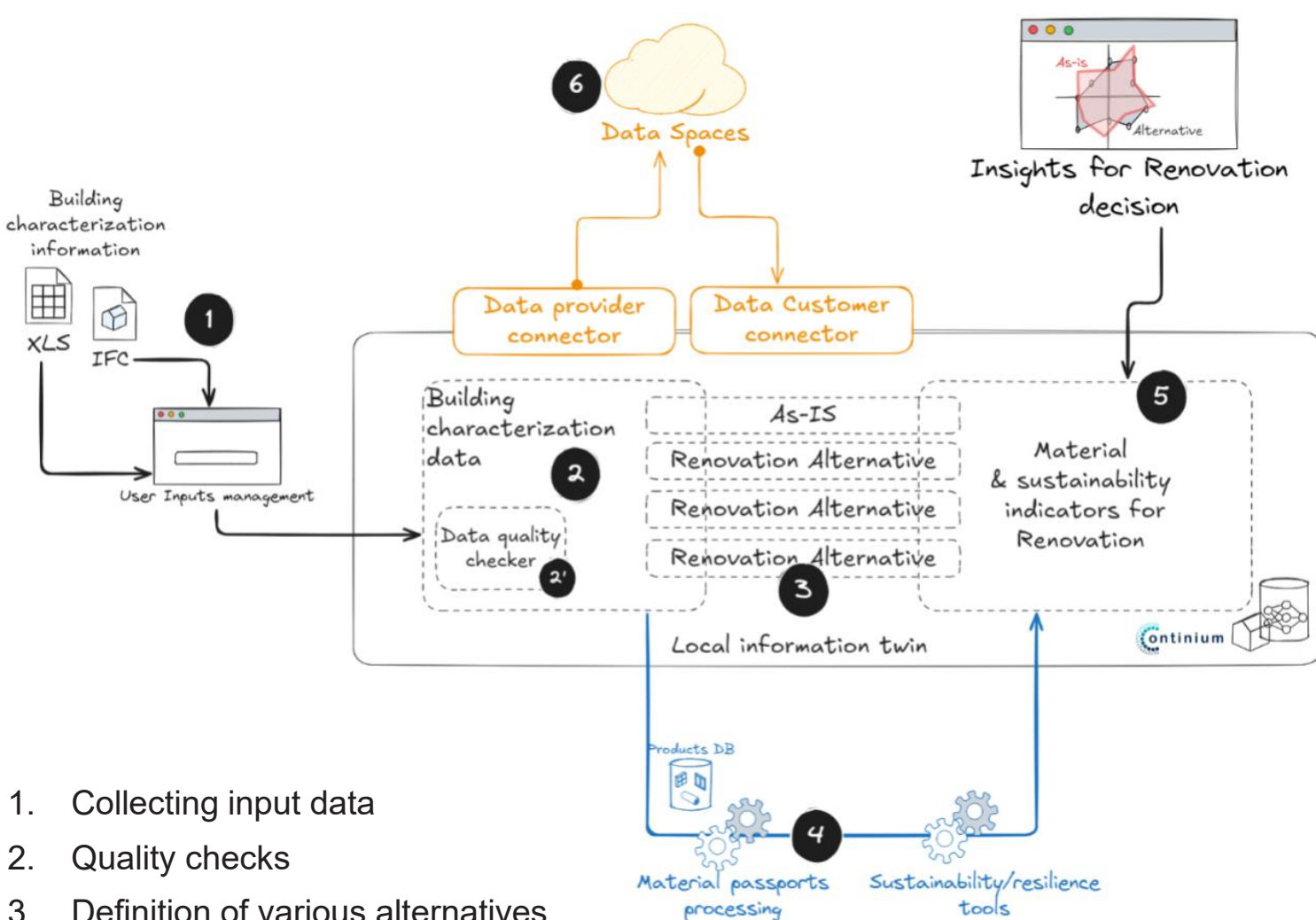
- UC1 Decentralised multi-source data management,
- UC2 Energy monitoring and optimization,
- UC3 Data-driven network asset management,
- UC4 Predictive maintenance,
- UC5 Risk, resilience and biodiversity nexus,
- UC6 Renovation planning and design,
- UC7 Techno-economic investment planning for property owners,
- UC8 Boost of green energy investments by market actors.

This poster focuses on two Use Cases applied on the front runner pilot in Italy:

- **Risk, Resilience and Biodiversity Nexus (UC5)**
This UC concerns climate change mitigation, adaptation and biodiversity nexus based on a comprehensive analysis at building and district levels. Based on the WILSON innovations, urban stakeholders can proactively plan for various scenarios and improve their resilience while reducing their environmental impacts.
- **Renovation Planning and Design (UC6)**
This UC applies methodologies to assess project performance, considering the sustainable use of resources to plan deep renovations integrating circular economy principles into the planning and design process.

/ METHODOLOGY

From on-site data to decision support by using a Digital Twin-centred platform that unifies heterogeneous data sources into a single semantic framework.



1. Collecting input data
2. Quality checks
3. Definition of various alternatives
4. Activation of simulation tools to produce the material passport
5. Storage of indicators within the local information twin
6. Integration with other external services/domains

/ PILOT : FORMER CASERMA PAPA

WILSON provides innovations to support decision-making when selecting the final project among various alternatives

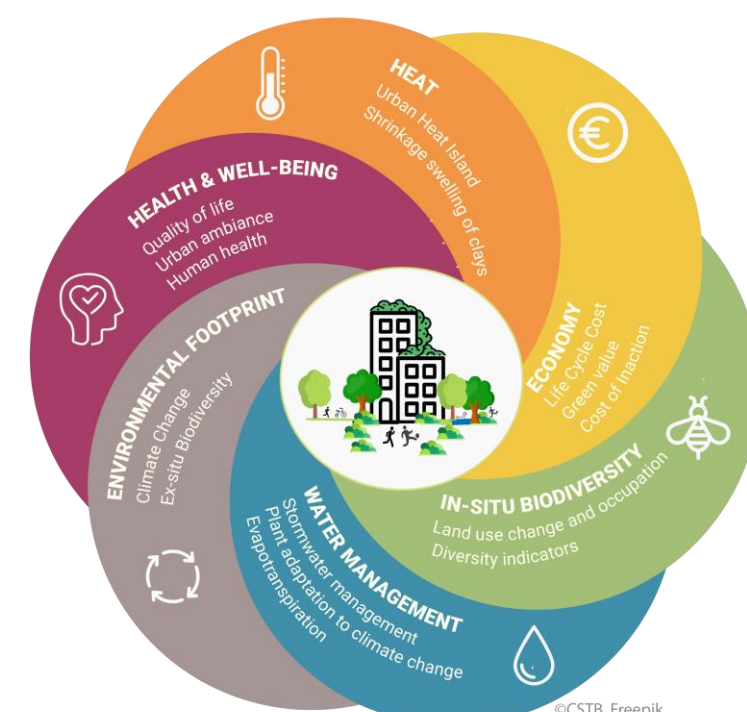


Located in Brescia, this pilot project involves significant renovations of a 39,000 m² area in the city center, known as “ex-caserma Papa,” owned by Agenzia del Demanio (ADD). The site includes both new constructions and renovations to enhance efficiency and utility for offices and residential buildings.

/ INNOVATIONS

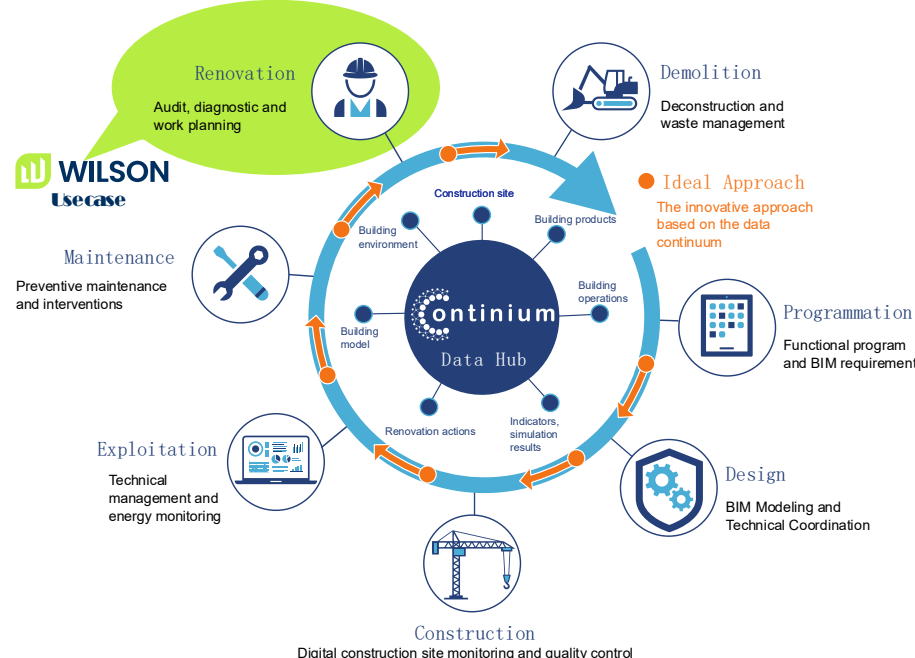
HIBOU and its Urban Nature Platform

An integrated method for the Hybrid assessment of the Impacts and Benefits of the Nature-Based sOolutions in Urban system.



Method and digital tool to assess the efficiency of Nature-Based Solutions (NBS) for urban projects, either in comparison to or in synergy with their alternatives, to address various urban challenges such as environmental footprint, biodiversity, water and risk management, well-being, and the economy.

CONTINIUM for the data management



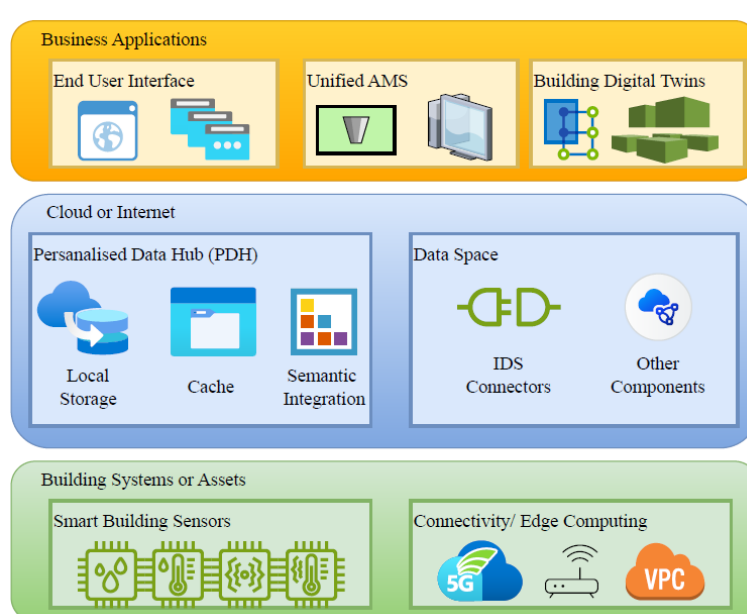
Continium is a centralized digital twin repository that harmonizes heterogeneous building data into a coherent semantic representation to power engineering calculations and facilitate traceability through digital passports.

Risk and resilience tool



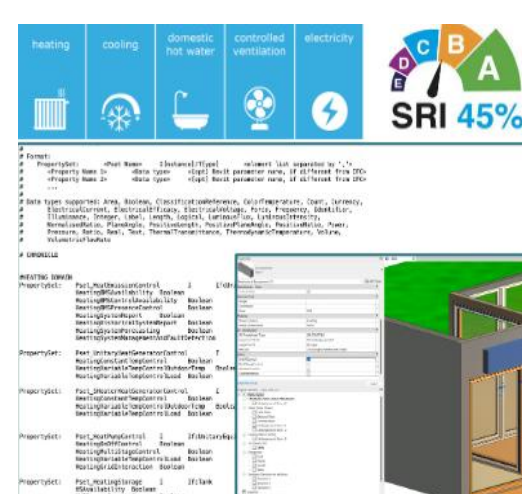
The Risk and Resilience Tool integrates hazard, exposure, and vulnerability assessments to evaluate climate and natural risks affecting buildings and urban assets. It quantifies impacts, identifies critical components, and supports the prioritization of adaptation strategies to enhance robustness, functionality, recovery capacity, and long-term sustainability.

Personalised Data Hubs (PDHs)



The WILSON project includes the use of Data Space technology (right in Fig.) and PDH technology (left in Fig.). A single PDH is available per building and serves as an access point to relevant data for external stakeholders that are connected to the WILSON data space.

BIM-enabled SRI calculator



The BIM-enabled Smart Readiness Indicator (SRI) calculator is a tool that advances smart building assessments by integrating building data, lifecycle indicators, and digital twin services. For the Italian Pilot, its key value lies in risk mitigation: it acknowledges potential discrepancies between design-phase assumptions and actual post-renovation performance. Once operational data becomes available, the tool will enable future recalibration.

/ ACHIEVEMENTS AND NEXT STEPS

- Significant improvements have been made to the HIBOU-related KPI calculation models, including biodiversity indicators, LCA-based KPIs, and Urban Heat Island (UHI) assessment through enhanced thermal modelling that better captures the specificities of NBS.
- Most of these developments have now been fully operationalised within the Urban Nature Platform, enabling their practical calculation and application.
- CONTINIUM implements Linked Data principles and can, via an API, transmit information to simulation tools and retrieve their calculation results (KPIs). This approach is aligned with the PDH concept..
- The methodology for the Risk and Resilience tool has been developed, and implementation is currently underway.
- KPI calculations are ongoing; additional improvements and replication guidelines will be provided.

/ MORE INFORMATION

WILSON : Distributed Data Modelling and Federated Digital Twinning for Lifecycle Data-Driven Sustainable Operation and Management of Buildings and Districts <https://wilson-project.eu/>

Schiopu N, *et al.* HIBOU - An integrated method for the Hybrid assessment of the Impacts and Benefits of the nature-based sOolutions in Urban system, EGU25, Vienna, Austria, 2025 <https://wilson-project.eu/events-and-news/>

Sorin, E et al. Ontology-driven methodology and digital twin service to support integrated decisions for sustainable building renovation, Circular Economy – Interdisciplinary Conference, Toulouse, France, 2026 <https://ceic-2026-toulouse.fr/>

Sharma R. et al., SmartData Interlock: An Access Control Architecture and Data Exchange Model for Secure Data Ecosystem in Smart Buildings, IEEE Transactions on Privacy, 2026, <https://ieeexplore.ieee.org/document/11515005>

