

# ECTP Draft Strategic Research & Innovation Agenda 2030 (SRIA)

*Working document July 2023*



**ECTP**  
**INNOVATIVE BUILT  
ENVIRONMENT**

# Content of this document

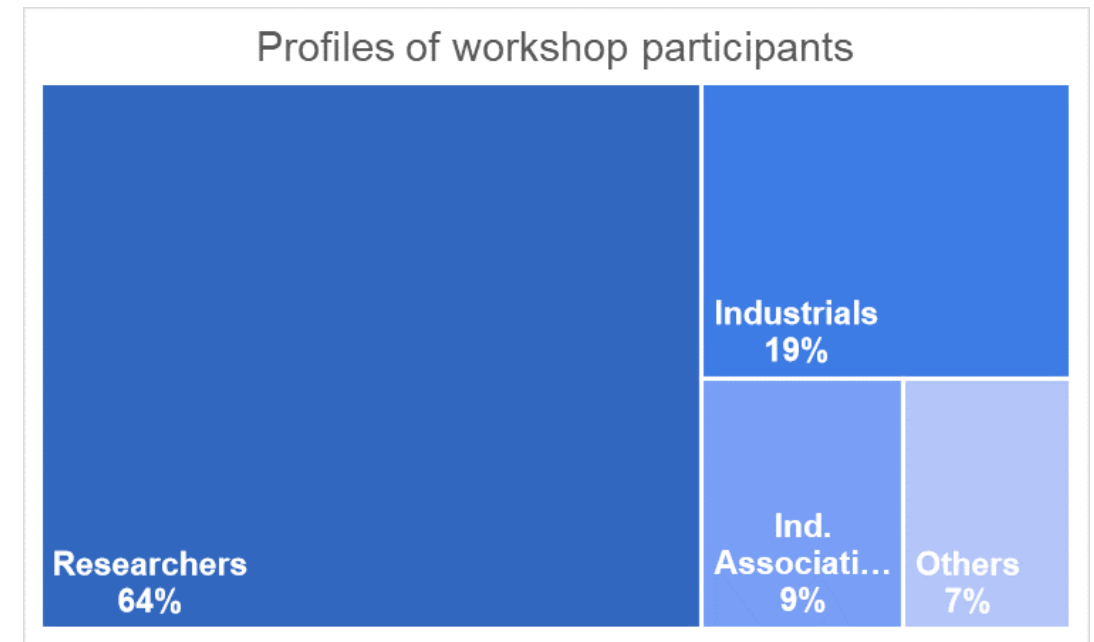
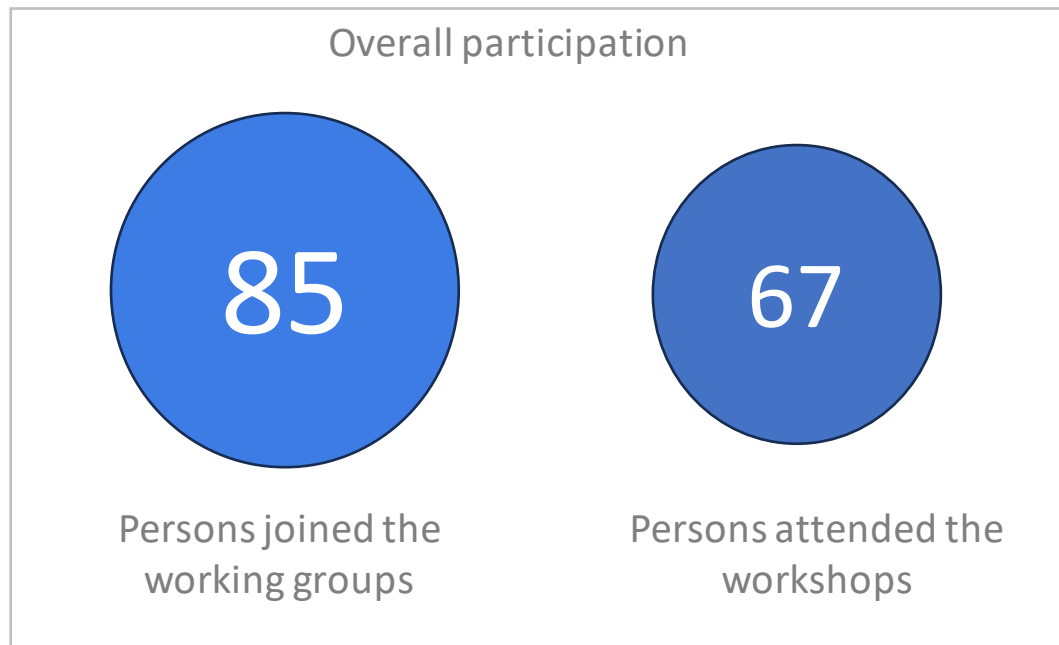
1. [Process implemented for the collaborative update of ECTP SRIA](#)
2. [Main changes in the technical, social & political context since 2018 \(previous SRIA\)](#)
3. [How the SRIA is organised](#): guidelines to read the next sections
4. [Overview and scope of the three Objectives 2030](#)
5. [Research & Innovation priorities for \*\*Objective 1\*\*: Resilient, decarbonised, adaptative and regenerative Built Environment](#)
6. [Research & Innovation priorities for \*\*Objective 2\*\*: Enriching, inclusive and health-improving Built Environment](#)
7. [Research & Innovation priorities for \*\*Objective 3\*\*: Competitive, digitalised and circular value chain](#)
8. [How to provide feedback on this draft?](#)

# 1. Process implemented for the collaborative update of ECTP SRIA



# 1. Process implemented for the collaborative update of ECTP SRIA

## Participation of ECTP members to the SRIA update process



Good balance of participation between the three working groups

# 2. Context, challenges and drivers in 2023

Some key changes since the 2018 SRIA:



## A pandemic:

- Deep changes in living patterns (work/home, mobility, health)
- Disruptions in supply chains
- Need to prepare for the next one ☹️

## War in Ukraine and overall geopolitical situation

- Drastic increase of energy prices
- Concern about security of energy supply
- More disruptions in supply chains, world competition on raw materials



## Intensification in extreme weather events:

- 2022 summer was the hottest ever in Europe
- Floods, droughts, megafires...



## Uptake of AI and automation

- AI computing power doubling every 3.4 month
- Share of AI-patent filings almost tripled since 2019



## Uptake of EVs

- Explosion of sales since 2019 (x6 in EU)
- Charging infrastructure lagging behind in most EU countries

## 2. Context, challenges and drivers in 2023

Some remaining challenges still to be addressed:

- Decarbonise the built environment
- Digitalise and integrate the construction industry
- Ensure security of citizens against physical and cyber threats
- Contribute to social cohesion, citizen wellbeing
- Address talents and skills shortage
- Address ageing of infrastructures
- Preserve and valorise cultural heritage
- Address ageing of population
- ...

# 2. Context, challenges and drivers in 2023

## A very rich EU policy & regulatory landscape

### A lot of regulatory changes launched since 2019...

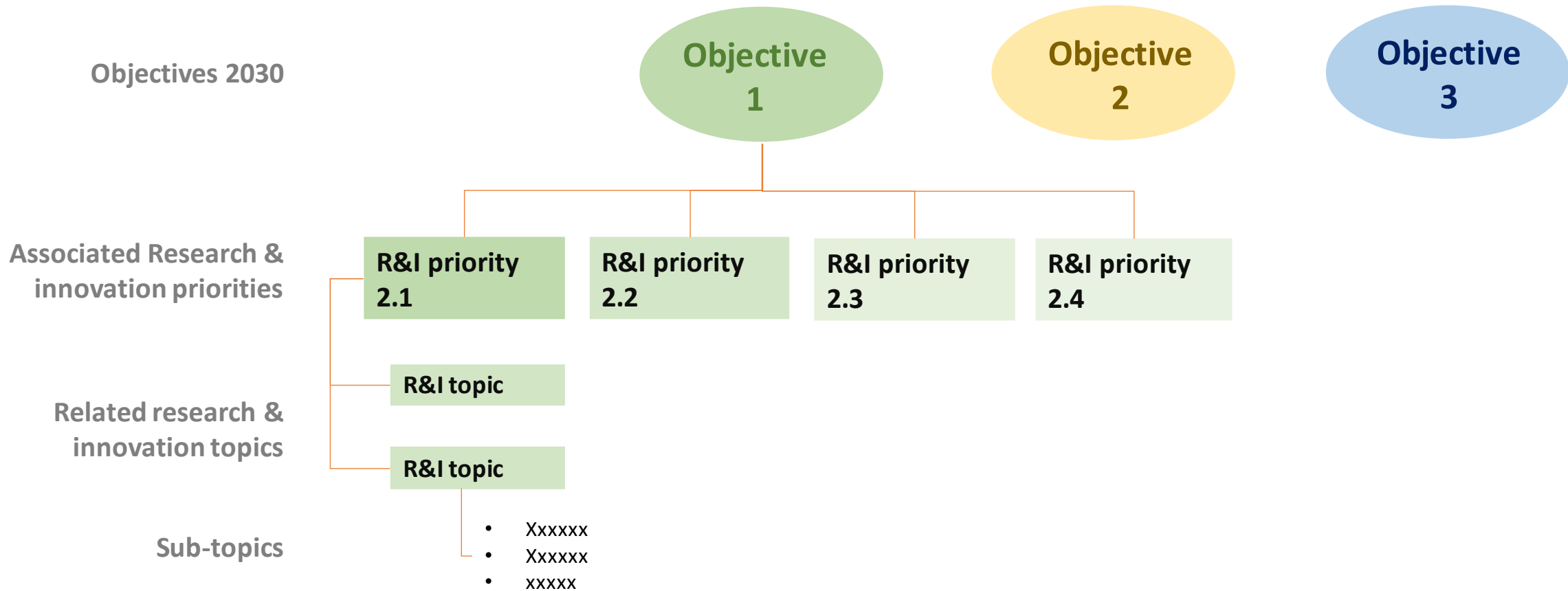
- EU Green Deal and Fit for 55 Package: revision of EED and RED, of Alternative Fuels Infrastructure Directive, ...
- Recast of the EPBD
- Revision of Ambient Air Quality Directives
- Revision of Combined Transport Directive and Intelligent Transport Systems. TEN-T revision
- Reform of the electricity market design
- Revised Construction Products Regulation
- Proposal for a European Critical Raw Materials Act and Net-Zero Industry Act
- Water Reuse Regulation
- Revision of Urban Waste Water Treatment Directive
- Nature Restoration Law
- EU Taxonomy, for sustainable investments
- Data Governance Act, Cybersecurity Act, NIS2 Directive
- Artificial Intelligence Act, AI liability Directive

### ...supported by ambitious policies, strategies & initiatives

- Circular economy action plan
- Zero Pollution Action Plan
- Sustainable and Smart Mobility Strategy
- Renovation wave strategy and action plan
- New European Bauhaus (enriching, sustainable, inclusive)
- EU Biodiversity Strategy for 2030
- EU Pollinators Initiative
- Green Infrastructure Strategy
- Adaptation Strategy
- Common European Data Spaces (cultural heritage, energy)
- Level(s) framework
- GPP Criteria
- Transition pathway for Construction

# 3. How the SRIA is organised: guidelines to read the next sections

## Structure of the overall SRIA:





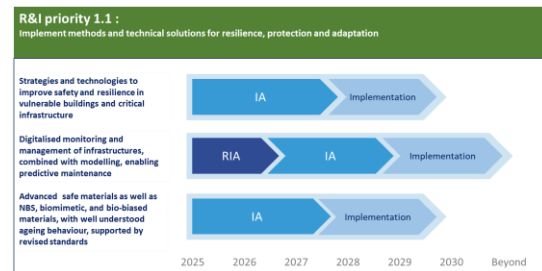
# 3. How the SRIA is organised: guidelines to read the next sections

## Structure within each Objective 2030:

### Overview of Research and Innovation (R&I) priorities (1 slide)

Objective 1: Resilient, adaptive, decarbonised and regenerative Built Environment			
<b>R&amp;I priority</b>	<b>1.1 Implement methods and technical solutions for resilience, protection and adaptation</b>	<b>1.2 Make solutions for building renovation and decarbonisation more affordable and easier to implement</b>	<b>1.3 Demonstrate solutions for better building/ infrastructure integration into energy and mobility networks</b>
<b>Associated R&amp;I topics</b>	Strategies and technologies to improve safety and resilience in vulnerable buildings and critical infrastructure Digitalised monitoring and management of infrastructures, combined with modelling, enabling predictive maintenance Advanced safe materials as well as NBS, biomimetic, and bio-based materials, with well understood ageing behaviour, supported by revised standards	Identification and implementation of decarbonisation pathways for the EU building stock Modular, energy efficient, low-carbon solutions for renovation and extension User-centric optimisation of operating life phase of buildings and infrastructures with active control or self-regulation	Integration of RES production (electricity, heat, ...), H2 and local storage in the built environment Smart-network ready buildings, locally optimised and providing flexibility to the energy networks Integration of the built environment, in particular infrastructures, to the mobility network
	<b>1.4 Demonstrate regenerative and frugal designs, integrating NBS and considering adaptability and life cycle</b>		Frugal and adaptable designs Renovation and circularity at building and district scale for positive impact on the environment Tools, education and regulatory frameworks for improved market uptake

### Timeline of each R&I priority and the associated topics (4 priorities = 4 slides)



### Details of each R&I priority and the associated topics (4 priorities = 4 slides)

**R&I priority 1.1 : Implement methods and technical solutions for resilience, protection and adaptation**

**R&I topic 1.1.1:** Strategies and technologies to improve safety and resilience in vulnerable buildings and critical infrastructure  
Aim: urgently improve safety and resilience in vulnerable buildings and infrastructures

**R&I topic 1.1.2:** Digitalised monitoring and management of infrastructures, combined with modelling, enabling predictive maintenance  
Aim: develop and predictive maintenance for infrastructures to reduce failures and increase resilience to hazards

**R&I topic 1.1.3:** Advanced safe materials as well as NBS, biomimetic, and bio-based materials, with well understood ageing behaviour supported by revised standards  
Aim: ensure the integration of materials that can improve resilience to climate change and hazards

**Subtopics:**

- Develop new methods and advanced sensors for infrastructure monitoring (e.g. quantum sensors, IoT, drones, fibre optics, remote sensing) (TLE 4 → TLE 8 by 2030)
- Develop Digital Twins combined with VBA, AI analysis, for predictive risk assessment, event management, post event evaluation (TLE 4 → TLE 8 by 2030)
- Develop self-healing materials and tools for predictive maintenance of buildings and infrastructures (e.g. transport and self-healing repairing coatings) (TLE 4 → TLE 8 by 2030)

**Subtopics:**

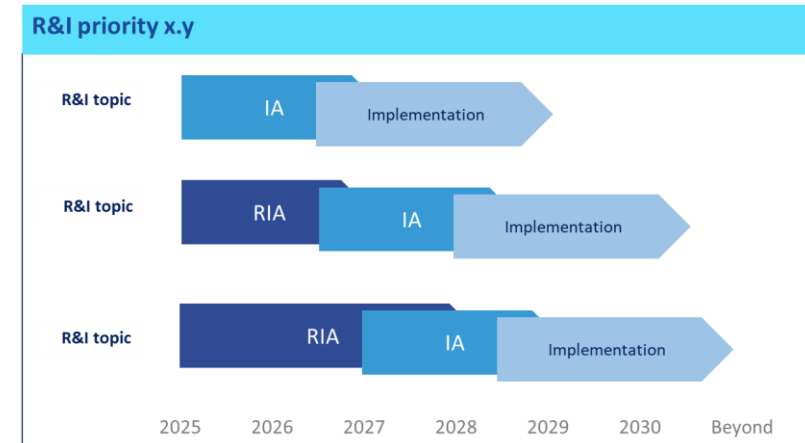
- Demonstrate durable and safe bio-based materials and smart materials (e.g. smart concrete, reinforcement, thermostats, phase change, biomimetic materials...) that can increase the resilience of the built environment and its occupants (TLE 5 today → TLE 8 by 2030, S&S to S&S by 2030)
- Develop and implement new accelerated ageing protocols for biomimetic/ inspired materials and components (TLE 5 today → TLE 8 by 2030) to better understand their long-term behaviour
- Adapt standards to account for new findings on the use of materials, their recycling, circular bio-based and NBS, but also changing conditions (climate, extreme events...) (TLE 4 → TLE 8 by 2030)

22

# 3. How the SRIA is organised: guidelines to read the next sections

## How to read the timeline of each R&I priority

- The **current maturity** of concepts/innovations is assessed (considering ongoing Horizon Europe calls 2023-2024): it is the starting point of each arrow
- A **maturity roadmap** is represented using the key European funding instruments: the arrows "RIA" and "IA" correspond to the years of implementation of projects (the related Horizon Europe calls are released during the previous year(s))
- Each R&I topic includes several subtopics with varying maturity levels, which explains the overlap between arrows



- **RIA**: *Research and Innovation Action, covering TRL 2-3 to TRL 5 (Applied research, proof of concept...)*
- **IA**: *Innovation Action, covering TRL 5 to TRL 7 (prototype, demonstration)*
- **Implementation and scale up**: *covering TRL 7 to TRL 9 (Coordination and Support Actions, LIFE, Innovation Fund, EIC Accelerator, Digital Europe)*

# 3. How the SRIA is organised: guidelines to read the next sections

The maturity of the concepts and innovations was assessed using two scales:

Used by the European Commission:

## Technology Readiness levels

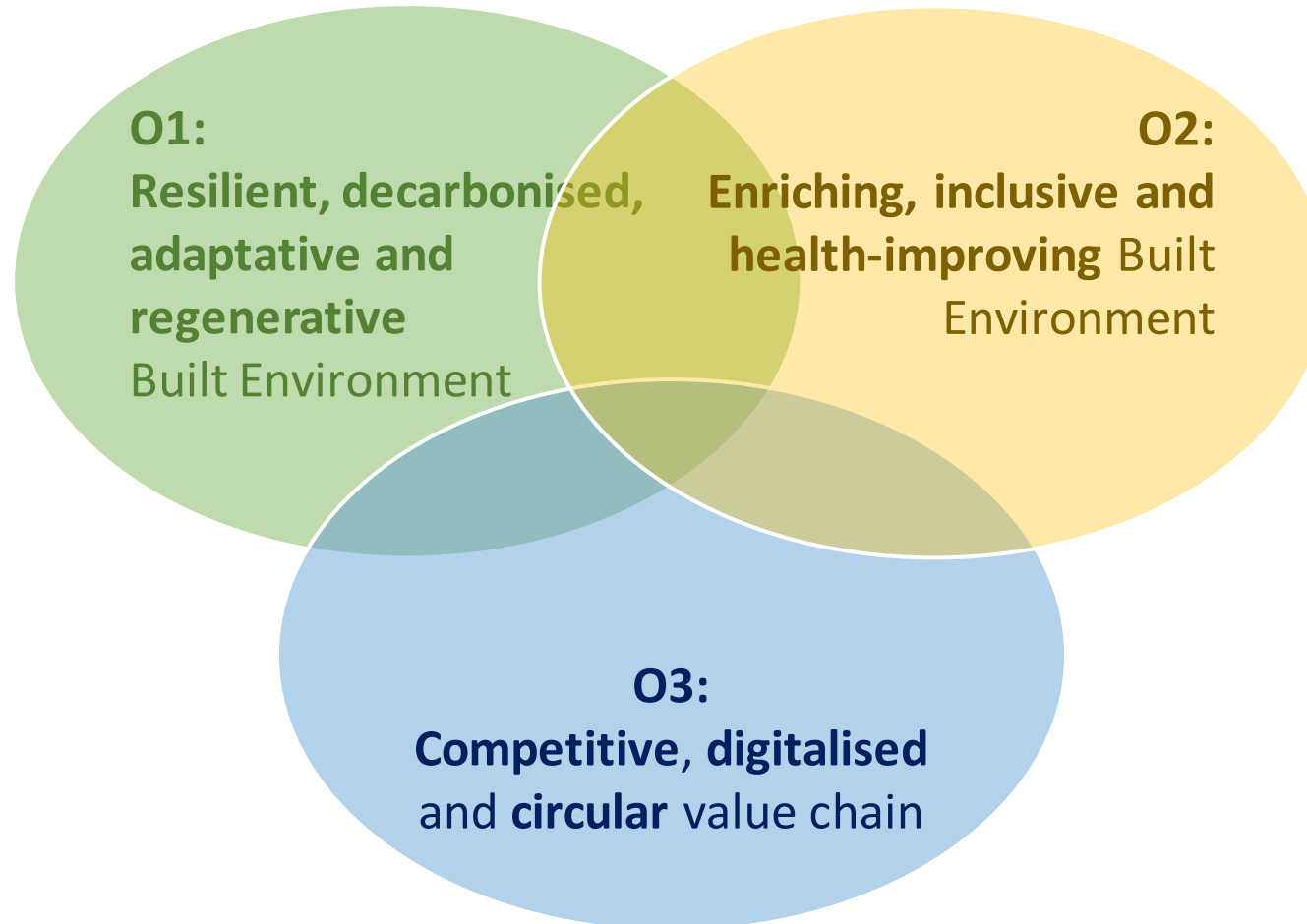
- TRL 1 Basic research, principles observed
- TRL 2 Technology concept formulated
- TRL 3 Applied research, proof of concept
- TRL 4 Small scale prototype
- TRL 5 Large scale prototype
- TRL 6 Prototype system
- TRL 7 Demonstrated system in operational environment
- TRL 8 First of a kind commercial system
- TRL 9 full commercial application

Proposed by [Innovation Fund Denmark](#) to assess the level of integration into the societal environment of an innovation:

## Societal Readiness Levels

- SRL1 Identification of the generic societal need and associated readiness aspects
- SRL2 Formulation of proposed solution and potential impacts; appraisal of societal readiness issues; identification of relevant stakeholders for the development
- SRL3 Initial sharing of the solution with relevant stakeholders: a limited group of the society knows the solution or similar initiatives
- SRL4 Solution validated through pilot testing: a limited group of the society tests the solution or similar initiatives
- SRL5 Solution validated through pilot testing in real environments by relevant stakeholders; the society knows the solution or similar initiatives but is not aware of their benefits
- SRL6 Solution demonstrated in real world environments with relevant stakeholders
- SRL7 Refinement of the solution; the society is completely aware of the solution's benefits, a part of the society starts to adopt similar solutions
- SRL8 Targeted solution, as well as a plan for societal adaptation, complete and qualified; society is ready to adopt the solution
- SRL9 The society is using the solution available on the market

# 4. The updated Objectives 2030



**O1:**  
**Resilient, decarbonised,  
adaptative and  
regenerative Built  
Environment**

## Scope of Objective 1

### *Safe & resilient:*

- People and infrastructures protection (safety & security)
- Resiliency and preparedness to climate change (altered conditions) and disruptive events (e.g. earthquake)
- Coping with uncertainty
- Preventive maintenance
- Seamless integration of buildings and infrastructures in cities for more resilience
- Safeguarding building value

### *Adaptative & flexible:*

- Adaptation to new technologies and usages
- Integration with the electricity grid: buildings as active nodes providing flexibility services
- Integration with other networks (DH&C, transport)
- Monitoring & optimization of operation of buildings and infrastructures

### *Decarbonised & regenerative:*

- Energy efficiency/ decarbonisation of the built environment
- BE as carbon sink
- Mitigation and regeneration (positive impacts) of environment & climate
- “Renaturation”

Cross cutting: Enabling conditions for market uptake

## Scope of Objective 2

### O2: Enriching, inclusive and health-improving Built Environment

#### *Enriching:*

- Cultural and creative industries as a resource for societal transformations and climate mitigation
- Building protection and adaptation strategies for CH
- Social resilience, sustainable behaviours and biodiversity to improve the quality of life and climate resilience of urban areas
- Continuity of service between private and public spaces, and urban-rural development
- Social return on investment in the B.E.
- New and sustainable business models

#### *Inclusive:*

- Affordable and equal B.E.,
- Equity for all gender, ages and ethnicity (universal design)
- Improved accessibility
- Co-design, human-centred approach and behavioural insights
- Going beyond human design: nature-inclusive, intergenerational design
- Fast adaptation to new needs, uses, or threats
- Flexible and adaptable built heritage to new needs and social patterns

#### *Health-improving:*

- Healthy, comfortable, protective and safe B.E.
- Built environment performance for health, wellbeing and human performance
- Healthy and age-friendly cities
- Adaptation of buildings and infrastructure for Active and Healthy Ageing
- Improved Indoor and outdoor Environment Quality
- New building typologies, urban and rural infrastructures for social and mental health
- Cultural assets as a vehicle of urban and rural regeneration

Cross-cutting: Adaptation and use of newly developed solutions in the B.E. | Urban and rural greening & Green infrastructures | Citizen empowerment



## Scope of Objective 3

### *Competitive:*

- Affordable and efficient processes
- Seamless supply of raw material
- Integrated services along the value chain
- Impact assessment
- Aesthetics, UX
- Safety

### *Digitalised:*

- Improved knowledge and processes thanks to data acquisition and use
- Integration of solutions/services, interoperability
- Automated and customizable processes
- Dynamic data management: Data availability, validation processes, validity and ageing management
- Value of digitalisation (social, economic)

### *Circular:*

- Maximisation of reuse and recycling/upcycling of materials
- Optimised use of local resources (human & materials)
- Sustainability by design
- Risk and safety management

Cross cutting: Skilled workforce | integrated business models

# 3. The updated Objectives 2030

## Overview of R&I priorities in each objective

### Objective 1: Resilient, adaptative, decarbonised and regenerative Built Environment

1.1 Implement methods and technical solutions for resilience, protection and adaptation

1.2 Make solutions for building renovation and decarbonisation more affordable and easier to implement

1.3 Demonstrate solutions for better building/ infrastructure integration into energy and mobility networks

1.4 Demonstrate regenerative and frugal designs, integrating NBS and considering adaptability and life cycle

### Objective 2: Enriching, inclusive and health- improving Built Environment

2.1 Integrate the user-led approach in urban planning and design of building and infrastructures to maximise their societal value

2.2 Demonstrate solutions for the short- and long-term adaptation of the B.E. to evolving populations and conditions

2.3 Integrate new models, designs and products into standard (NEB?) practices for a safer, healthier and happier life in the B.E.

2.4 Demonstrate solutions to preserve and enhance cultural heritage as a resource for social empowerment and climate change adaptation

### Objective 3: Competitive, digitalised and circular value chain

3.1 Ensure seamless and high-quality data streams with clear governance and demonstrated value, for life cycle and value chain optimisation

3.2 Demonstrate solutions enabling increased industrial and human performances

3.3 Demonstrate solutions and local workflows to enable re-use, recycling and upcycling

3.4 Develop a holistic framework to assess the impact and potential of buildings, infrastructures, components and materials



# 5. Research & Innovation priorities for Objective 1: overview

## Objective 1: Resilient, adaptative, decarbonised and regenerative Built Environment

R&I  
priority

**1.1 Implement methods and technical solutions for resilience, protection and adaptation**

**1.2 Make solutions for building renovation and decarbonisation more affordable and easier to implement**

**1.3 Demonstrate solutions for better building/ infrastructure integration into energy and mobility networks**

**1.4 Demonstrate regenerative and frugal designs, integrating NBS and considering adaptability and life cycle**

Associated  
R&I topics

Strategies and technologies to improve safety and resilience in vulnerable buildings and critical infrastructure

Identification and implementation of decarbonization pathways for the EU building stock

Integration of RES production (electricity, heat,...), H2 and local storage in the built environment

Frugal and adaptable designs

Digitalised monitoring and management of infrastructures, combined with modelling, enabling predictive maintenance

Modular, energy efficient, low-carbon solutions for renovation and extension

Smart-network ready buildings, locally optimised and providing flexibility to the energy networks

Renaturation and circularity at building and district scale for positive impact on the environment

Advanced safe materials as well as NBS, biomimetic, and bio-biased materials, with well understood ageing behaviour, supported by revised standards

User-centric optimisation of operation/ use phase of buildings and infrastructures with active control or self-regulation

Integration of the built environment, in particular infrastructure, to the mobility network

Tools, education and regulatory frameworks for improved market uptake

# 5. Research & Innovation priorities for Objective 1: timeline

## R&I priority 1.1 :

Implement methods and technical solutions for resilience, protection and adaptation

Strategies and technologies to improve safety and resilience in vulnerable buildings and critical infrastructure



Digitalised monitoring and management of infrastructures, combined with modelling, enabling predictive maintenance



Advanced safe materials as well as NBS, biomimetic, and bio-biased materials, with well understood ageing behaviour, supported by revised standards

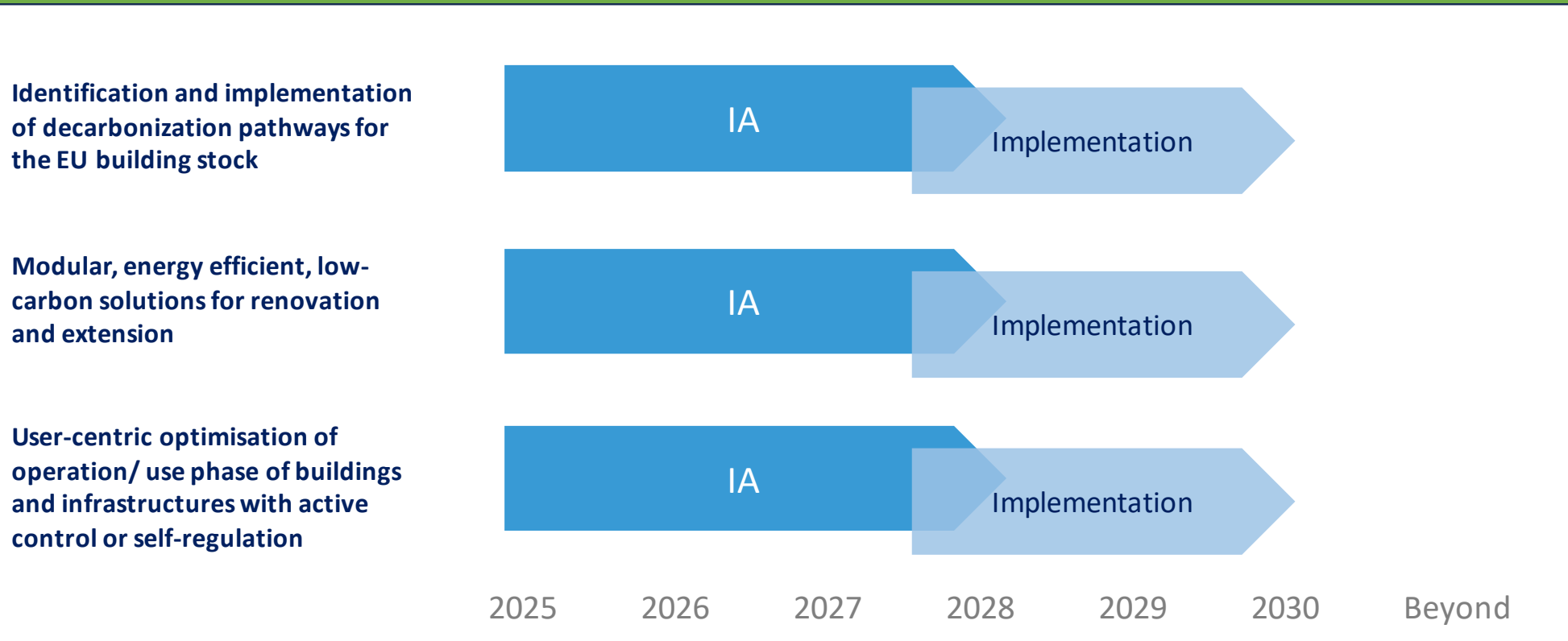


2025      2026      2027      2028      2029      2030      Beyond

# 5. Research & Innovation priorities for Objective 1: timeline

## R&I priority 1.2 :

Make solutions for the decarbonisation of the existing building stock more affordable and easier to implement



# 5. Research & Innovation priorities for Objective 1: timeline

## R&I priority 1.3

Demonstrate solutions for better building/ infrastructure integration into energy and mobility networks

**Integration of RES production (electricity, heat,...), H2 and local storage in the built environment**

RIA  
(for H2 solutions)

IA

Implementation

**Smart-network ready buildings, locally optimised and providing flexibility to the energy networks**

IA

Implementation

**Integration of the built environment, in particular infrastructure, to the mobility network**

IA

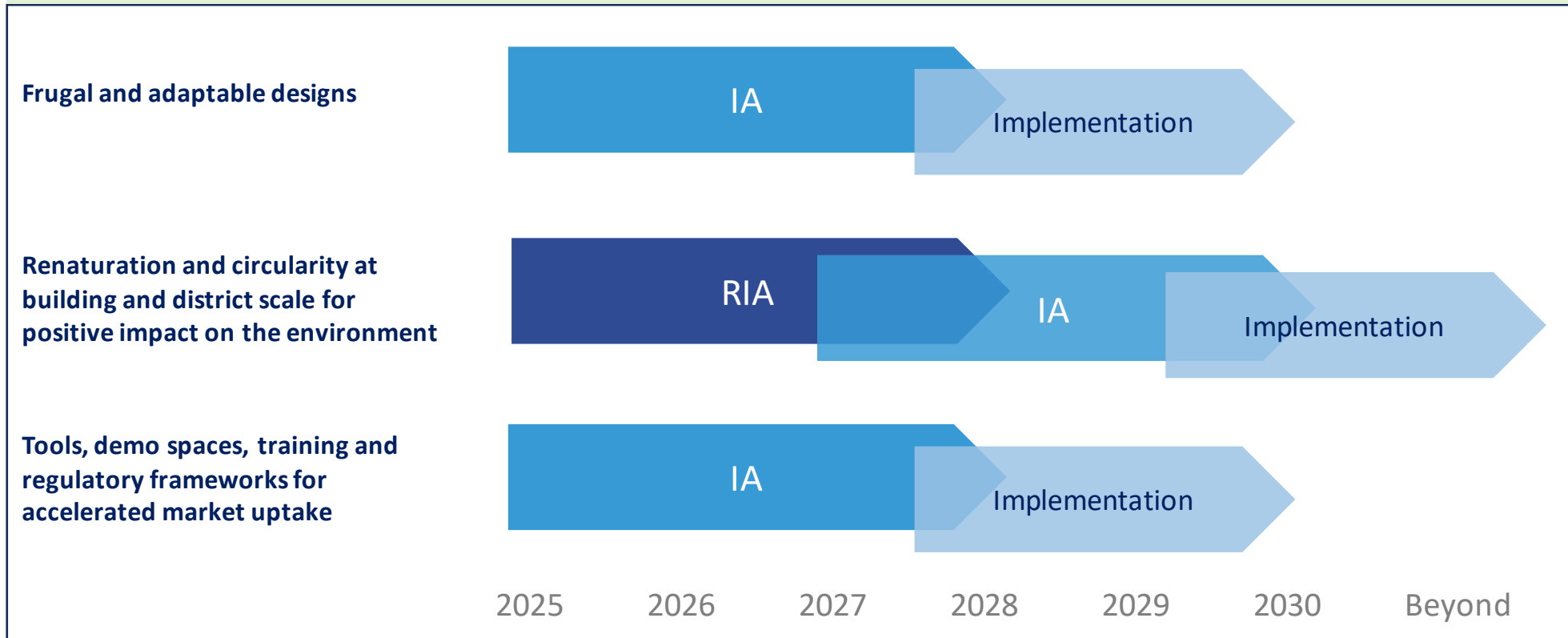
Implementation

2025      2026      2027      2028      2029      2030      Beyond

# 5. Research & Innovation priorities for Objective 1: timeline

## R&I priority 1.4 :

Demonstrate regenerative and frugal designs, integrating NBS and considering adaptability and life-cycle



# 5. Research & Innovation priorities for Objective 1: detailed topics

## R&I priority 1.1 : Implement methods and technical solutions for resilience, protection and adaptation

### R&I topic 1.1.1:

Strategies and technologies to improve safety and resilience in vulnerable buildings and critical infrastructure

*Aim: urgently improve safety and resilience in vulnerable buildings and infrastructures*

#### Subtopics:

- Develop **harmonised, holistic vulnerability assessment tools and KPIs** with multi-hazards risk analysis and method to measure buildings & infrastructures resilience, mixing various data sources and considering uncertainty, to define short, mid and long-term scenarios and mitigation measures (governance, social, technical standpoints) (TRL4 → TRL8 by 2030)
- Develop and implement **adaptation solutions to prepare vulnerable buildings and critical infrastructures to climate change and its consequences** (e.g. keep habitable in unprecedented heat-waves and during power outage in summer & winter, adaptation to increased occurrence of extreme events), while retaining high building value. This could include international cooperation (TRL4 → TRL8 by 2030, lower SRL: training of value chain is needed).
- Develop and implement awareness campaign, training, engagement tools to increase community-based resilience, and monitor the impact of the actions (TRL4/5 → TRL8 by 2030)

### R&I topic 1.1.2:

Digitalised monitoring and management of infrastructures, combined with modelling, enabling predictive maintenance

*Aim: roll out predictive maintenance for infrastructures to reduce failures and increase resilience to hazards*

#### Subtopics:

- Develop **new methods and advanced sensors for infrastructure monitoring** (inc. quantum sensors, IoT, drones, fibre optics, remote sensing) (TRL4 → TRL 8 by 2030)
- Develop **Digital Twins** combined with VR/AR, AI analysis, **for predictive risk assessment, event management, post event evaluation** (TRL3-4 → TRL 8 by 2032)
- Develop 'all-hazards' **models and tools for predictive maintenance of buildings and infrastructures** (incl. transport) and determining remaining useful life (TRL 4 → TRL 8 by 2030)

### R&I topic 1.1.3:

Advanced safe materials as well as NBS, biomimetic, and bio-biased materials, with well understood ageing behaviour, supported by revised standards

*Aim: prepare the integration of materials that can improve resilience to climate change and hazards*

#### Subtopics:

- Demonstrate **durable and safe bio-based materials and smart materials** (e.g. smart composites, reinforcement thermoplastic, phase change, biomimetic materials...) that can increase the resiliency of the build environment and its occupants (TRL4-5 today → TRL 8 by 2030, SRL3 to SRL7 by 2028)
- Develop and implement **new accelerated ageing protocols for innovative / recycled materials and components** (TRL 5 today → TRL 8 by 2027) to better understand their long-term behaviour
- Adapt **standards** to account for new findings on the use of materials, incl. recycled, circular, bio-based and NBS, but also changing conditions (climate, extreme events...) (TRL 4 → TRL 8 by 2030)



# 5. Research & Innovation priorities for Objective 1: detailed topics

## R&I priority 1.2 Make solutions for the decarbonisation of the existing building stock more affordable and easier to implement

### R&I topic 1.2.1:

Identification and implementation of decarbonization pathways for the EU building stock

*Aim: streamline the 'renovation pipeline' and support building owners in the decision-making process*

#### Subtopics:

- Develop a **comprehensive tool dedicated to the building stock decarbonisation** (also from the public domain- infrastructure- roads, railways, energy etc.) : pooling of different European databases to support building owners in the understanding of footprint of their stock, development of decarbonisation scenarios, informed decision-making and follow-up of action plans (TRL 5 today → TRL 8 by 2028)
- Develop **advanced BIM integrating user data, BMS and LCA/ LCC** to support the selection of decarbonisation pathways with simulation, optimization etc... This requires the use of adequate ontologies and of uncertainty intervals (TRL 3/4 → TRL 8 by 2030).
- Deploy **new financing and business models for deep renovation** of existing building stock (eg ESCOs, crowd funding, etc.) (SRL 4 today → SRL 9 by 2030)

### R&I topic 1.2.2:

Modular, energy efficient, low-carbon solutions for renovation and extension

*Aim: accelerate/industrialise the renovation process and make it less intrusive*

#### Subtopics:

- Develop **lightweight / prefabricated construction solutions for renovation and upgrade** of existing buildings (TRL 5 today → TRL 8 by 2028)
- Develop **fast and prefabricated construction solutions for rebuilding of existing infrastructure under operation** (TRL 5 today → TRL 8 by 2028)
- Develop **modular affordable, scalable renovation packages** exploiting local natural sources for heating, cooling, ventilation, lighting as well as for energy production, reducing energy losses through the building envelope but also improving summer comfort, adaptable to different building uses and users' needs and taking into account indoor environmental quality (today TRL 3-6 → TRL 8 by 2030)
- Develop **portable additive manufacturing solutions** to repair in situ and facilitate the reuse of damaged constructions (TRL 4 today → to TRL 8 in 2030, SRL 2 today → SRL 8 in 2030)

### R&I topic 1.2.3:

User-centric optimisation of operation/ use phase of buildings and infrastructures with active control or self-regulation

*Aim: reduce the energy consumption during the use phase of the built environment, through a combination of active and passive approaches, with occupants at the center*

#### Subtopics:

- Demonstrate (cloud or edge) **platforms to monitor and optimise the use phase** of buildings and infrastructures, thanks to sensors (incl. for IEQ), IoT, actuators, control systems and BMS, and that fully integrate the users. (TRL today 5-6 → TRL 8 by 2028)
- Develop approaches to **safely integrate Artificial Intelligence to technologies, BMS and optimisation platform** so that they match occupants' behaviours in the most energy efficient way (TRL 3-4 today → TRL 8 by 2030)
- Share and implement best practices for the **self-regulation of buildings to decrease need for active control**, thanks to advanced materials or low-tech adaptable envelope systems (e.g. controlled natural ventilation, passive cooling) (TRL today 5-6 → TRL 8 by 2028)
- Integrate **highly efficient (80-90%) mCHP solutions** based on Fuel Cells in buildings to reduce primary energy consumption for the generation of electricity and heat (TRL today 4 → TRL 8 by 2028)



# 5. Research & Innovation priorities for Objective 1: detailed topics

## R&I priority 1.3 Demonstrate solutions for better building/ infrastructure integration into energy and mobility networks

### R&I topic 1.3.1:

Integration of RES production (electricity, heat), H2 and local storage in the built environment

*Aim: increase the production and use of renewable energy at building scale*

#### Subtopics:

- Demonstrate **active buildings envelopes & solutions for infrastructures integrating as local generation and electrical / thermal storage and control** (e.g. solar), using smart or biomimetic materials solutions. (TRL4 now → TRL8 in 2028)
- Demonstrate the technical feasibility and life cycle benefits of **second life EV batteries as storage device** to increase self-consumption (TLR 5 now → TRL8 in 2030)
- Develop **approaches and solutions for the safe implementation of hydrogen** in the built environment as an alternative to gas (incl. installations for supply and storage, availability of green H2) (TRL3 today → TRL 8 by 2028, SRL 2 → SRL6 by 2030)
- Develop and **implement power-to-power solutions using hydrogen as an energy vector** to increase flexibility, reliability and efficiency at building and district scale (TRL 5-6 today → TRL 8-9 by 2030)

### R&I topic 1.3.2:

Smart-network ready buildings, locally optimised and providing flexibility to the energy networks

*Aim: fully integrate the buildings to the energy networks so that they become an active node*

#### Subtopics:

- Develop a **comprehensive energy modelling for performance assessment of a building block** with a dynamic flexible approach including interactions with their future environment (e.g. Urban Heat Islands effect) (today TRL 4 → TRL 8 by 2030)
- Develop **technological solutions and optimisation platforms for the integration of smart buildings in energy networks, enabling optimisation of energy flows, energy sharing (incl. local P2P) and energy communities**, managing in a secure way data related to user profile, building dynamics, local energy production & demand (today TRL 4 → TRL 8 by 2030)
- Consolidate, scale up and replicate approaches and solutions for **Positive Energy Districts (PEDs)**, including technologies & platforms described above, and develop enabling governance and business models (TLR 4/5 now → TRL8 in 2030)

### R&I topic 1.3.3:

Integration of the built environment, in particular infrastructure, to the mobility network

*Aim: make sure that transport infrastructures adapt to stakeholders' needs and constraints (mobility, freight)*

#### Subtopics:

- Demonstrate and implement approaches to **better promote sustainable mobility through the building environment** (e.g. green spaces and safer infrastructures for cycling and walking) and include co-benefits (e.g. renaturation, well-being and health) into energy & environmental balance (TRL5 today → TRL8 by 2028)
- Deploy optimal solutions to integrate **new mobility practices** and user requirements to existing infrastructures (TRL5 today → TRL8 by 2028)
- Develop, implement and replicate designs for **integrated, multi-modal and multi-stakeholders transport hubs** (TRL 5 today → TRL8 by 2030)



# 5. Research & Innovation priorities for Objective 1: detailed topics

## R&I priority 1.4 Demonstrate regenerative and frugal designs, integrating NBS and considering adaptability and life cycle

### R&I topic 1.4.1:

#### Frugal and adaptable designs

*Aim: make the built environment more frugal (beyond energy), 'self-sufficient' and adaptable to new uses*

#### Subtopics:

- Develop designs that can balance **energy efficiency and adaptability** (change/optimisation of use), (TRL 4 today → TRL8 by 2030)
- Develop effective and affordable solutions at local scale for **water treatment/re-use and resource upcycling** (e.g. re-use of grey water) (TRL 4 today → TRL8 by 2030)
- Develop **best practices for frugal designs** for different typologies of buildings (frugality in energy, in materials, in technology) (TRL 4 today → TRL8 by 2030)
- Develop **advanced maintenance and upgrade concepts** for large infrastructures to extend lifetime and save grey energy (TRL 4 today → TRL8 by 2030)

### R&I topic 1.4.2:

#### Renaturation and circularity at building and district scale for positive impact on the environment

*Aim: go beyond sustainability and make a positive impact on the environment (regenerative built environment)*

#### Subtopics:

- Develop a **harmonised definition of "regenerative building" with metric and KPIs, as well as a structured knowledge framework and enabling technologies/designs**. This should include Post Occupancy Evaluation approach coupling measure and qualitative data collection. (TRL2-3 → TRL8 in 2032)
- Develop **affordable, durable and safe NBS for green integration to the building envelope** to contribute to solar gain control, water management, protection of biodiversity etc, as well as decision-making and maintenance guidelines (TRL2-3 → TRL8 in 2032)
- Explore **solutions for CO2 storage in the built environment** (carbonisation of materials, use of NBS: (green facades and roofs, food production, etc.) (TRL 2-3 → TRL8 in 2032)
- Develop **innovative urban symbiosis approaches** based on strategies, technologies and materials that improve the renaturation and circularity of the built environment. (TRL 2-3 → TRL8 in 2032)

### R&I topic 1.4.3:

#### Tools, demo spaces, training and regulatory frameworks for accelerated market uptake

*Aim: develop the enabling conditions for the uptake of innovative designs, materials and solutions*

#### Subtopics:

- Develop **holistic decision-making support tools for the planning and design** of large projects, taking into account lifecycle approaches, local conditions, social and climate vulnerability (TRL4 → TRL 8 by 2030)
- Use **Digital Twins to test new materials or designs** (TRL 4 → TRL 8 by 2030)
- Develop **'demo spaces' (proof of concepts, living labs) and paths to fast-track certification** for innovative/ circular technologies to provide quantitative information (incl. user feedback) to market stakeholders (SRL4 → SRL 8 by 2030)
- Develop and implement **training modules for architects, upskilling of workers and co-creation approaches** to support market uptake of low-carbon, biobased or circular materials and integration of NBS (SRL 4 → SRL 9 by 2030)
- Provide **policy recommendations to adjust regulation & building codes** (e.g. to permit/ support the use of recycled material and NBS, or to re-purpose buildings) (SRL4 today → SRL 9 by 2030)



# 6. Research & Innovation priorities for Objective 2: overview

## Objective 2: Enriching, inclusive and health-improving Built Environment

R&I  
priority

2.1 Integrate the user-led approach in urban planning and design of building and infrastructures to maximise their societal value

2.2 Demonstrate solutions for the short- and long-term adaptation of the B.E. to evolving populations and conditions

2.3 Integrate new models, designs and products into (NEB?) standard practices for a safer, healthier and happier life in the B.E.

2.4 Demonstrate solutions to preserve and enhance cultural heritage as a resource for social empowerment and climate change adaptation

Digitalised and user-led urban planning and design

Continuous assessment and monitoring of inclusive solutions in operations and citizen empowerment

Better understanding of health and wellbeing determinants and related B.E. performance in Europe

Preventive conservation strategies and cost-effective technologies

New assessment methods and governance models for an improved societal B.E. experience

New housing and B.E. models for multigenerational living, gender and ethnicity equity

Adapted design and new strategies to increase well-being of all EU citizens

Flexible and adaptable built heritage design to new needs and social patterns

Social studies to understand and avoid exclusionary mechanisms

Nature-based solutions & urban greening as a factor of social inclusion and climate mitigation, **in line with NEB (?)**

Materials and standard processes for safer and healthier indoor and outdoor environment

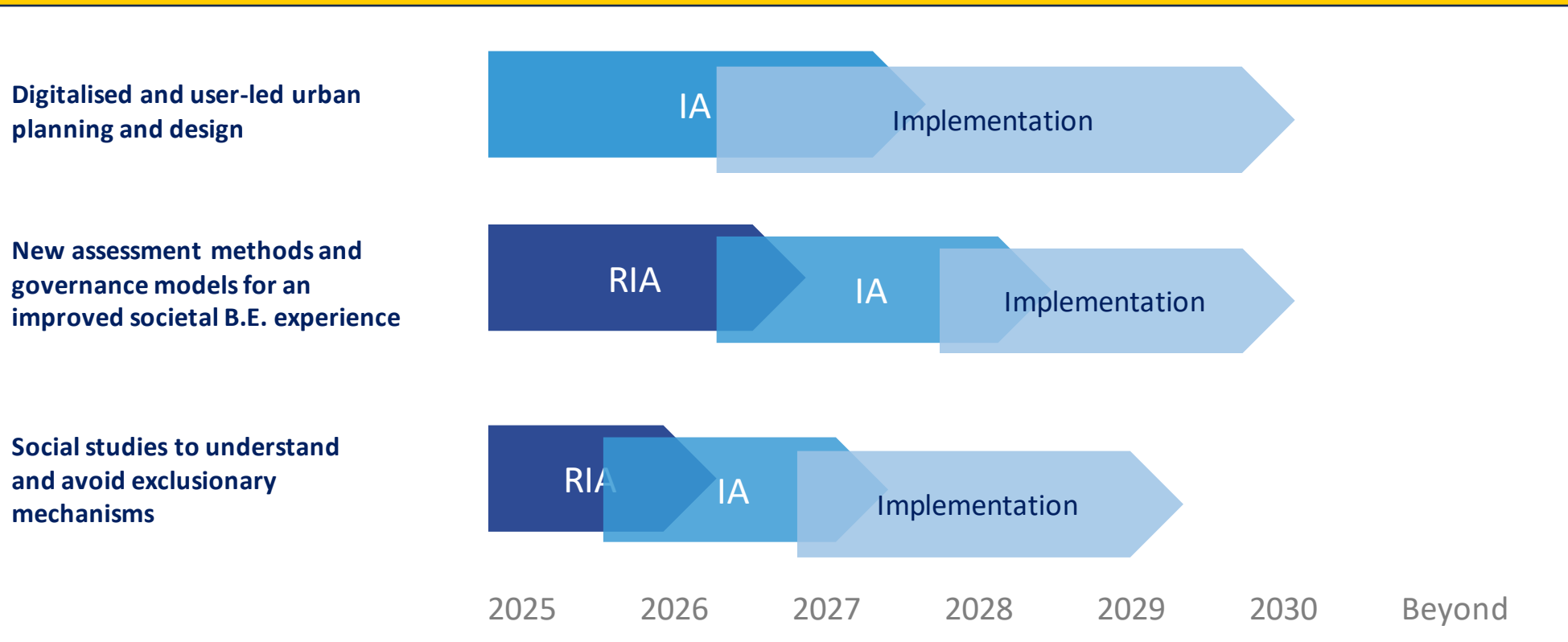
Sustainable management of cultural heritage as a socio-economic catalyser of historic cities and territories

Associated  
R&I topics

# 6. Research & Innovation priorities for Objective 2: Timeline

## R&I priority 2.1:

Integrate the user-led approach in urban planning and design of building and infrastructures to maximise their societal value

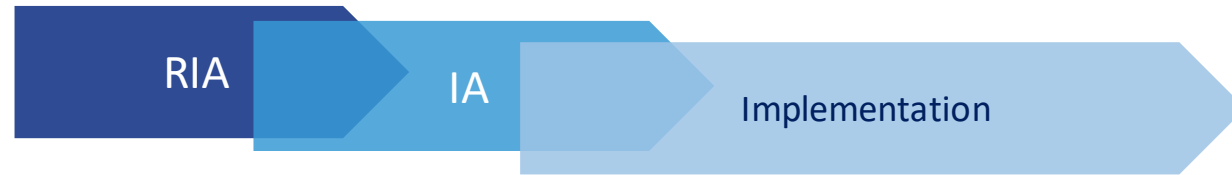


# 6. Research & Innovation priorities for Objective 2: Timeline

## R&I priority 2.2:

Demonstrate solutions for the short- and long-term adaptation of the B.E. to evolving populations and conditions, improving affordability and accessibility

**Continuous assessment and monitoring of inclusive solutions in operations and citizen empowerment**



**New housing and B.E. models for multigenerational living, gender and ethnicity equity**



**Nature based solutions & urban greening as a factor of social inclusion and climate mitigation, in line with NEB**

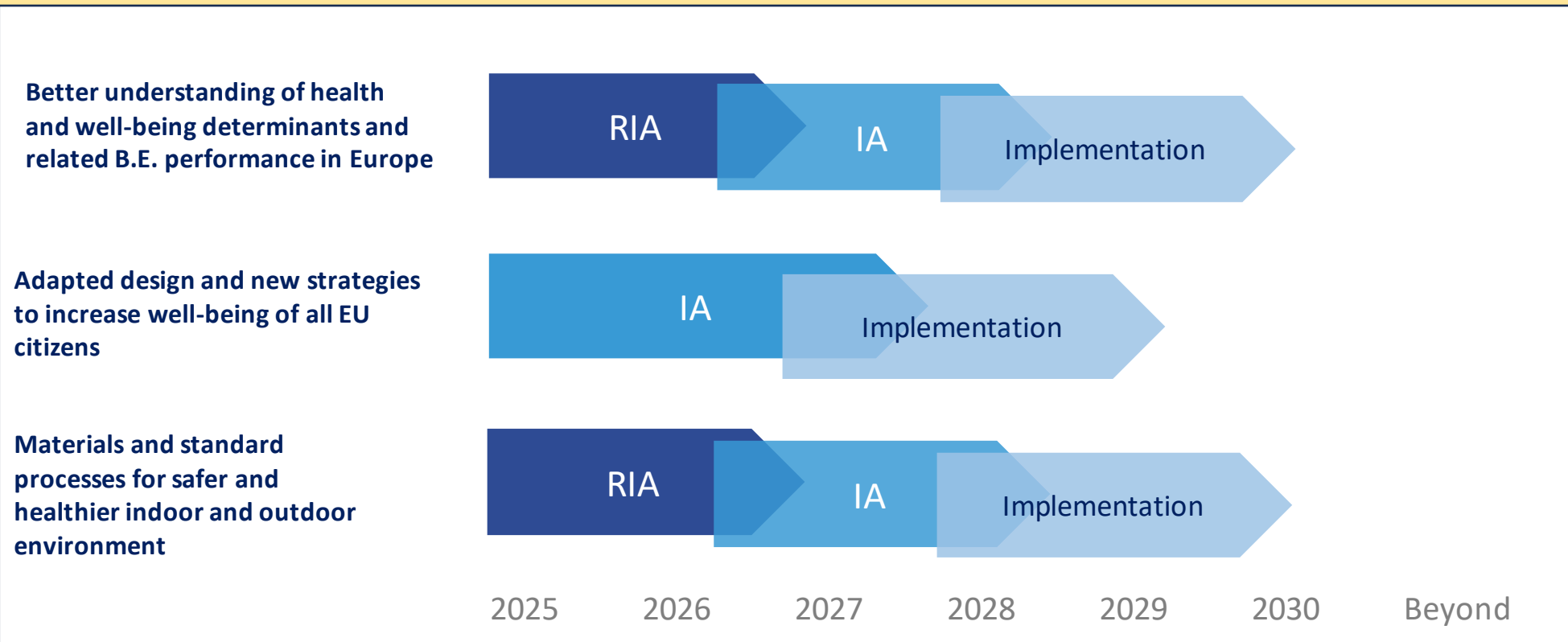


2025      2026      2027      2028      2029      2030      Beyond

# 6. Research & Innovation priorities for Objective 2: Timeline

## R&I priority 2.3:

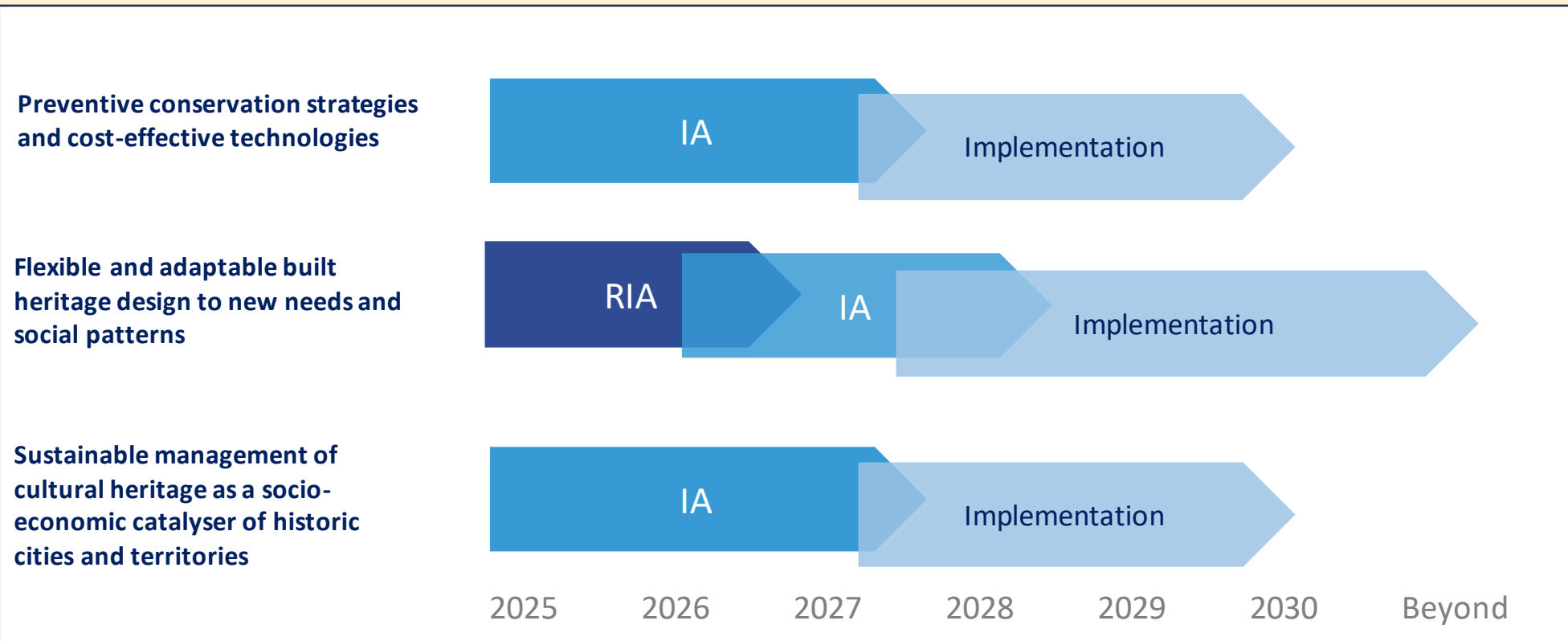
Integrate new models, designs and products into standard (NEB?) practices for a safer, healthier and happier life in the B.E.



# 6. Research & Innovation priorities for Objective 2: Timeline

## R&I priority 2.4:

Demonstrate solutions to preserve and enhance cultural heritage as a resource for social empowerment and climate change adaptation



# 6. Research & Innovation priorities for Objective 2: detailed topics

## R&I priority 2.1:

Integrate the user-led approach in urban planning and design of building and infrastructures to maximise their societal value

### R&I topic 2.1.1:

#### Digitalised and user-led urban planning and design

*Aim: enable a user-led participatory design, ensuring a more user-centred B.E.*

- **Integrate AI** within interactive tools to **promote new co-design and co-creation methodologies**, including the non-human dimension (flora and fauna) and enabling equality (TRL 7 → TRL 9 by 2027)
- Develop/use **digital tools and AR/MR/VR to first simulate and then show/edit in real time construction and urban development projects**, in order to raise city planners / future users' awareness and participations (TRL 7 → TRL 9 by 2027)
- Develop tools and methods for **multi-party and multi-parameter design** and propose ownership models with citizen in the loop. This includes best practices, assessment of risk vs benefit sharing, etc. (SRL 3 → SRL 7 by 2030)
- **Extend lived experience methodologies to lived experience project governance**, research co-creation, and workforce training (TRL 6 → TRL 8 by 2027)

### R&I topic 2.1.2:

#### New assessment methods and governance models for an improved societal B.E. experience

*Aim: adopt new participative approaches to go beyond human design and steer for generation of societal value*

- Develop tools for and **integrate digitalized user-led participatory processes with benchmark** and evidence-based method to support decision-making and provide optimal solution to a more user-centric and nature inclusive B.E. (TRL 3 → TRL 8 by 2030, SRL 3 → SRL 7 by 2030)
- Develop and **demonstrate mixed methods approaches to understand built environment experiences** and increase awareness (e.g. SoftGIS methods, use of TRL/SRL scale to evaluate the citizen experiences etc) (TRL 5 → TRL 8 by 2030)
- Propose a **new set of indicators on social impact** and standardise the use of S-LCA approaches to support decision-making and raise awareness (TRL 6 → TRL 8 by 2030)
- Establish a practical framework to **evaluate user/citizen acceptance of reused/circular materials** in new built and/or renovated houses (SRL 3 → SRL 8 in 2030)

### R&I topic 2.1.3:

#### Social studies to understand and avoid exclusionary mechanisms

*Aim: ensure a more inclusive design and avoid exclusionary mechanisms*

- Define social, psychological and cultural differences in user requirements, expectations and utilisation **patterns** of the built environment to **integrate subjective dimension** and increase the user ownership (TRL 6 → TRL 8 by 2027)
- Propose **continuous training, life-long learning and education programme** to citizens as well as to the workforce, considering the **gender dimension**, and document progress (TRL 5 → TRL 8 by 2027)
- Set up a practical framework to **co-design common spaces in residential building and areas with diverse groups of users to create intergenerational spaces**, ingrained in the idea of 15-minute city (TRL 1-2 → TRL 8 by 2029) (e.g. community-based infrastructure)
- **Include massive migration and associated effects due to extreme events into all R&I priorities** in relation to urban futures (TRL 3 → TRL 8 by 2029)
- **Integrate citizens science and crowdfunding** with the actual design of new / refurbished B.E to deploy solutions that will tackle the gender and ethnicity gap (TRL 6 → TRL 8 by 2028)

# 6. Research & Innovation priorities for Objective 2: detailed topics

## R&I priority 2.2:

Demonstrate solutions for the short- and long-term adaptation of the B.E. to evolving populations and conditions, improving affordability and accessibility

### R&I topic 2.2.1:

Continuous assessment and monitoring of inclusive solutions in operations and citizen empowerment

*Aim: get user feedback and enable an effective operation under changing governance and*

#### Subtopics:

- Integration of digital tools and platforms for **continuous assessment and monitoring of data driven design decisions**, allowing collaboration of relevant actors and community engagement (TRL 5 → TRL 8/SRL 7 by end of 2027)
- Develop digital/AI-based solutions and information library to better **assess the accessibility of buildings, cultural assets and public spaces** and improve accessibility of urban and rural spaces (TRL 3 → TRL 8 by 2028)
- Share available solutions and good practices in inclusive B.E. to **accelerate replication between cities and better policy making** (TRL 5 → TRL 8 by 2027)
- Deploy **automated compliance checking of building design** (BIM, IFC, LBD) with predefined requirements (TRL 3 → TRL 8 by 2031)

### R&I topic 2.2.2:

New housing and B.E. models for multigenerational living, gender and ethnicity equity

*Aim: Ensure a more user centric B.E. considering evolving populations*

#### Subtopics:

- Develop **affordable and inclusive housing models** that provide more liveable solutions for **multigenerational living** (TRL 4 → TRL 8 by 2029)
- **Demonstrate built environment infrastructure that reduces inequities** for disadvantaged-population as well as models to support refugee migration and citizen-acceptance (TRL 4 → TRL 8 by 2030)
- Set up **emergency preparedness responses and disaster risk management for all** (TRL 4/5 → TRL 8 by 2030)
- Develop more diverse housing typologies and sustainable renovation and adaptation technologies to guarantee affordable and energy efficient housing (TRL 3 → TRL 8 by 2035)
- **Understand networks enhancing community-based grass root movements** and identify solution that are replicable and scalable to address isolation in cities and enable connected communities (TRL 5 → TRL 9 by 2029) (e.g; community-based infrastructure)

### R&I topic 2.2.3:

Nature-based solutions & urban greening as a factor of social inclusion and climate mitigation, **in line with NEB ?**

*Aim: Recognise use of biobased materials and urban greening as an asset delivering well-being and socio-environmental benefits*

#### Subtopics:

- Develop **construction packs that welcome biodiversity** for a win-win relationship (TRL 3 → TRL 8 by 2030)
- Test and promote **approaches to enhance biodiversity in cities for health and inclusion** (TRL 3-4 to 6-7 by 2027)
- Propose and implement solutions **enabling public and local authorities to interact with citizens/users and implement nature-based solutions**, including funding mechanism and sustainability and scalability plan (TRL 9 by 2028)
- **Understand the distribution of urban ecosystem services** to address environmental/climate justice issues
- **Deploy nature-based solutions for social inclusion** to support and engage culturally diverse groups, different age groups, disabilities and neurodiversities



# 6. Research & Innovation priorities for Objective 2: detailed topics

## R&I priority 2.3:

Integrate new models, designs and products into standard (NEB ?) practices for a safer, healthier and happier life in the B.E.

### R&I topic 2.3.1:

Better understanding of health and well-being determinants and related B.E. performance in Europe

*Aim: mobilise the potential of the built environment and limit the need for institutionalised healthcare*

#### Subtopics:

- Develop **modules and applications on emerging insights in salutogenesis theory for integration into state-of-art planning** (smart conventional concept integration) and **development of Digital/AI-based tools** (SRL 3 for application in BE domain → SRL 7 by 2030)
- **Measure and map determinants of health across European cities** (AQ, noise, active mobility etc.) to provide evidence for the set up of frameworks/ roadmaps of interventions with policy makers (TRL 3-4 → TRL 8 by 2028)
- **Study the role of the built environment in family-based / gender-based violence** populations (SRL 3 → SRL 8 by 2030)
- **Establish integrated design models among health professionals and urban planners / architects / urban decision makers** on building level (indoor environment) and urban planning level (TRL 3-5 → TRL 8 by 2030)

### R&I topic 2.3.2:

Adapted design and new strategies to increase well-being of all EU citizens

*Aim: support well-being and healthy and active ageing*

#### Subtopics:

- **Create and demonstrate spaces for social interaction for the residents**, improving subjective security and feelings of belonging, and thus, enhancing well being (e.g. agri tech in buildings, mixed use neighbourhoods, urban-rural connectivity etc) (TRL 5 → TRL 8 by 2030)
- Set up a **framework to increase the percentage of buildings & neighbourhoods that cater for the changing (ageing) demographics of the populations**, bringing ethnographic and codesign techniques to ageing well and considering the role of smart tech and datafication (TRL 5 → TRL 8 by 2028)
- Develop **new business models and technologies** (autonomous vehicles, smart sensors, smart monitoring) **for care services in rural areas** to allow a healthy ageing in place (TRL 4 → TRL 8 by 2030)
- **Increase awareness of healthy buildings and well-being starting with vocational courses and university programmes** in Architecture, Civil Engineering... (SRL 5 → SRL 8 by 2028)

### R&I topic 2.3.3:

Materials and standard processes for safer and healthier indoor and outdoor environment

*Aim: increase the safety of city areas and intelligent use of construction materials and HVAC for a healthier environment & an optimal comfort of living*

- Develop **fall prevention strategies at EU level** (TRL 4 → TRL 7-8 by 2030). This includes demonstration of slip resistant floors with nanomaterials for low maintenance costs, standardization of sustainability assessment of slip resistance of floors at the EU level (performance durability over time).
- **Demonstrate performance of HVAC to standardize their use** and create built environments with better resilience to pandemic threats and better overall performance in terms of exposure to harmful aerosol particles (TRL 7 2027 to TRL 9 in 2030)
- **Develop user centric designed HVAC systems** to fully use the potential of these systems for the health of the occupants. Evaluate possible situational effects and develop guidelines for EU wide implementation. (TRL 3/4 → TRL 8 by 2030)
- **Demonstrate and deploy new designs and materials for improved IEQ/OEQ, comfort of living and aesthetics.** This includes developing new metrics to assess their well-being performance (physical and mental health as well as citizen acceptance) (TRL 3 → TRL 8 by 2030)

# 6. Research & Innovation priorities for Objective 2: detailed topics

## R&I priority 2.4:

Demonstrate solutions to preserve and enhance cultural heritage as a resource for social empowerment and climate change adaptation

### R&I topic 2.4.1:

Preventive conservation strategies and cost-effective technologies

*Aim: Safeguard CH against deterioration, climate change and disruptive events*

#### Subtopics:

- **Develop a sustainable conservation value chain.** This includes the understanding of multi-scale deterioration process, development of new and well adapted conservation materials, advanced assessment methods to control the efficiency and a new framework enabling a cost-effective production of conservation materials on small to medium scale (TRL 5 → TRL 8 by 2030)
- **Explore the past building technologies and craftsmanship to identify and translate adaptation and mitigation strategies for climate change and disruptive events** (earthquake, flooding, etc.) into the B.E. (TRL 5 → TRL 8 in 2030)
- **Draw on the experience of previous generations to support circular economy in cultural heritage conservation**, highlighting it is a part of heritage (SRL 3 → SRL8 in 2030)

### R&I topic 2.4.2:

Flexible and adaptable built heritage design to new needs and social patterns

*Aim: forge sustainable cities and territories and empower citizen*

#### Subtopics:

- **Application of AI to integrated design approaches** for beautiful, inclusive and net zero heritage solutions in line with NEB (TRL 3-4 → TRL 8 by 2032)
- **Assess the role of cultural interventions in cities** to drive inclusion and avoid isolation (TRL5-6 → TRL 8 by 2030)
- **Deploy inclusive design oriented at preserving cultural heritage and catering to variety of needs**, co-created with the local residents, using AR/VR tools. This design should always consider aesthetical aspects (TRL 1 → TRL 7 by 2030)

### R&I topic 2.4.3:

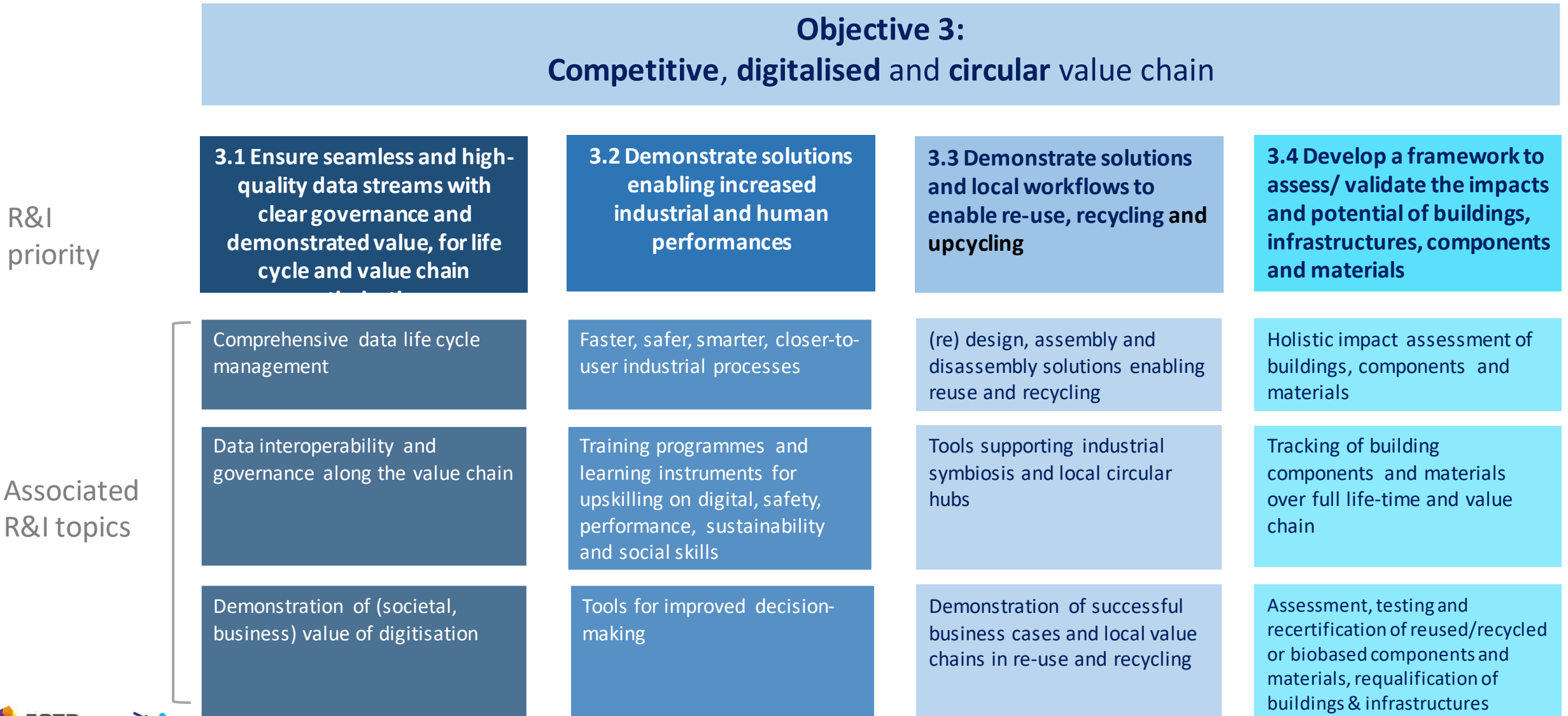
Sustainable management of cultural heritage as a socio-economic catalyser of historic cities and territories

*Aim: bring economic and social dynamism in urban and rural areas*

#### Subtopics:

- **Develop sustainable tourism strategies to support cultural heritage maintenance** while keeping cities authenticity and avoid gentrification (TRL 5 → TRL 8 by 2030)
- **Promote cultural heritage as a valuable well-being assets** for citizens and tourists
- **Propose continuous training and education programmes** to young generation for a better understanding of EU cultural heritage values
- **Develop digital/ AI based solutions to use and reuse the historical building stock** as a priority over demolition and new construction (TRL5 → TRL 8 by 2030)

# 7. Research & Innovation priorities for Objective 3: overview



# 7. Research & Innovation priorities for Objective 3: Timeline

## R&I priority 3.1:

Ensure seamless and high-quality data streams with clear governance and demonstrated value, for life cycle and value chain optimisation

**Comprehensive data life cycle management**



**Data interoperability and governance along the value chain**



**Demonstration of (societal, business) value of digitisation**

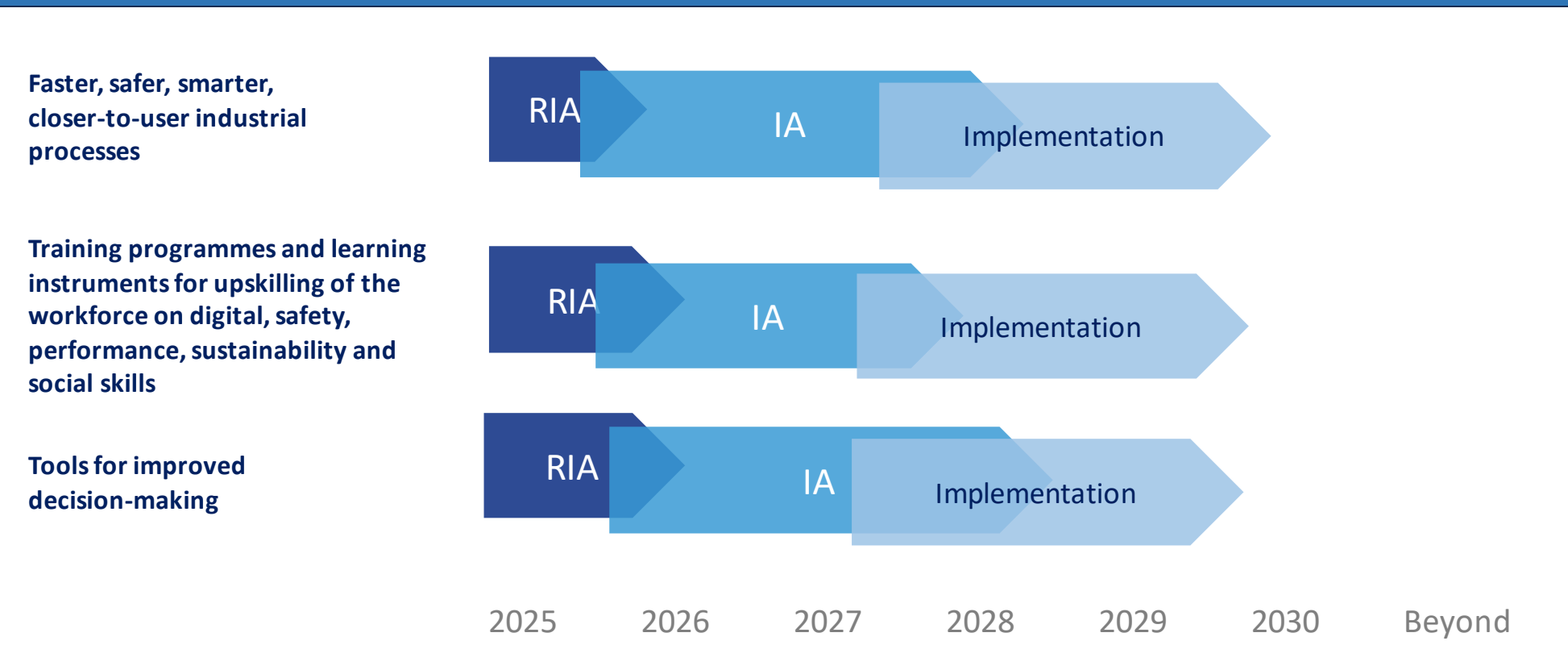


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# 7. Research & Innovation priorities for Objective 3: Timeline

## R&I priority 3.2:

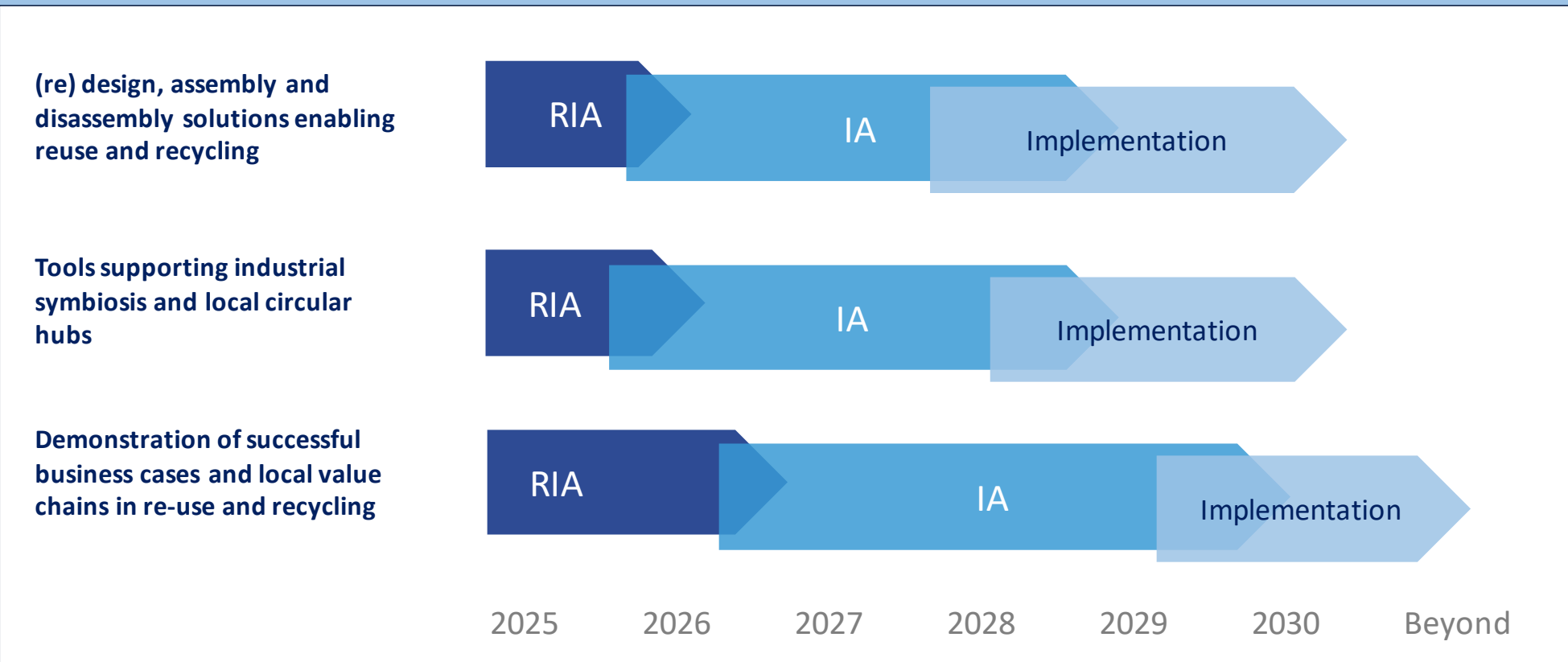
Demonstrate solutions enabling increased industrial and human performances



# 7. Research & Innovation priorities for Objective 3: Timeline

## R&I priority 3.3:

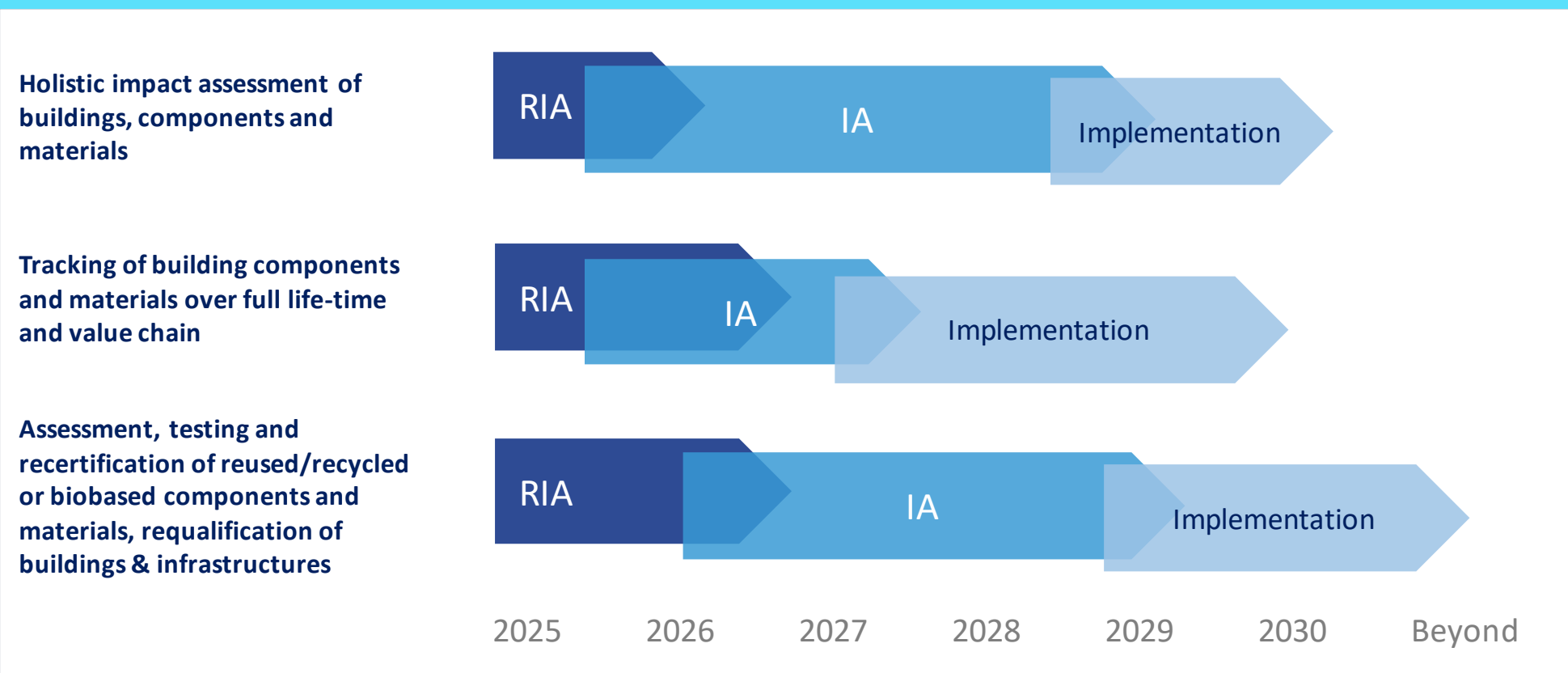
Demonstrate solutions and local workflows to enable re-use, recycling and upcycling



# 7. Research & Innovation priorities for Objective 3: Timeline

## R&I priority 3.4

Develop a framework to assess/ validate the impacts and potential of buildings, infrastructures, components and materials



# 7. Research & Innovation priorities for Objective 3: detailed topics

## R&I priority 3.1:

Ensure seamless and high-quality data streams with clear governance and demonstrated value, for life cycle and value chain optimisation

### R&I topic 3.1.1:

#### Comprehensive data life cycle management

*Aim: ensure data availability, validity, sovereignty, use, sharing and storage, from short to long-term*

##### Subtopics:

- Develop **multipurpose Life cycle data management tools** for built environment with circular perspective. (TRL 4-5 → TRL 8 in 2028)
- Develop **EU data lake(s)** for construction (incl. private & public data sets, pushing for more open data) (TRL 7-8 in 2028) and link to the relevant **Common European Data Spaces**
- Develop a European common referential for Technical Data and LCA data, to foster the use of these data
- Assume a generalized strategy for data management regarding the time validity and quality of data, the level of aggregation, etc. (TRL 4-6 → TRL 8 in 2026)
- Explore technical legal, and organisational solutions to ensure the **long-term availability and non-obsolence of data**
- Define **processes and procedures for effective data validation, anonymization**, integration into shared databases

### R&I topic 3.1.2:

#### Data interoperability and value chain integration

*Aim: enable increased data integration between tools and throughout the value chain*

##### Subtopics:

- Set up a **standardised framework to ensure data interoperability in BIM** and all related components. (TRL 4-7 → TRL 8 in 2028). This includes: common construction ontology and models, integration of machine readable certification, homogenised framework for material information
- Establish a practical framework to enable a **decentralized digital identity for all construction entities** (components, operations, resources). Like URIs or GUIDs but persistent, secure, verifiable, retrievable, decentralized and versionable. (TRL 5 → TRL 8 in 2030)
- Develop solutions for the **decentralized production and consumption of data**
- Install national and European coordinated **open data architectures** based on international standards for open data access and scalable digital business models.

### R&I topic 3.1.3:

#### Demonstration of (societal, business) value of digitisation

*Aim: make sure to implement digitalisation when it is useful and beneficial*

- Demonstrate at the EoL why building/infrastructure owner will benefit from data collected during building life (→ TRL8 in 2028)
- Demonstrate in a transparent manner the benefit for customers/citizens from digital twins and XR technologies. (SRL 3-4 & TRL 5-6. → TRL 8 2027-2028)
- Develop and demonstrate data driven methodology on Total Value of Ownership (in analogy to Total Cost of Ownership), including possible public-private approaches to ensure residual value of buildings, building elements and materials.



# 7. Research & Innovation priorities for Objective 3: detailed topics

## R&I Priority 3.2: Demonstrate solutions enabling increased industrial and human performances

### R&I topic 3.2.1:

Faster, safer, smarter, closer-to-user industrial processes

*Aim: increase the competitiveness of industrial processes*

#### Subtopics:

- **Robots** to support manually intensive tasks related with constructing itself (to contribute to the problem of the lack of blue-collars, safety issues and physical injuries). (TRL 3-4 → TRL/SRL 8 by 2026)
- **Develop AI-driven construction** processes (instead of data-driven). E.g., hundreds of different planning alternatives and construction processes can be automatically analysed for a single project. AI can provide also real-time adaptation to project progress and arising challenges
- Identify/demonstrate **successful business cases for off-site manufacturing and prefab solutions**, especially for renovations, to enable scale up investments
- Implement the integration into BIM of tools like scanning sensor (**BIM to Machines**)
- Develop and demonstrate substitute materials, showing the potential of biobased materials and optimal usage of parametric design and industrial, modular, file-to-factory built.

### R&I topic 3.2.2:

Training programmes and learning instruments for upskilling on digital, safety, performance, sustainability and soft skills

*Aim: increase the competitiveness of European workforce*

#### Subtopics:

- Develop **new training & life-long learning methods** and tools (**incl. XR, IA**, to maximize maintenance quality, construction/deconstruction processes and safety, the integration of new materials, technologies and designs, as well as soft/social skills)
- Develop '**agile curriculae**' on **innovative digital methods** and solutions, with continuous updating of the learning content
- Develop EU wide recognized skills based curriculae, through the **harmonization of the different levels of education** (academic, LLL, vocational training...)
- Promote processes and solutions enabling better inclusion in the construction sector (in particular gender balance). **what is the R&I activity here?**

### R&I topic 3.2.3:

Tools for improved decision-making

*Aim: increase the efficiency of industrial investments*

#### Subtopics:

- Develop, demonstrate and validate **new economic tools enabling value transfer** between stakeholders, in order to encourage primary investors to enhance the quality of their buildings, knowing that they will have a payback from future owners, users, stakeholders...TRL5/6 to TRL8 (or BRL)
- Apply **generative AI for the evaluation of upgrading solutions of asset** (accessibility, energy efficiency,...) based on digital models (BIM)
- Planning and forecasting: lean alternatives and overtime implementation of incremental intervention in accordance with technology availability, severity of the expected scenario and economies **what is the R&I activity here?**
- Demonstrate and deploy BIM&DT -based **assessment tools for ESG & EU taxonomy** for supporting investments decision-making

# 7. Research & Innovation priorities for Objective 3: detailed topics

## R&I Priority 3.3: Demonstrate solutions and local workflows to enable re-use, recycling and upcycling processes

### R&I topic 3.3.1:

#### Design, remanufacturing, and (dis-,re-) assembly solutions for reuse and recycling

*Aim: provide the tools to implement reuse and recycling*

##### Subtopics:

- Develop solutions, incl. **co-botics**, for **onsite assembly, disassembly and re-assembly** of modular and circular building components (TRL2/4 - TRL 8/SRL 8 by 2030)
- Develop **generative, multi-parametric design methods and tools**, considering locally harvestable building elements (TRL 2-5- → TRL 8/SRL 8 by 2030), considering the future reusability/recyclability of components, and including cost-benefit analysis
- Demonstrate the adaption of the ‘**Safe and Sustainable by design**’ approach to construction products’ design, with related **indicators** to be considered in design phase
- Develop **automated remanufacturing** solutions
- Develop **BIM-based solutions** to organise and share the information for recycling and demolition: Scan to BIM, propertysets, and methods for cost-effective modeling. (TRL 5-6 → TRL 8 in 2028)
- Pre-qualified and standardized **reversible connections** as alternatives to the linear ones (e.g. welding, adhesives, deformable connectors,)

### R&I topic 3.3.2:

#### Tools to support industrial symbiosis and circular hubs

*Aim: support the development of local value chains and markets*

##### Subtopics:

- **Develop platform for industrial symbiosis** (the waste of one factory/one construction site becomes a resource for another), incl. the occupancy/underuse of the building stock (TRL3-4 → TRL8 by 2028)
- Develop all in one digital solutions (from pre-auditing to the final new products) for **building material upcycling** (TRL 4-5 → TRL 8 in 2028)
- Investigate the **regulatory conditions** (incl. certification) necessary for the emergence of re-use/ recycling **marketplaces** (TRL 5-6 → TRL 8/SRL 8: 2028)
- Support the creation of local value chain (300 km radius)/ Develop, maintain and coordinate local hubs for resale of reclaimed construction materials: **what is the R&I activity here?**

### R&I topic 3.3.3:

#### Demonstration of successful business cases and local value chains in re-use and recycling

*Aim: support the market uptake of the recycling and reuse processes developed*

##### Subtopics:

- Demonstrate ‘**showcase**’ **buildings & infrastructures** designed and built with reused components to stimulate broad interest from the public/owners, test end-user acceptability and increase attractiveness of such practices - SRL2 today - SRL6 2028
- **Demonstrate re-use and re-cycling practices and value chains** for specific high-impact materials and components (TRL3 today → TRL7-8 by 2030)
- **Identify and assess the market opportunities** for a variety of reused/recycled products, including end-user acceptance, process industrialisation potential, and data needs and gaps (TRL 2-3 → 2030: TRL 7-8)

# 7. Research & Innovation priorities for Objective 3: detailed topics

## R&I Prioriti 3.4:

### Develop a framework to assess and validate the impacts and potential of buildings, infrastructures, components and materials

#### R&I topic 3.4.1:

##### Holistic impact assessment of buildings, components and materials

*Aim: enable to design and compare products considering all their impacts, over their whole life cycle*

##### Subtopics:

- Develop a **holistic assessment framework** encompassing Life Cycle Costs, Environmental impacts (incl. life-cycle Global Warming Potential (GWP) and Carbon storage) and social impacts, (TRL4 → TRL8/SRL7 by 2030)
- Develop the **related tools (relying on BIM (static) and Digital Twins (dynamic) data)** to validate and evaluate buildings' sustainability performance, through the use of Level(s) framework
- Develop **design and assessment tools to model and monitor material flows within buildings**, like it is done for energy performance

#### R&I topic 3.4.2:

##### Tracking of building components and materials over full life-time and value chain

*Aim: ensure the transparency in usage/operation of material/components and buildings*

##### Subtopics:

- Setup the framework and tools (data models, software, integration into BIM) for **Digital Material/product passport** with ability to track them from production to end of life. (TRL 8 in 2028)
- Setup the framework, tools and common platform for **EU building passport**
- Design and test easier processes and tools for **environmental product declarations**, and set up a related EU data platform
- Develop an EU platform for sharing data about fossil-free and emission-free construction machinery and equipment (availability, autonomy, power, cost,...). Today TRL1. TRL8 by 2028

#### R&I topic 3.4.3:

##### Assessment, testing and recertification of reused/recycled or biobased components and materials, requalification of buildings & infrastructures

*Aim: ensure the safety in re-use of material/components and buildings*

##### Subtopics:

- Develop EU wide methodologies for the **requalification/recertification of building elements**, with transparent evaluation model and criteria for recycling quality (downcycling is not recycling)
- Develop UE wide methodologies for fast track qualification en model based verification of biobased materials and building elements
- Develop **non-destructive testing methods** to (fastly) requalify reused materials, products and components, and study how to link this information with digital product passports
- Develop easy and accessible (possibly AI-supported) methods and **tools to assess and validate the reusability and availability of building parts** and materials, from building to city scale (TRL2-4 → TRL 8 in 2030)
- Elaborate some common definition and metrics for **building vacancy and underuse**

# How to give feedback on this draft?



## If you are an ECTP member:

Please send your feedback per email:

- High-level remarks in the email core text
- Comments on specific R&I priorities and topics directly in this pdf.
- If you add subtopics, please make sure to specify the innovation's maturity levels (today and when it should reach TRL/SRL8)

Please send to: [Clementine.coujard@dowel.eu](mailto:Clementine.coujard@dowel.eu)

## If you are not an ECTP member:

Please use the [online form by clicking here](#).