



ECTP Heritage and Regeneration Committee

Horizon Europe 2022-2027 POSITION PAPER



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List of acronyms

AI	Artificial Intelligence
BIM	Building Information Modelling
DT	Digital Twin
EPC	Energy Performance Certificates
EU	European Union
HBIM	Heritage Building Information Model
H&R	Heritage & Regeneration
ICT	Information and Communication technology
IoT	Internet of Things
R&I	Research & Innovation
VOC	Volatile Organic Compound

I. Introduction

1.1. Overall context and challenges

The built cultural heritage refers to the built assets inherited from past generations, which people and society identify with and value as an expression of their traditions and cultural identity.

Finding the suitable ways to integrate such heritage into contemporary times and the evolving environment is a major challenge.

Cultural heritage is exposed to significant threats:

- The **lack of financing** leads to insufficient maintenance, skills, and knowledge to preserve the assets, which makes it critical to develop efficient maintenance strategies and tools.
- Restoration remains the primary consideration in ensuring heritage sustainability, leading to a **limited understanding of innovation** to support its legacy down to future generations.
- The effect of **climate change** impacts more particularly the cultural heritage as it is more prone to deterioration and structural damage.
- The built cultural heritage remains a primary target for **human attacks**, as symbol of our culture and way of life.
- A **holistic approach** is lacking in strategic planning and regeneration strategies: historical assets are too often considered at the building unit scale only, and new usages are rarely envisaged.

But opportunities are at hand:

- **Digitalisation** constitutes a major driver to improve the preservation, maintenance, retrofitting, access, and promotion of cultural heritage.
- New **materials and technologies** can help improve the reliability and durability of assets, defending them from the threatens by environment (including climate change) and humans and transmitting them to future generations.
- Built cultural heritage has a **significant potential to reduce its carbon footprint** (through improving energy efficiency) and overall, in some cases reducing the need to construct new buildings and providing more compact cities.
- **Collaborative governance** initiatives are developing and shall change the manner regeneration strategies are designed and implemented.
- Cultural Heritage is often perceived as a collective property, therefore intervening on this asset constitute an important **opportunity for showcasing innovation** and promoting the integration of energy transition principles to the entire society.
- **New business and financing models** from other sectors show replicability for cultural heritage.
- Cultural heritage is and will remain a strong tool of understanding between communities, towards peace and respect.

As stated by the EC European Framework for Action on Cultural Heritage¹, the European built cultural heritage must therefore evolve towards more **sustainability**, **resilience** and **inclusiveness**, through innovation and collaboration.

1.2. Scope and Approach

This Position Paper aims to give an overview of the research and innovation paths that the ECTP Committee on Heritage and Regeneration recommends by 2027 to tackle the above-mentioned challenges.

To elaborate those recommendations, a workshop was organised with the Executive Board of the H&R Committee, followed by a collaborative process involving all H&R Committee, and a consultation of key external stakeholders.

This Position Paper looks to:

- Identify research needs to drive the social, environmental, and economic impact of the cultural heritage to the forefront of European research and innovation agendas.
- Focus on future innovations and technologies to improve restoration, access, innovative reuse, and preservation of cultural heritage.
- Raise awareness and communicate priorities to strategic stakeholders (public and private).
- Promote science translation of research results, ensuring the smooth implementation of up-to-date, evidence-informed policies and practices.
- Support research-funding proposals and partnerships.
- Advocate and share knowledge within and beyond the ECTP.

1.3. High-level objectives formalised by the Heritage and Regeneration committee

Considering the outlined challenges, the H&R Committee has identified three high-level objectives that are critical to the cultural built heritage, namely:

- **Objective 1: Sustainable and resilient cultural heritage**
- **Objective 2: Digital built heritage for preservation and inclusiveness**
- **Objective 3: Cultural built heritage as economic and social catalyser**

For each of these objectives, a set of priority areas are identified for the future research and innovation activities of the sector: they each correspond to specific challenges and are complemented by a list of focused R&I topics. The next diagram provides an overview of the priority areas identified for each objective. The next sections of this Position Paper detail these objectives, R&I priority areas and topics.

¹ European Framework for Action on Cultural Heritage, Commission Staff Working Document, 2018



FIGURE 1: High-level objectives formalised by the Heritage & Regeneration committee, and related priority areas for research and innovation. In yellow, highly ICT-related priorities.

II. Objective 1: Sustainable and resilient cultural heritage

Cultural heritage is particularly vulnerable to destruction and decay due to several factors: climate change leads to more severe and frequent extreme events (e.g., heavy rains, floods, earthquakes) but also evolving ‘standard’ conditions (e.g. higher temperatures); threats related to human actions, whatever deliberate or unintentional, remain as real as ever (e.g. fire); and the lack of competences can lead to failed restoration or maintenance. At the same time, cultural assets also have their part to play towards the EU target of carbon neutral Europe, i.e., reduce their carbon footprint on the energy and circularity aspects.

The large possibility offered by new technologies, in particular ICT and materials, need to be transferred and implemented to the cultural heritage context, with its specificities.

Based on these considerations, three R&I priority areas are identified to reach the overall objective of a more sustainable and resilient cultural built heritage:

- Resilience to climate change and man-made threats.
- Raising the quality and efficiency of physical conservation, restoration, and maintenance processes.
- Climate neutrality (net-zero-emissions target).

These three R&I priority areas are detailed in the next sections. Note that the overall digitalisation process of the cultural built heritage is more specifically addressed in the high-level objective 2.

2.1. Resilience to climate change and man-made threats

Cultural heritage is fragile and particularly prone to degradation due to climate change, both in its extreme events (heavy rains, floods, heat waves, etc) and slower changes (temperature, sea level, soil salinity, biofilm growth). It is also very exposed to human actions, either intentional or involuntary.

There is a need to better predict and assess the wider impacts of climate change on cultural built heritage, and to develop protection and adaptation strategies. Risk management strategies are required to strengthen the potential of resistance and recovery of cultural assets: from anticipation and preparation to mitigation and recovery measures. ICT technologies and new materials can contribute to this objective, as well as upgraded workflows.

Research topics in this area include:

- Risk management strategies to protect vulnerable historic cities against extreme hazards.
- Improvement of structural resilience in case of extreme events (earthquakes, storms, fire, etc) or strong deterioration.
- Novel solutions at territorial/city level to mitigate the effects of extreme hazards in cultural built heritage.
- New tracking mechanisms to prevent vandalism and illicit trade of cultural assets.
- Risk management platform relying on HBIM, IoT and data management tools.
- Development of innovative materials and technologies able to protect heritage buildings from deterioration and climate change (protection from water/rain, temperature, salts, biological growth).
- Development of innovative solutions to protect buildings against heatwaves and avoid an intensive use of air-conditioning.
- Promotion of nature-based solutions for the increase of resilience and the protection of vernacular heritage.

2.2. Preventive conservation, maintenance, and restoration

Maintaining, preserving, and retrofitting built cultural heritage remains a challenge, due to several factors:

- The lack of knowledge on deterioration processes and evolution over time, and therefore on the relevant intervention strategies, maintenance plans and their potential impact.
- The lack of skilled workforce, including craftspeople, that needs a high degree of specialisation to reach the targeted performances in retrofitting (comfort, energy efficiency, compliance with aesthetics criteria, non-degradation of the asset).
- The unique situation of each site, that prevents from easily replicable solutions.
- The shortage of supply for some specific materials, or lack of adequate solutions to retrofit in a sustainable manner.

The real-time monitoring of parameters, and the resulting new possibilities to model the degradation processes and the impact of new solutions, is a potential game changer for restoration and maintenance – however turning this into practice is still ahead of us. Also, new and bio-based materials will provide new paths for more sustainable retrofit.

Research topics in this area include:

Onsite interventions

- Learn from traditional techniques and materials towards the use of nature-based concepts.
- Develop solutions to reach energy efficiency through non-intrusive solutions, especially starting from the optimization of the historic building potentialities in mitigating outdoor conditions (passive behaviour of the building fabric).
- Develop a particular tailored technical inspection for condition assessment and planning of interventions of the built heritage (including certification and standardization).
- Improve relief and non-intrusive techniques for the characterization of the building fabric as well as its deterioration.
- Develop robotic 3D printing systems for restoration and retrofitting of historical envelopes.
- Elaborate low-disruption and retrofitting processes using alternative BIM solutions that consider costs, energy performance and disruption for users, as well as prefabrication.

Materials

- Develop innovative materials able to transmit a non-endangered heritage to future generations (compatible, reversible, re-processable, nature-based and nature-inspired materials, etc.), including the co-design of new solutions between researchers and conservators for a quicker uptake of these solutions.
- Address the contradiction between ensuring the procurement of original or substituting materials and preserving nature.

Modelling and digital twins

- Test traditional materials to include them in energy simulations and to simulate compatibilities with new materials that can last over time.
- Develop new accurate deterioration models to predict service life of materials (also innovative materials) and structures under different conditions.
- Use continuous monitoring and modelling/forecasting to understand deterioration as well to assess materials/technologies conservation and prevent critical potential situations or promptly solve critical conditions already occurred.
- Adapt Digital Twin platform (BIM + IoT) to the cultural assets context and the converge definition.

Monitoring and maintenance

- Integrate the use of virtual and augmented reality in the creation of interactive experiences for the enjoyment of the heritage and transmission of the cultural legacy, including both tangible and non-tangible.
- Scale up the implementation of continuous feedback with real time data and the use of machine learning and data science techniques in cultural heritage buildings, including museum. Maintenance needs continuous monitoring (not only thermal but also lightning as well as material moisture, salts, particulates, VOC, etc.) and non-destructive or minimal invasive testing to understand deterioration for preventive conservation.
- Develop and demonstrate new maintenance solutions and approaches (monitoring, sensors, smart solutions, protocols, new professionalism), ensuring higher economic sustainability, better conservation of cultural heritage and stronger resilience.
- Develop sustainable decision-making tools on interventions based on monitoring, modelling, forecasting, digital twins, and AI algorithm for diagnostics, considering the whole life cycle.

2.3. Net-zero-emissions cultural built heritage

Cultural heritage offers large potential to drive climate action and support a transition to a climate neutral Europe by 2050, mainly on two dimensions: improvements in energy efficiency and integration of renewable energy; and circularity of its supply chains.

Research topics in this area include:

Energy

- Develop energy efficiency solutions compatible with cultural heritage. Energy efficiency solutions should target both the efficiency of the building-plant system and the efficiency of the building operation, e.g., through smart and AI management methods.
- Develop the holistic assessment of CO₂ of a building over its entire lifetime (LCA).
- Design new energy planning strategies for the use of renewable energies (e.g., photovoltaic panels, geothermal systems, Fuel Cell technologies for the use of green hydrogen, etc) in historic buildings, centres, and cities.
- At strategic planning level (simulation), demonstrate the cost-efficiency of operation and maintenance processes while maintaining energy efficiency, wellbeing, and preservation.
- Develop the interconnection of traditional/historic buildings with new buildings in terms of energy trading and district heating.
- Develop methodologies to include traditional/historic buildings in the Energy Performance Certificates, including broad default values.
- Education of occupants to specifics of historic buildings for energy efficiency and preservation, including using smart solutions and dashboards.

Circularity

- Promote use of local, green, and sustainable materials in built heritage restoration.
- Develop the use of recycled materials for alternative or new conservation products. This should include materials resulting from demolitions (Management of end-of-life waste).
- Facilitate the training and upskilling of the construction workforce in innovative methodology, circular approach, and advance materials to undertake upgrading works to the historic building stock. Traditional techniques and materials should also be considered, and how to readapt them.

III. Objective 2: Digital built heritage for preservation and inclusiveness

Stimulating participation in cultural heritage activities remains a challenge: according to a Eurobarometer Survey (2017), 48% of Europeans said they are not involved with cultural heritage in any way. Yet, the same survey shows that 68 % of respondents would like to know more about Europe's cultural heritage².

Also, some cultural assets are technically not accessible to the public or are too fragile to be visited on a regular basis.

To improve the access to and attractiveness of cultural built heritage, it is proposed to organise the required R&I activities along three priority areas:

- Multidimensional digitalisation: overall integration of digital technologies to the maintenance and preservation processes of the cultural built heritage.
- Onsite: interpretation and visitor experience (including accessibility and storytelling).
- Offsite: digital preservation and remote access to the cultural built heritage.
- Updating databases at EU level on the vulnerability of infrastructure and buildings.
- Data management platforms, with robust models and data management procedures.
- New technologies: digital tools to improve performance forecasting and monitoring before and throughout the lifecycle.

They are detailed in the next sections.

3.1. Multidimensional digitisation

Digital technologies can play a key role in improving the preservation, resilience, and sustainability of cultural heritage:

Historic Building Information Modelling (HBIM) and Digital Twins (DT) are key enablers of preservation strategies: the combination of HBIM and DT concepts can indeed lead to assisted or automatic identification of hazards, and technical solutions for improved conservation – however interoperability is still a pending issue. It also has the potential to evaluate the impact of each suggested intervention using relevant parameters (budget, planning, etc.).

Also, the significant decrease in sensor costs, coupled with Internet of Thing shall contribute to deploy real-time monitoring.

² See European Framework for Action on Cultural Heritage, EC, 2018



FIGURE 2 TYPE OF INFORMATION THAT SHOULD BE INTEGRATED IN HBIM DATA MODEL IN COMPARISON WITH STANDARD (SOURCE: P.JOUAN, P. HALLOT³)

Research topics in this area include:

- Use high performance data analytics to create accurate out-of-the-lab degradation assessment models and algorithms for proper conservation and (re)use of the built heritage.
- Apply digital twin to modular construction compatible to cultural heritage for a sustainable refurbishing and high comfort and wellbeing level.
- Develop/integrate smart solutions to support energy-efficiency adapted to the cultural heritage specifics.
- Demonstrate cost-effectiveness of digitalisation in cultural heritage.
- Coupling of DT and HBIM: the encoding of data related to the Cultural Significance of assets requires the elaboration of a prototype model for data structuration in HBIM. One of the major issues is the difficulty of transforming qualitative data, inserted in the model, into quantitative data allowing them to be considered in the analysis and simulation processes in HBIM and DT environments.
- Study the interoperability between HBIM and DT software (including semantics).
- Develop and implement an evaluation model prototype in the DT environment to evaluate the impact of each suggested intervention based on all significant parameters (budget, planning, etc.), including how these solutions will affect the conservation of the identified features of significance.

³ Digital Twin: A HBIM-Based Methodology To Support Preventive Conservation Of Historic Assets Through Heritage Significance Awareness, P.Jouan, P. Hallot, 2019

3.2. Interpretation and visitor experience (onsite)

Interpretation means to add meaning to experiences, whether this comes from feelings or thoughts: how we interpret the built heritage is critical for the way we shape our common future⁴. Heritage interpretation can be defined as an approach to non-formal learning that aims to establish a link between visitors and what they can discover at heritage sites.

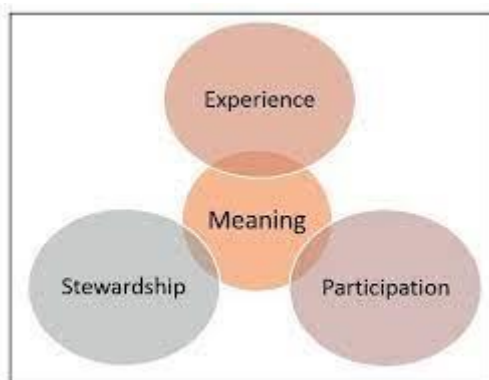


FIGURE 3: THE INTERPRETATION TRIANGLE, SOURCE: THORSTEN (2018)

Story telling techniques and **information and communication technologies** offer new opportunities to enrich this interpretation process, especially through virtual, augmented, and mixed reality. A prerequisite to successful onsite visitor experience is of course to ensure an easy access and safe exit to the sites.

Research topics in this area include:

ICT for enhanced user experience

- Adapt tools for Augmented Reality and Mixed Reality for enhanced user experience to the context of cultural heritage (e.g., several steps of information by QR-codes or apps; visit to cultural heritage sites: provision of actual plans, 3D sketches and descriptions with access to certain important publication, etc.; visualisation of missing or unvisitable parts of the building...).
- Develop game-based learning and educational design models ensuring social and educational inclusion in museums and cultural services, through digital and enabling technologies.
- Develop virtual "drone flights" solutions for disabled people.
- Apply AI-based techniques for storytelling and concept creation in the cultural and creative industries, ensuring correct content and coherence with the historical and social value of the heritage.
- Apply cognitive computing to improve the user's sensitive and interpretive experience.
- Ensure interoperability between Digital Twin platform used for the management of CH assets and VR/AR/MR tools for valorisation.

Improved onsite accessibility

- Ensure accessible routes of urban and rural heritage and accessible fast evacuation routes of heritage assets in case of danger, respecting and overcoming the heritage barriers.

⁴ See <https://interpret-europe.net/about-heritage-interpretation/>

- Develop apps to guide on which element of historic cities are accessible for wheelchair access, how to go there etc.
- Define evacuation plan + develop tools to help disabled people.

Stakeholders' engagement

- Replicate the approach called "visiteering" that includes elements of 'visiting' and 'volunteering' activities, as adopted in the UK.
- Develop programming (and storytelling) to enhance visitors' experience and engagement. Programming is about structuring the activities that take place at heritage properties. Storytelling helps providing more engaging experiences

3.3. Digital preservation and remote access to the built CH (offsite)

The Charter on the Preservation of Digital Heritage of UNESCO defines digital heritage as embracing "cultural, educational, scientific and administrative resources, as well as technical, legal, medical and other kinds of information created digitally, or converted into digital form from existing analogue resources". Digital preservation is therefore the set of processes aimed at ensuring the continued accessibility of digital or digitalised materials.

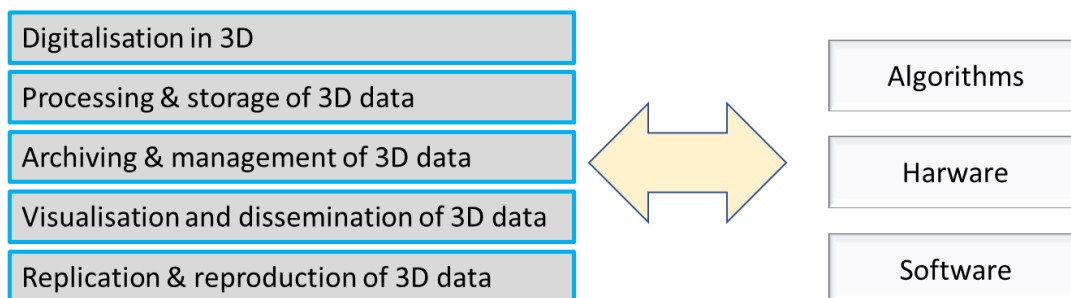


FIGURE 4: COMPLETE RECORDING OF CULTURAL HERITAGE, SOURCE: TSIAFAKI ET AL., 2017

3D technology (using laser scanning, photogrammetry, drones), coupled with Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR), offers innovative ways to provide tailored access to heritage for education, tourism, research and entertainment by e.g., recreating spaces, decorations and configurations from the past or future. However, 3D digitisation of architectural heritage is a very specific digitisation process in which objectives, size, budget, and applicability are key factors in choosing an appropriate method, and where there is not an all-in-one digitisation solution⁵.

Research topics in this area include:

- Develop multi-approach digitisation techniques to ensure user-centric and on-line accessibility to the built heritage.

⁵ See Preservation of Architectural Heritage Through 3D Digitization, Tsiafaki et al., 2017

- Digitation technologies for cultural heritage to be used for multi-scale modelling (intelligent reduction of data). Inclusion of sensor positions and data in the model (real-time modelling by monitoring).
- Promotion and recognition of EU vernacular architecture.
- Digital preservation which is a part of preventive conservation needs advanced (not only thermal but also material moisture, Salts, Particulates, VOC, IR, Hyperspectral, low cost, reliable etc.) monitoring and non-destructive or minimal invasive testing to understand deterioration. Monitoring supports as well as preventive conservation.

IV. Objective 3: Cultural built heritage as economic and social catalyser

Cultural heritage is a driver for the dynamism and attractiveness not only of cities, but also of rural areas, bringing economic and social benefits. A holistic approach is required to identify synergies between urban and territorial planning, sustainable tourism strategies and the local cultural and creative sectors.

This objective is therefore broken down in two priority areas:

- Regeneration strategies, including the topics of adaptive re-use of historical buildings and participatory governance.
- Economic and financing models, with questions related to PPPs and specific insurance issues.

They are detailed in the next sections.

4.1. Regeneration strategies

Cultural heritage buildings such as historical buildings (including industrial heritage like warehouses and factories), if restored and maintained properly, have the potential to foster the attractiveness of cities, both for their inhabitants and tourists.

The appropriate **re-use and adaptation** of historical buildings to the requirements of modern society - occupants wellbeing, accessibility, energy efficiency- can bring economic and social dynamism while reducing unsustainable urban sprawl.

The involvement of private actors or civil society organisations in the whole process of decision making, planning and implementation increases the accountability, transparency, and impact of public investments in the built cultural heritage. Implementing **participatory governance models** reinforces stakeholders' perception and appreciation of heritage buildings and ensures the sustainability of

adaptive re-use plans: it is therefore an efficient way to boost the potential of cultural heritage as a resource for local economic and social development.⁶

Research topics in this area include:

- Promote the use and reuse of the historical building stock as a priority over demolition and new construction. Develop new participatory tools (APP + platform) based on AI technologies for maintenance of cultural heritage, including Heritage at risk/danger.
- Apply new participative approaches to involve building owners and users in the decision-making (games, Apps, etc) for strategic choices (i.e., prioritize in the investments for energy saving, environmental aspects, circular economy, etc)
- Develop education, training on conservation, NDT and monitoring experts and craftsmen. Creation of a platform/infrastructure at European level to guarantee common approaches and best possible standards (such as the forthcoming European Competence Centre for the Conservation of Cultural Heritage).
- Develop new solutions to make historic buildings and centres/districts more attractive for living (improvement of indoor comfort, accessibility, safety in case of earthquake, etc.). This should be tackled with a multidisciplinary approach (technical, economic, cultural, social, and legislative). It is particularly challenging for industrial, 20th Century and dissonant heritage.
- New strategies for the use of cultural heritage as a vehicle to increase attractiveness of rural areas.

4.2. Economic and financing models

The recent practice demonstrates the successful cooperation between public and private actors in the renovation of cultural heritage assets. There is today a series of successful approaches for private-public partnerships (PPPs)⁷ showcased by INTERREG projects, but they are still pending to be made really functional and replicated.

Crowdfunding, as an innovative approach for securing funds for restoration often serves other purposes beyond finance, such as community engagement.

Research topics in this area include:

- Develop economic models and legal instruments for private participation in heritage management.
- European promotion of better financing of research on the built heritage digitisation, innovation, and sustainability.
- Create operational best practices and guidelines for the management (asset management, energy management etc.) of CH building (especially public ones).
- Develop sustainable value chain and quality assurance for conservation materials.

⁶ See Built Cultural Heritage, Integrating heritage buildings into contemporary society, A Policy Brief from the Policy Learning Platform on Environment and resource efficiency, INTERREG EUROPE, June 2020

⁷ Source: « Built Cultural Heritage, Integrating heritage buildings into contemporary society”, A Policy Brief from the Policy Learning Platform on Environment and resource efficiency, Interreg, June 2020

- Develop solutions to facilitate the lowering of high-cost insurance policy to solve insurance problem (e.g., fire): insurance not available or very expensive.
- Design integrated management strategies of natural and cultural assets of a territory.
- Develop a 4P (Public-Private-Participative (or People)-Partnerships) system of indicators and monitoring of actions on the built heritage to support objective criterion, decision-making and replicability.
- Give consideration to heritage in sustainable tourism development policies to preserve heritage, satisfy visitor expectations, improve inhabitants' quality of life and support the local economy.

V. Conclusion

5.1. Timing of the different R&I priorities

Members of the H&R committee were asked about the most relevant scheduling for the above identified R&I activities, according to three time horizon: the next Horizon Europe's Work programme (2023-2025), the following one (2025-2027), or after the end of the current framework programme (beyond 2027).

The table below synthesises their views. The colour code is as follows:

>75% of votes	between 50 and 75% of votes	between 25 and 50% of votes	<25% of votes	No votes
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Objective 1. Sustainable and resilient cultural heritage

Resilience to climate change and man-made hazards
Preventive conservation, maintenance and restoration
Net-zero emissions cultural heritage

	2023-2025	2025-2027	Beyond 2027
Resilience to climate change and man-made hazards	62%	23%	15%
Preventive conservation, maintenance and restoration	85%	8%	8%
Net-zero emissions cultural heritage	54%	31%	15%

Objective2. Digital built heritage for preservation & inclusiveness

Multidimensional digitisation
Interpretation and visitor experience (onsite)
Digital preservation and wider access to the built CH

	2023-2025	2025-2027	Beyond 2027
Multidimensional digitisation	23%	62%	15%
Interpretation and visitor experience (onsite)	38%	31%	31%
Digital preservation and wider access to the built CH	15%	46%	38%

Objective3. Cultural built heritage as economic & social catalyser

Regeneration strategies
Economic and financing models

	2023-2025	2025-2027	Beyond 2027
Regeneration strategies	62%	23%	15%
Economic and financing models	31%	46%	23%

5.2. Synergies between the Heritage & Regeneration position paper and other ECTP committees

The next diagram synthesises the main topics that are addressed by several ECTP Committees and their respective Position Papers. For the Heritage and Regeneration Committee, the topics featuring synergies with other Committees are:

- The questions of efficient retrofitting, also addressed by the Energy Efficient Buildings Committee: for H&R, the focus is on the suitability of retrofit solutions for historical assets, and upskilling of workforce to implement such solutions.
- The topics related to the digitalisation of processes, addressed by the Digital Built Environment Committee. H&R has a specific focus on the Digital cultural heritage and digital processes for preservation of maintenance of cultural heritage assets.
- The aspects of resilience, climate mitigation of circularity that are also tackled by the Material and Sustainability Committee. H&R has a focus on solutions that suited to the specifics of historical buildings, and related (local) supply chains.
- The questions of comfort and accessibility of historical buildings, and the strategies for building reuse and local regeneration, also addressed by Built4Life.
- The interaction between infrastructure retrofit or development and the preservation of cultural heritage (impact assessment).

	Energy Efficient buildings	Digital built environment	Material & sustainability	Built4Life	Heritage & Regeneration	Infrastructure & mobility
Infrastructure & mobility	Climate mitigation Energy integration & management	Inclusiveness Asset management Skills & safety Strategic planning	Resilience & climate mitigation Circularity	Inclusiveness & accessibility	Cross-impact assessment	
Heritage & Regeneration	Retrofitting solutions & skills	Inclusiveness Digital preservation Retrofit & Maintenance	Resilience & climate mitigation Circularity	Comfort & accessibility Regeneration		
Built4Life	Quality of life Energy communities Biodiversity	Quality of life Inclusiveness & adaptation Smart places	Inclusiveness & adaptation Indoor env. quality Climate adaptation			
Material & sustainability	Retrofit, RES, CCUS Circularity	Construction & renovation processes, incl. circularity				
Digital built environment	Smart buildings Skills & safety					
Energy Efficient buildings						

FIGURE 5: SYNERGIES BETWEEN ECTP COMMITTEES

5.3. Link with other initiatives

The topics proposed in this Position Papers are aligned with:

- The first calls for proposals published by Horizon Europe programme (2021)
- The lessons learnt from Interreg projects⁶ (2018,2020)
- The white paper from JPI on “Cultural Heritage and Climate Change: New challenges and perspectives for research” (2022)
- The recommendations by the Congress of Local and Regional Authorities on “Culture without borders: Cultural heritage management for local and regional development” (2021)
- The EC European Framework for Action on Cultural Heritage (2018)
- The conclusions of the 27th CIPA International Symposium “Documenting the past for a better future”, 2019
- The 4CH Project _ Competence Centre for the Conservation of Cultural Heritage (2021-2023), funded by the Horizon 2020 SOCIETAL CHALLENGES-Europe in a Changing World - Inclusive, Innovative and Reflective Societies program [GA 101004468].