Brussels, 13 November 2018

COST 091/18

DECISION

Subject: **Memorandum of Understanding for the implementation of the COST Action "Underground Built Heritage as catalyser for Community Valorisation" (Underground4value) CA18110**

The COST Member Countries and/or the COST Cooperating State will find attached the Memorandum of Understanding for the COST Action Underground Built Heritage as catalyser for Community Valorisation approved by the Committee of Senior Officials through written procedure on 13 November 2018.

MEMORANDUM OF UNDERSTANDING

For the implementation of a COST Action designated as

COST Action CA18110
UNDERGROUND BUILT HERITAGE AS CATALYSER FOR COMMUNITY VALORISATION
(Underground4value)

The COST Member Countries and/or the COST Cooperating State, accepting the present Memorandum of Understanding (MoU) wish to undertake joint activities of mutual interest and declare their common intention to participate in the COST Action (the Action), referred to above and described in the Technical Annex of this MoU.

The Action will be carried out in accordance with the set of COST Implementation Rules approved by the Committee of Senior Officials (CSO), or any new document amending or replacing them:

a. "Rules for Participation in and Implementation of COST Activities" (COST 132/14 REV2);
b. "COST Action Proposal Submission, Evaluation, Selection and Approval" (COST 133/14 REV);
c. "COST Action Management, Monitoring and Final Assessment" (COST 134/14 REV2);
d. "COST International Cooperation and Specific Organisations Participation" (COST 135/14 REV).

The main aim and objective of the Action is to The main aim and objective of the Action is to promote Underground Built Heritage as a valuable resource to celebrate and preserve and, when sustainable, to re-use and valorise, realising its full potential to support local communities' development.. This will be achieved through the specific objectives detailed in the Technical Annex.

The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 64 million in 2018.

The MoU will enter into force once at least seven (7) COST Member Countries and/or COST Cooperating State have accepted it, and the corresponding Management Committee Members have been appointed, as described in the CSO Decision COST 134/14 REV2.

The COST Action will start from the date of the first Management Committee meeting and shall be implemented for a period of four (4) years, unless an extension is approved by the CSO following the procedure described in the CSO Decision COST 134/14 REV2.

TECHNICAL ANNEX

OVERVIEW

Summary

The proposal will establish and implement an expert network, aiming at promoting balanced and sustainable approaches for the conservation of the underground heritage and, at the same time, realising the potential of underground space in urban and rural areas for regeneration policies. The experts will be organised in three working groups: 1. Underground space conservation and monitoring; 2. underground Heritage-Led urban and rural regeneration; 3. Planning and governance tools. Each expert will share best-practices, by reporting on governance mechanisms, planning framework, stakeholders' involvement management, financing mechanisms, technical needs, and their direct impacts on the underground built environment preservation, environment, society and economy, as well as potential negative externalities (i.e. 'gentrification', hard-branding, mass tourism, recreational villages, underground degradation…). Collected information will be the basis for developing new research and training, open and accessible to all parties interested in the underground regeneration, and it will provide knowledge on main technical and organisational barriers to the underground regeneration and correlated solutions. The proposal aims at guaranteeing continuity of use and significance to the underground historic fabric, revitalisation of the public realm and skills development for townspeople. It will disseminate knowledge on underground culture and assist local communities' decision-making with adequate cultural, scientific and technical knowledge of the underground built environment from many different aspects (i.e. archaeology, geotechnics, history, urban planning, cultural anthropology, economics, architecture, cultural tourism). Finally, it will contribute to other EU programmes implementation.

Areas of Expertise Relevant for the Action	**Keywords**
● Social and economic geography: Spatial development, land use, regional planning ● History and Archeology: Preservation of cultural heritage ● Social and economic geography: Databases, data mining, data curation, computational modelling ● Civil engineering: Preservation of cultural heritage ● Environmental engineering: Remote sensing	● Underground Built Environment ● Heritage-Led Regeneration ● Heritage Conservation Methods ● Sustainability Transition ● Technological and Social Innovation

Specific Objectives

To achieve the main objective described in this MoU, the following specific objectives shall be accomplished:

Research Coordination

● Managing and treasuring the wide-ranging participants' competencies in order to identify key areas of scientific, technical, commercial, managerial, political, cultural and social nature, which are currently deemed problematic for a sustainable use of the Underground Built Heritage

● Setting up and coordinating small teams of participants for performing every year four case-studies assessments, and favouring the comparison of similar UBH in different economic, social, political and cultural contexts

● Interacting with local communities, disseminating innovative thinking and supporting them to explore alternative social trajectories in an adaptive, forward-looking manner

● Improving network openness by delivering presentations at regional and local conferences, with an intense coordination effort in order to guarantee the homogeneity of the research results, translated in different languages.

Capacity Building

● Providing a balanced and sustainable methodology for supporting the conservation and re-use of the UBH, by classifying different approaches through case-studies, by adapting, operationalising and testing the "Recommendation on the Historic Urban Landscape (HUL)", and by introducing new innovative technologies for the UBH knowledge, preservation, and valorisation

● Developing new skills for planners, decision-makers, promoters, and local development facilitators, by testing and running a new training course on UBH, which will integrate multi-disciplinary knowledge about the underground heritage with a planning framework based on HUL and boosting cultural planning, strategic spatial planning, transition planning and management
● Realising the potential of UBH for empowering local communities, by supporting their active involvement, stimulating bottom-up initiatives (e.g. Living Labs), and guaranteeing continuity of use and significance to the underground historic fabric, revitalisation of the public realm and skills development for townspeople

TECHNICAL ANNEX

1. S&T EXCELLENCE

1.1. CHALLENGE

1.1.1. DESCRIPTION OF THE CHALLENGE (MAIN AIM)

Underground Built Heritage (UBH) is a **unique cultural resource**, which might contribute to **individual and collective identity**, **social cohesion and inclusion**, being laid at the heart of community's sense of place. Its long history extends back several thousands of years, when cavities became shelters from inclement weather or wild animals. Successively, they became cultural and religious places, spaces for housing or mining activities, food production and storage, and natural resources' distribution. **Typologies of UBH sites** include natural and anthropic caves, underground burial/rites structures, mines and quarries, other man-made caves for exploitation and dwelling, underground infrastructures (cisterns, ancient drainage systems, tunnels, etc.), ancient buried structures and settlements..

These artefacts are **context-specific**, being characterised by an **historical and cultural exclusivity**, which strongly influences people's sense of belonging and of 'ownership' of particular localities, as well as daily routines, local rituals, traditions, ambiences, and atmospheres. As cultural heritage, they represent a **valuable resources for the sustainability challenge,** with the potential of catalysing urban/rural regeneration and attracting tourism, raising community awareness and making local communities more resilient to globalised systems of production and consumption by preserving their unique environmental and cultural aspects. In particular, their built structures and spaces have a **relevant role for heritage-led urban regeneration initiatives**, and their integration in these schemes generate popular, successful characteristic urban quarters, where people enjoy living, and engender economic development through job creations while creating social well being through crime reduction, health, education and social capital.

The main Underground4value challenge is **promoting UBH** as a **valuable resource** to **celebrate and preserve** and when **sustainable**, to **re-use and valorise**, realising its full **potential to support local communities' development.**

Although success stories in the field of UBH have captured the attention of the world, this resource's preservation and valorisation finds **relevant constraints**. First, **there are significant knowledge gaps** as UBH sites are largely unexplored, even not documented, and indeed under-utilised. Second, geotechnical **and geo-environmental concerns**, together with the presence of archaeological sites and infrastructure, deliver a perception that the underground space is a **high-risk and costly area of intervention**. UBH demands for surveys, which could benefit from innovative technologies, in order to understand complex damage and decay mechanisms, long-term environmental processes and medium to short-term natural, human and ecological risks. Therefore conservation and re-use of UBH sites requires **adequate scientific and technical knowledge**, **technological capabilities and financial resources**, which local public bodies usually lack. Therefore, once lost the original function, this resource frequently remains a hidden and forgotten landscape, lying abandoned and in a bad state of conservation.

To fill this gap, it is essential to **structure a reliable UBH knowledge base**, that is wide ranging, timely and economically accessible. It is necessary to classify different typologies and define common standards and methodologies, to cover many different aspects (i.e. archaeology, geotechnics, history, spatial and urban planning, cultural anthropology, economics, architecture, cultural tourism). The digital

revolution's integration, in addition, could simplify UBH related surveying and dissemination practices, by supporting different stakeholders with historical and archaeological backgrounds, integrated geophysical explorations, and surveys of the earth and subsoil resource. It would also allow simplified procedures and protocols for **assessing the state of the UBH conservation**, within European regulations in heritage conservation (CEN/TC 346 - Conservation of cultural property), reducing technological and financial difficulties in the data collection of underground conditions. Furthermore, new emerging technologies such as three-dimensional (3D) computer modelling and different sensing techniques, could become a primary thrust for underground heritage research and development (e.g. 'seeing through the ground'). Finally, by approaching and managing **UBH as a commons** it would be possible to improve **collaboration among scientists** and **reducing costs for sharing knowledge**.

If not sustainable and **unresponsive to local communities' needs** and potentialities, physical **planning tools** could represent a relevant constraint to local community development, and use UBH for generating spaces of pure consumption and gentrification (Labadi 2008) or developing 'entertainment-led regeneration' (McCarthy 2002). In addition, many city planners, decision-makers and builders **take into account underground space for its 'invisibility'** and potential 'space availability' especially there limited surface space is unable to meet the demands of **new urban functions**. Nowadays, underground spaces often host transport interchanges, car parking, common ducts for utilities, warehousing and hazardous materials storage, and even sport facilities. In terms of a functional approach, UBH can often seem a **constraint for underground development**, given the **absence of a specific legislation** on underground heritage areas and little evidence of a policy-driven conservation and valorisation of UBH at European level. Nevertheless, there is a **rising awareness that physical approaches can only be part of the solution to communities' problems**, and that planners should better "…address how people mix and connect, their motivations, and whether they 'own' where they live" (Bianchini, 1999).

In general, UBH conservation falls under l**egislation in natural heritage conservation or archaeological / cultural heritage protection laws** and regulations, which mainly depend on local public bodies with different organisational and legal frameworks. At international level, the main reference for promoting a **UBH sustainable use** is the "**Recommendation on the Historic Urban Landscape (HUL**)", adopted in 2011 UNESCO's General Conference. The HUL is aa **holistic approach** for historic urban landscape management, which considers **heritage as a social, cultural and economic asset** for the urban development and aims at "…preserving the quality of the human environment, **enhancing the productive and sustainable use of urban spaces**, while recognising their dynamic character, and promoting social and functional diversity" (UNESCO, 2011). It implies the application of a **range of traditional and innovative tools**, based on civic engagement, knowledge and planning tools, regulatory systems, and financial tools to adapt to different local contexts and built heritage. Expressly, the **civic engagement tools** aim at involving and empowering different stakeholders, supporting their capacity building, and helping them to identify key values in their urban areas, to develop visions, goals and actions to safeguard their heritage and promote sustainable development. HUL management therefore, calls for the **integration of these tools in urban governance dynamics**, in order to facilitate dialogue by learning from communities' histories, traditions, values, needs and aspirations and mediating between groups with conflicting interests (UNESCO 2011). HUL tools offer a flexible and general **conceptual framework**, characterised by **"soft-law",** which countries can implement and adapt to their specific contexts on a voluntary basis. It does not provide a robust and comprehensive set of tools or binding regulations. On the contrary, it opens the door to a dialogue without entering in contrast with existing planning arrangements. This approach follows the same direction of the **transition towards sustainability**, which requires further changes in **interdependent societal systems** and **across multiple scales** – from the supply chains to the communities and individual citizens' behaviours and values – and implies **complex and uncertain processes**, mainly depending on experimentation, learning and sharing ideas.

These processes demand to acquire and test tools for encouraging dialogue and engaging stakeholders across society "to determine where we need to go and how we are going to get there" (EEA 2016). These tools should **stimulate and facilitate local communities' empowerment** and connect natural, social, cultural, political and economic environments, gauging impacts across different spheres of life, and grasping the importance not only of 'hard' but also of 'soft' infrastructures" (Bianchini, 1999).

Today, rather than being a development opportunity, **heritage conservation represents a cost and a barrier to regional and urban development**. Changing this perspective requires an innovation in the development path, by introducing new practices and behaviours that enable society to meet its needs in a more sustainable way. Topics such as cultural heritage, urban and rural regeneration, and sustainable tourism would become **strategic opportunities** at neighbourhood, urban and regional levels, if developed in a context of community engagement, with more effective coalitions of 'actors' supported by structures that encourage collaborative relationships. One challenge is the application of

two community management tools - such as **Strategic Stakeholder Dialogue** (SSD) (Van Tulder et al 2004) and **Transition Management** (TM) (Kemp at al. 2005), and their integration into a new tool, the **Strategic Transition Management** (STM), based on local communities' experiments and empowerment, and a multi-level strategic dialogue (e.g. Living Labs).

Therefore, to develop and experiment such an integrated approach, promote innovation and the fullest open exchange of good/best practices, it is necessary to establish and implement a wide **multi-national/cultural/sectoral network** of academics, practitioners, decision-makers, and innovators. To achieve that challenge, the Action will work towards finding efficient ways to:

- **Establish new channels of communication** among different disciplines, among academia, decision-makers, and private stakeholders to share knowledge and best practices, to reduce the current strong disciplinary specialisation and sectionalism as well as the lack of communication between researchers and decision-makers.
- **Develop a reliable knowledge base, managed as a commons,** to provide decision-makers with historical and archaeological backgrounds, integrated geophysical explorations, and surveys of the earth and subsoil resources.
- **Introduce technological innovation,** by promoting 3D computer modelling of UBH, as a primary thrust for underground heritage research and development (e.g. 'seeing through the ground'), as well as detailed high-resolution reconstructions with the integration of different sensing techniques.
- **Mapping different UBH re-use and broader heritage-led regeneration case-studies** in different countries, and improving the overall comprehension of success factors in terms of business and management, financing mechanisms, stakeholders' involvement, governance mechanisms, procurement, technical needs, and environmental, social and economic impacts.
- **Opening the network to partnerships with local management frameworks** for each of the identified case studies of UBH conservation and re-use, as well as **interacting** with different local stakeholders, both public and private, to reach consensus on which values should be protected and carried on to future generations and determine the attributes that carry these values
- **Pioneering socially and environmentally innovative solutions,** by stimulating, developing and supporting processes of local community co-evolution and co-creation, which allows communities to explore alternative social trajectories in an adaptive, forward-looking manner, such as the Strategic Transition Management (STM).
- **Designing and testing new training modules for planners, decision-makers, promoters, and local development facilitators,** based on scientific approaches (regional sciences, urban geography, computer sciences, and economic policy), with the input of disciplines in the humanities, for addressing cultural issues, as well as strategies and tools for urban/rural regeneration policies, sustainable tourism, community empowerment, and UBH conservation.

1.1.2. RELEVANCE AND TIMELINE

The Action's relevance is stated in Art. 3.3 of the Treaty on European Union, which states the EU role of ensuring "… that **Europe's cultural heritage** is safeguarded and enhanced". That statement has been recently reinforced by the EC communication "Towards an integrated approach to cultural heritage for Europe" (COM(2014) 477 final), which affirms that "Europe's cultural heritage, both tangible and intangible, is an **irreplaceable repository of knowledge and a valuable resource for economic growth, employment and social cohesion**" (p. 2). In that communication, the EC calls for:

- Actions encouraging the **modernisation of the heritage sector**, raising awareness and engaging new audiences
- Definition of a **strategic approach to research and innovation**, knowledge sharing and smart specialization
- Identification of skills needed and improvement of training for heritage professionals
- Development of a **more participative interpretation and governance models** that are better suited to contemporary Europe, through greater involvement of the private sector and civil society.

The Action fully addresses the EC goals by developing innovative approaches to surveys, analyses, monitoring and testing in regards to HUL**,** and by promoting new training tools for planners and decision-makers, and finally empowering local communities.

In addition, '**Cultural Heritage for Sustainable Growth**' has been identified as one of the societal challenges of Horizon 2020 that reflects the policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere (COM(2011) 808 final). Specifically in regards to the area in the Horizon 2020 "Climate action, environment, resource efficiency and raw materials work programme 2016-2017", the Action supports the work programme objective of harnessing "**the full potential of cultural heritage as a production rather than a cost factor**". It aims at maximising the intrinsic economic, cultural and societal value of underground heritage "…in promoting well-being, cultural diversity and social cohesion" (p. 62). It also addresses the challenge of using **cultural heritage as a driver for sustainable growth of urban and rural areas**, retrieving history, culture and identity of the UBH and developing it as "a factor of production and competitiveness and a means for introducing socially and environmentally innovative solutions" (p.62). By fulfilling assessments on UBH case-studies, in cooperation with local communities, the Action properly addresses the challenge to "go far beyond the simple conservation, restoration, physical rehabilitation or repurposing of a site, and to demonstrate heritage potential as a powerful economic, social and environmental catalyst for regeneration, sustainable development, economic growth and improvement of people's well-being and living environments" (p.62).

All the **knowledge produced by the Action multidisciplinary network** will be a relevant background for developing a dedicated digital platform, which will consistently provide sensorial and behavioural data collection from different sources in a cost efficient way, and guarantee assessment, monitoring, and online training toolkits for decision-makers, practitioners, stakeholders and local communities.

Finally, by using the HUL, the Action will contribute to the specific UNESCO challenges, as follows:

- Improving the HUL approach, by adapting the new instruments to the UBH specific contexts
- Disseminating the approach widely across European and national territories
- Facilitating its implementation throughout the development of detailed tools
- Promoting new jobs and training new skills
- Providing tools for monitoring its impact on the conservation and management of UBH.

1.2. OBJECTIVES

1.2.1. RESEARCH COORDINATION OBJECTIVES

The development and coordination of a wide **multi-national/cultural/sectoral network** demands, on the one side, achieving a **common understanding** of the Action goals, approaches and defining the target groups. On the other side, it demands for managing and treasuring the **wide-ranging participants' competencies** in order to identify key areas of scientific, technical, commercial, managerial, political, cultural and social nature, which are currently deemed problematic for a sustainable use of the UBH.

A **preliminary survey among the participants on approaches and experiences** for the UBH conservation and re-use will consequently facilitate the work of the Action, reinforce their involvement and provide a first knowledge base, which will be available to the network and continuously updated.

Another objective is setting up and coordinating **small teams of participants** to perform yearly **four case-study assessments**, by using the Short-Term Scientific Missions (STSMs) tool. These assessments, jointly conducted by participants' of different nationalities, disciplines and education, will promote a better communication in the network, as well as give visibility to the Action, paving the way to new participants.

A case-study approach will favour the **comparison of similar UBH in different economic, social, political and cultural contexts,** testing common practices and/or similar financial schemes as a **proxy of existing benchmarks** and/or strong cultural influences in planning and development. Broadening the participation to non-European partner countries would be very valuable for a wider sampling.

The objective of **interacting with local communities**, **disseminating innovative thinking** and supporting them to explore alternative social trajectories in an adaptive, forward-looking manner, will be **carried out during STSMs, workshops and in particular in the training courses**, where trainers and trainees will work together on specific topics, producing a yearly publication.

Finally, although the main dissemination policy will privilege International/European conferences and articles on sectoral scientific journals, the Action will improve its openness by delivering **presentations at regional and local conferences**. That will demand for an **intense coordination effort** in order to guarantee the homogeneity of the research results, translated in different languages.

1.2.2. CAPACITY-BUILDING OBJECTIVES

The capacity building objectives are threefold, namely:

- Providing a **balanced and sustainable methodology for supporting the conservation and re-use of the UBH**, by classifying different approaches through case-studies, by adapting, operationalising and testing the "Recommendation on the Historic Urban Landscape (HUL)", and by introducing **new innovative technologies for the UBH** knowledge, preservation, and valorisation
- **Realising the potential of UBH for empowering local communities**, by supporting their active involvement, stimulating bottom-up initiatives (e.g. Living Labs), and guaranteeing continuity of use and significance to the underground historic fabric, revitalisation of the public realm and skills development for townspeople.
- **Developing new skills for planners, decision-makers, promoters, and local development facilitators**, by testing and running a new training course on UBH, which will integrate multi-disciplinary knowledge about the underground heritage with a planning framework based on HUL and boosting cultural planning, strategic spatial planning, transition planning and management.

The Action will provide adequate cultural, scientific and technical knowledge of the UBH with reference to different aspects (i.e. archaeology, geotechnics, history, urban planning, architecture, cultural anthropology, economics, tourism, sustainable development), as well as introduce new technologies and innovative approaches in a multi-disciplinary context.

1.3. PROGRESS BEYOND THE STATE-OF-THE-ART AND INNOVATION POTENTIAL

1.3.1. DESCRIPTION OF THE STATE-OF-THE-ART

Success stories in the field of underground built heritage, such as the urban regeneration of Matera (IT) and Göreme in Cappadocia (TR), or the Wieliczka salt mines (PL), have captured the attention of the world. Every year new underground heritage-led regenerations are developed in different parts of the globe. Nonetheless, the overall UBH state-of-the-art is very limited and sectoral, being mainly analysed throughout three disciplinary trends: underground planning and development, underground archaeology and speleology and cultural heritage planning.

The first to recognise the **need to integrate underground space in the planning system** was Édouard Utudjian in the 1930s', by establishing the GECUS (Groupe d'Études du Centre Urbain Souterrain), coordinating as secretary general the CPITUS (Comité permanent international des techniques et de l'urbanisme souterrain) and creating the periodical 'Le Monde souterrain' (1934-1973). Strongly influenced by Le Corbusier's rationalism, Utudjian promoted a **3D zoning** for integrating the underground space in the surface city ("**ville épaisse**"). That pioneering experience opened the field for many other initiatives, aiming at using **underground spaces as a strategic resource**, especially for dense urban areas, with respect to concurrent objectives such as densification, integration and securitisation of infrastructure and services. In recent times, an increasing number of international groups of research, by means of several initiatives, have demonstrated the **underground attractiveness in shaping a new urban vision**. In particular, two cooperative actions are remarkable:

- **Associated research Centres for the Urban Underground Space** (ACUUS), an international, non-governmental organization promoting partnerships amongst all actors in the field of planning, management, research and uses of urban underground space, founded in 1996.
- **ITA Committee on Underground Space (ITACUS)**, a permanent committee of the International Tunnelling and underground space Association (ITA) promoting events and raising awareness of the need for planning for the future of underground space use.

Distinctively, ACUUS promotes **methods, techniques and professional skills** allowing the municipalities and developers to better intervene in the urban underground. Among their objectives, there is the aim of establishing a cadaster of the urban underground and to make it usable (and to be sold, bequeathed or rented) at certain conditions by all urban actors, public and private, especially through public-private partnerships. In terms of Cultural Heritage, ACUUS suggests that **urban underground construction builders** should consider, by necessary means and with the agreement of the local authorities, the **conservation, the protection or the relocation of archaeological patrimony**. In addition, it has developed the first online database for Worldwide Underground Space development (https://www.acuus.org/index.php/the-underground-atlas), which the Action could greatly

implement. However, ACUUS approach does not consider UBH as a resource for development and does not take into account any community-led strategy.

On the other side, ITACUS, together with other associations and organisations (ISOCARP, ICLEI, IFME, UNISDR), recently developed a **'Think Deep' approach** and the 'Young Professional's Think Deep Program', addressed at **stimulating interaction among interdisciplinary professionals** in the field of the underground space. That approach, based on **Transition Management**, believes that without a vision of the use of urban underground space, without a planning tool and without a strategy for managing the use of this vast spatial asset, all developments will be on a 'first come, first served' basis. This will lead to spatial congestion and competition between resources. The term 'Deep' is also part of the emergent '**Deep City Method'**, developed at the École polytechnique fédérale de Lausanne, which aims at supporting urban planners to decide how to best exploit underground resources, and assisting cities in extending their legal systems into these traditionally lawless areas. Based on a **macro zoning of the underground urban space** at a city scale, the approach selects high potential land parcels for short-term development, while it reserves special protection areas for valuable geo-resources protection for long-term use. Both approaches provide planning tools for the underground space, without any consideration of cultural heritage and community identity.

In the context of the **underground archaeology and speleology studies' literature**, the largest part of the advancements are related to the development of new technologies for surveying cavities and '**seeing through the ground'**, analysing their stability, monitoring environmental factors, and handling conservation treatments. From a methodological point of view, the main evolution is represented by the **general classification of artificial cavities** (2012) of the Commission on Artificial Cavities of the 'Union Internationale de Speleologie (UIS)', based on time and modality of realisation, and organised through a typological tree with seven main categories, each of them subdivided into sub-types. That classification could represent a useful tool for facilitating communication among researchers, and stimulating more detailed classifications.

Not specific to UBH, is the **literature on sustainable cultural heritage**, which is relatively recent, if we consider that the connection between heritage and sustainable development was introduced only in 2002, with the 'Budapest Declaration' (UNESCO 2002). The Declaration expresses the need to "ensure an appropriate and equitable balance between conservation, sustainability and development, so that World Heritage properties can be protected through appropriate activities contributing to the social and economic development and the quality of life of our communities". In particular, it sees urban heritage conservation as a primary feature for sustainable development, by reducing poverty through economic growth, tourism and job creation (Labadi and Logan 2016). Then, as already mentioned, **Historic Urban Landscape** (HUL) (2011) exemplifies a relevant progress towards a planning approach, by focusing on cultural resources availability in a certain place. Another conceptual progress is the 'Florence Declaration on Heritage and Landscape as Human Values' (ICOMOS 2014), which introduces two concepts, the **landscape** and the **community-based planning**. The first, "whether urban or rural, is a new paradigm for harmonious development, offering an approach that can integrate economic, social and environmental processes". The second, founded on the "involvement of local communities, the recognition of, and respect for, their cultural heritage, as well as innovative and traditional practices can favour more effective management and governance of multifunctional landscapes, contributing to their resilience and adaptability". In addition, several EU projects, particularly in the framework of the INTERREG programme have dealt with cultural heritage and methods for its exploitation and management.

Finally, it is significant to include in this brief survey the **massive literature on both urban and rural regeneration**. The first often highlights the potentialities of heritage-led urban regeneration initiatives (Roberts and Sykes, 2000; Evans and Shaw, 2004), by considering the **built heritage** as a **valuable catalyst,** which contributes to individual and collective identity, social cohesion and inclusion. Adaptive reuse of heritage resources can provide a sense of stability and a sense of continuity for people and societies. Rural regeneration literature has recently placed greater emphasis on enabling and empowering local people in rural areas to take greater control over their own lives through 'bottom-up' development approaches that involve local people in their planning. This approach is encapsulated at EU level under the name of **Community-Led Local Development (CLLD).** CLLD is defined as "a tool for involving citizens at local level in developing responses to the social, environmental and economic challenges we face today" (Common Guidance of the European Commission' Directorates-General AGRI, EMPL, MARE and REGIO on Community-Led Local Development in European Structural and Investment Funds, February 2013).

1.3.2. PROGRESS BEYOND THE STATE-OF-THE-ART

The Action represents a **fundamental milestone** for integrating **underground space, cultural heritage studies and community-based planning**. Thanks to the Action's activities, the knowledge transmission and exchange will reveal practices, imaginaries and local cultures associated with the UBH, renew their interpretation, and stimulate knowledge and the perspective vision of local communities. UHB landscape will become a place of equilibrium for nature, identity and attractiveness, by re-associating multiple uses and giving capacity for development at all levels (regional, local) and all temporalities (short, medium and long term) while generating positive and self-sustaining "natural" interdependencies.

Although not a research project, nor and Educational Programme, the Action will propose some **methodological advancements**, specifically in reference to the **HUL framework.** It will integrate different planning approaches through a transition management approach (for developing bottom-up initiatives, such as local living labs).

The Action will make a relevant step forward with respect to the current state-of-the-art and provide a significant knowledge base for a sustainable use of the UBH by:

- **Exploring new planning approaches**, such as the Strategic Transition Management (STM), and their use in the built heritage conservation and re-use, through the WG activities, the case-studies STSMs, and the training courses
- Creating a multi-disciplinary network on the **sustainable use of the UBH**
- **Disseminating results** of the methodological and knowledge advancement at international, regional, and local level
- **Developing new training modules for planners**, local community facilitators, promoters, and decision-makers.

The Action will **increase public awareness** about the concrete opportunities of **integrating culture and identity** into the regional and local decision-making processes for preserving the UBH, and **developing a planning approach** with the following attributes: **holistic, flexible, innovative, experimental, people-centred, humanistic, cultured, and open-ended.**

The action will follow, and possibly have a dialogue with, the **current and future cultural heritage funded projects** in both Horizon 2020 framework and INTERREG programme.

For **implementing the UBH knowledge base**, the Action will **advance**, on the one side, **in the classification of artificial cavities**, by linking the typologies to their functions and potential re-uses and will promote archaeological and historical research for each case-study. On the other side, it will examine **technological developments** of UBH non-invasive diagnosis, innovative ICT tools systems for sensoring and data collection, multiscale approaches, from landscape to archaeological sites or monuments, up to the single artefact, for detailed high-resolution visualisation and reconstruction of the more interesting items of the heritage.

The Action is **timely and needed**, for rethinking the current **weak communication** between **physical underground space planning** and the **cultural heritage perspective**. It will analyse research findings, methods, training courses and programmes and discuss **theoretical and practical issues** related to the selected case studies, the interaction with local communities, the continuous technological innovation, and the **regional smart specialisation strategies**.

The Action will **survey existing gaps and barriers** (technological, social, economic, administrative, political, legislative, etc..) that devalue UBH re-use and will individuate **current needs for new jobs and skills**, not limited to the touristic and recreational sectors, as well as emerging needs for decision-makers training. To this end, good practices and success-stories of co-operations between academic and research institutions, public-private sector, local communities and citizens, as in the case of 'Think Deep', will be analysed to assess arising Pros and Cons and their potential for implementation.

1.3.3. INNOVATION IN TACKLING THE CHALLENGE

The main conceptual innovation in the Action will be **to value the underground space** not only as an affordable solution for locating new urban functions and saving surface space for urban development, but also as a **depository of the local identity and history**, and placing its cultural component as a **catalyst for a broader strategy of community engagement and regeneration policies**.

The second innovation will be the **cross-fertilisation of the knowledge among scientists** (i.e. historians, architects, engineers, archaeologists, planners, geologists, etc.), practitioners, public officials

and technicians, being rather limited such interdisciplinary initiatives in the field of UBH. In addition, by assessing specific case studies, the Action will develop **interaction mechanisms with various actors,** such as public institutions, private stakeholders and **local communities**, which have **extensive experience regarding specific elements of UBH**.

There will also be innovative organisation of a **training school in cities characterised by relevant UBH**, aiming at stimulating the development of new skills in the field of planning and decision-making. The **training will expand the HUL framework** by developing new specific modules about UBH and introducing **Strategic Transition Management (STM)**. It will provide the planner with tools for stimulating, developing and supporting real-life experiments (**Living Labs**) in a goal-oriented modulation, aimed at shaping **processes of strategic dialogue, co-evolution** and **co-creation**.

The Action will point out **policy conditions that allow the conservation and reuse** of UBH sites, based on the needs of trust and transparency, and of integrating heritage aspects into sectoral policies. **Transparent and integrated policies** will make it possible to achieve a cooperative approach by the authorities responsible for restoration and conservation in the case of new functions for an underground artefact. As demonstrated by many success stories, **UBH added-value increases** when combined with objectives from other policies, such as spatial policy, water, energy or transport.

The Action, finally, will **multiply virtual and physical meeting-points**, at network level and local level, through different platforms, ICT tools and approaches, for sharing assessments, dialogues with stakeholders, selection of case studies, participation in international, national and local events, editing of books, organising missions, training schools and dedicated workshops.

1.4. ADDED VALUE OF NETWORKING

1.4.1. IN RELATION TO THE CHALLENGE

Networking is strongly needed to assist in removing the vacuum of institution-based, country-based stereotyped areas. Indeed, as networking allows people from different backgrounds to facilitate the exchange of knowledge and advice by sharing lessons from experience, it is one of the best ways for people to have a common goal without being limited by national or regional educational standards. Good networking schemes also include mentoring programmes, in which case, the fact that two people do not share the same educational background matters less than the professional situations or challenges that they both experienced/are experiencing.

International exposure and collaborative effort to enable knowledge sharing is an important target of the Action to break through national boundaries and develop common approaches of research, exploitation and training in the field of UBH. In particular, the need for building a common knowledge base, throughout underground conservation and reuse success stories, will strongly benefit from the possibility of comparing similar approaches in different contexts. Nonetheless, the decision to use, as main reference, the HUL, which is a flexible, adaptable, and broad holistic approach, is functional to the need of sharing it in a large network of varied experiences, cultures and linguistic skills.

1.4.2. IN RELATION TO EXISTING EFFORTS AT EUROPEAN AND/OR INTERNATIONAL LEVEL

Due to the nature of the Action, there are not many existing efforts of this kind but still it would be crucial to actively network, complement, liaise and “rub shoulders” with associations, experts and professionals running UBH-oriented activities in Europe and beyond. The Action will contact and interact with:

- Associated research Centres for the Urban Underground Space (ACUUS)
- ITA Committee on Underground Space (ITACUS)
- The International Society of City and Regional Planners (ISOCARP)
- European Institute for Comparative Urban Research (EURICUR)
- The Commission on Artificial Cavities of the ‘Union Internationale de Speleologie’ (UIS)
- Young Professional’s Think Deep Program
- Ongoing EU Funded projects

2. IMPACT

2.1. EXPECTED IMPACT

2.1.1. SHORT-TERM AND LONG-TERM SCIENTIFIC, TECHNOLOGICAL, AND/OR SOCIOECONOMIC IMPACTS

Thanks to an **extended and multidisciplinary network**, the Action will promote a **new integrated planning approach** in different countries and disciplinary contexts, as well as in different regional cultures, identities, and economies. It will represent an **important cultural challenge** and a positive change from the current methods, policies and practice. Thanks to the **assessment of UBH case-studies**, the Action will increase the popularity of **UBH as a strategic resource for contributing to regional and local development**, and will be of great value for **reducing uncertainties**, and in persuading people of its potentialities.

For supporting social innovation, the Action will **develop a promising planning environment**, by **providing an insight** into the conditions under which a project will be advanced, **helping to avoid** investments in UBH without long term sustainability, and finally, through co-creation practices, **stimulating individual and collective identity, social inclusion and cohesion**.

From a technological point of view, the Action will **have positive impacts on testing and using on-site monitoring tools** within the cavities, satellite remote spectral technologies, ground penetrating and holographic radars, seismic tomography, electrical resistivity tomography techniques, visual information interpretation, infrared thermography, monitoring, environmental parameters evaluation. In addition, it will contribute to **disseminate and promote new techniques** for evaluating the stability of the site (geometric features, presence and distance of pillars to support it, etc.), integrated approach to the stability of cavities, techniques of simulation to describe the worst-case scenarios in regards to the possibility of underground failures. In addition, the Action will provide a **relevant scientific base for developing a digital platform for the UBH knowledge base**.

At the same time, the Action's knowledge base will **foster the importance of the UBH conservation**, by classifying studies of decay, evaluation of cleaning methods, protective and consolidation treatments, as well as **promoting protocols** aimed at evaluating effectiveness and hazard control during conservation works. This work will contribute to a **realistic picture** of the global effort, and will **play an important role in job creation**, by assessing the need for new job profiles.

The training schools will provide a first moment of confrontation among participants – trainers and trainees. In particular, by applying the 'Transition Management' approach, planners will interactively learn how to facilitate communities' dialogue, and develop new social, economic and cultural behaviours from the opportunities offered by the UBH reuse also in terms of new lifestyles. In the long term, thanks to partnerships and co-creation among public, business, academics and local communities, **underground artefacts**, such as tunnels, underground pools, negative buildings and caves, once only used for solving climatic and social urban conflicts, **will grasp new life and functions**.

2.2. MEASURES TO MAXIMISE IMPACT

2.2.1. PLAN FOR INVOLVING THE MOST RELEVANT STAKEHOLDERS

Beneficiaries and users include **Universities** (academics, scholars, students in the field of History, Cultural Heritage, Architecture, Engineering, Geography, Chemistry, Geology, Archaeology, Geophysics, Law, Economics), **Professional Associations**, **Chambers of Commerce, Development Agencies, Tourism Promotion Bodies, Real Estate companies, Local communities** (mayor, city planners, city managers, cultural policy-makers, local communities leaders, citizens), **practitioners** (urban planners, architects, financial consultants, geologists, and other professionals).

The Action is structured for promoting new approaches at the local level and will use a **series of co-located meetings**, as well as **short-term scientific mission**, and **training schools in cities with UBH**, in order to approach and invite potential beneficiaries and users to cooperate and support the Action. In particular, for each case-study and relative STSM, the hosting partner will involve all relevant stakeholders and start-up a Living Lab, where external participants will contribute to the assessment of the case studies, develop innovative transition experiments, and test the HUL framework. Some of these stakeholders will also be invited to participate to the training schools, for a storytelling of their experience, and, finally, to evaluate proposed methods, which will be devised because of the Action.

Opportunities for involvement of relevant stakeholders and other interested parties in the Action will be promoted through the Action webpage and newsletters. All activities concerning the involvement of

relevant stakeholders will be dealt with a high degree of awareness of gender issues in accordance with Articles 2 and 3 of the EC Treaty (gender mainstreaming), as well as Article 141 (equality between women and men in matters of employment and occupation) and Article 13 (sex discrimination within and outside the work place).

2.2.2. DISSEMINATION AND/OR EXPLOITATION PLAN

Dissemination activities are two-fold: firstly, local dissemination in and around the case-studies communities and cities, secondly, broader dissemination across EU and beyond. Main dissemination activities will promote the project as a whole, disseminate the results, engage with and involve EU, local stakeholders and citizens, build a sharing environment of communication and exchange within the project itself and the local communities, involved in the case studies and training schools. From the beginning, the Action will draft a **dissemination plan**, to guarantee the achievement of the following dissemination objectives:

- **Create awareness, understanding, and interest** about the scope, objectives and results of the project at EU and local level
- **Provide all involved stakeholders** with specific and valuable knowledge and solutions
- **Engage stakeholders** and drive them to adopt and implement case-studies' outcomes
- **Reach the widest dissemination of the project results**, among local communities, experts, decision-makers and academics, as well as society in general

The Plan will include a **stakeholder management**, vital to successful community-oriented activities, particularly given the cross-cutting and innovative nature of the work, which applies stakeholder-mapping techniques to ensure that all appropriate parties are engaged, aligned, and mobilised.
To maximise benefits and results visibility, the Action will establish consistent **common standards for dissemination**, by developing standard dissemination packages, based on the principle of 'adopt/adapt/create', in order to respect local differences in culture, language, social contexts and needs, while fostering application of standards (with exploitation of resulting benefits). In addition, being community-oriented, the Action will define communication channels to involve case-studies communities in the activities and ensure they feel part of the project (local meetings, webinars, and storytelling).
At the EU level, the plan will include a dedicated website, regular newsletters sent via e-mail and shared on social media (Facebook, Twitter), publications and brief communications in specialised magazines, which would be re-posted on the website and on social media, with capture of important moments and conclusions on camera and film, to share on Instagram or YouTube. The Action members will be presenting in international conferences and symposiums and will run Special Sessions and Seminars on Underground Space and sustainable development, regional development, heritage-led regeneration, underground conservation and monitoring. References to Open Access publications will be targeted.
To explore the outcome from the Action, the progress achieved, and to gain a better understanding about the level of impact from the Action's activities on the relevant stakeholders and users, **feedback forms** will be developed, circulated and collected after each public event (e.g. a conference, a workshop and a training session). In this way, it will be possible to qualitatively measure the impact of every event and identify any corrective actions or modifications. Specifically, the Action's dissemination plan will include:

- **All results to be presented at suitable events**, where the Action will disseminate the main concepts at the basis of a sustainable use of the UBH and the potential of its success throughout Europe for empowering local communities to the goal of re-using the UBH.
- **Organisation and delivery of events** within the Action to promote knowledge sharing on UBH conservation and reuse case studies, new planning approaches, and new technologies for surveying, modelling, assessing and monitoring UBH
- **Application of the use of non-traditional channels for dissemination**, such as social media, including formal (e.g. LinkedIn) as well as informal tools (e.g. Facebook, Instagram).
- In order to multiply virtual meeting-points, **organisation of webinars with stakeholders** or new potential participants on specific topics, to share assessments, select case studies, or interact with local communities interested in testing the adapted HUL framework.

Other measures/indicators for monitoring progress and measuring impact from the Action will also be regularly employed. These include: number of attendees per event; number of females that attended an Action event; number of young professionals attending a public event of the Action; number of visits to the Action's webpage per month; number of downloads of an Action's newsletter and the like. Impact analyses will be carried out on the data collected using statistical methods. The results of the impact analyses will be made public and published on the Action's webpage.

2.3. POTENTIAL FOR INNOVATION VERSUS RISK LEVEL

2.3.1. POTENTIAL FOR SCIENTIFIC, TECHNOLOGICAL AND/OR SOCIOECONOMIC INNOVATION BREAKTHROUGHS

Due to the nature of the Action proposed, the potential for innovation in research, learning, and training is high, while the risk of failure mainly depends on organisational weaknesses. In fact, there are not many initiatives of this kind in the world, suggesting that the potential for innovation breakthroughs is rather high and guaranteed. The Action is organised with the purpose of looking at and improving the **current means, methods, policies, practice for producing a balanced and sustainable approach to UBH conservation and re-use**. The innovative nature of the Action can be found in two main advancement: 1) **the holistic approach** for the UBH conservation and re-use and 2) the introduction in the cultural heritage of the **paradigm of the living labs' co-creation**. The Action, thanks to a robust multi-disciplinary network will provide tools, suitable for both neighbourhood and district planning level and for single UBH interventions, very flexible for the up-scaling and easily replicable in different social, economic and cultural urban regeneration contexts, characterised by different underground space, local services demand, touristic potential, legal frameworks, and stakeholders.
The risk level of failure due to external factors and resources is rather unclear and difficult to quantify because of lack of similar initiatives held and organised before. The lack of suitable resources to learn from could be identified as a risk in itself, but it is strongly mitigated by the Action's wide network. With its multi-disciplinary nature, it covers different aspects of the UBH and planning, and is expected to secure access to the necessary resources for achieving the main aim of the Action, and to secure that the Action includes partners from a wide geographical area of Europe.

3. IMPLEMENTATION

3.1. DESCRIPTION OF THE WORK PLAN

3.1.1. DESCRIPTION OF WORKING GROUPS

The Action is organised in five multidisciplinary working groups (WG), each dealing with a specific Action's challenge. Each WG defines a methodological framework, gathering the best research and information available, collecting examples and experiences, sharing knowledge and experiences on different aspects of the UBH, analysing those related to the Action's case-studies, drawing lessons learnt, preparing the training material, and reporting the outcomes, yearly expanding the challenges' boundaries.

WG1: Knowledge Base Development. It defines the methodological framework for the UBH classification, establishes general criteria for selecting sites for conservation and/or reuse, identifies case studies, and structures, with other WGs' contribution, the template for the assessment of the case studies. At the beginning, it will manage a questionnaire for the partners, for a preliminary survey on competencies and local differences. The survey, by including many different aspects (i.e. archaeology, geotechnics, history, urban planning, cultural anthropology, economics, architecture, cultural tourism), will support the **digital platform** design as repository of knowledge, shared experiences and dissemination results. Every year, the WG will develop a knowledge base for each selected case study, by collecting historical data related to UBH, as well as major economic and social indicators to allow longitudinal analyses to be undertaken over time. Small teams, with at least one Early Career Investigator each, will be organised on annual base, for assessing on-site case studies, interacting with local stakeholders in a living lab approach, and sharing information on success stories and failures during Short Term Scientific Missions. Finally, the WG will prepare the training material on the case studies. The first year, selected case studies will be as follows:

	Naples (IT): Modern Age tuff quarries under one of the most crowded urban areas of the world, with about 800 caves, 3000 water cisterns, 180 km of aqueducts' tunnels, catacombs, cemeteries, tombs, air-raid shelters, partially used as touristic attraction and partially reconverted into transport infrastructure.

	Postojna (SI): Three underground natural caves located on the classical Karst, which represent a significant case study as historical example of regeneration and valorisation since visitors' information centre and tours date back to 17th century. It is also one of the first examples of underground best practice in architecture hosting a post office and a multiservice space for visitors.
	La Unión (ES): Mining caves since the time of Romanized-Iberian settlements, they have been transformed in a successful touristic destination. An exemplary site of abandoned caves and their valorisation as significant signs of local rural cultural heritage. The introduction of flamenco dance performances and music exhibitions are the most innovative approaches to re-functionalisation.
	Göreme - Cappadocia (TR): Located on the central Anatolia plateau, the region is set in a moonlike landscape of giant rock cones, housing historic cave-dwellings and Byzantine churches. Added to the World Heritage List by UNESCO in 1985, it offers a sustainable balance between heritage conservation, cultural tourism development and local community empowerment, thanks to many successful regeneration interventions.

WG2: UBH conservation. Starting by reviewing sectoral literatures, the WG individuates the main methodological approaches and defines new research questions for the UBH conservation, which are incorporated in the case-studies assessment and in future research needs. The WG pays attention to technologies for UBH non-invasive diagnosis, innovative ICT tools for on-site monitoring tools of the cavities (sensoring) techniques for evaluating the stability of the site, integrated approaches to the stability of cavities, techniques of simulation of underground failures, detailed high-resolution visualisation and reconstruction of the more interesting items of the heritage. The WG contributes to the case-studies assessment and to the training school modules, and finally publishes the results.

WG3: UBH reuse and valorisation strategies. The WG reviews literatures on the link between UBH, CH and sustainable tourism, urban and rural regeneration, creative industry development, cultural entrepreneurship. It defines the methodological baseline for the community-based development strategies, identifies main research questions, and contributes to the case studies assessment preparation. Then, it analyses case studies results, compares them to the baseline, and then revises methodology, questions and results. Considering the WG nature, it privileges the interaction with local firms, practitioners, and customers, taking into account case studies and local contexts' diversities, especially in terms of economic, institutional and human capital. Mechanisms for collaborative schemes will also be studied to understand the nature and the role of each partner involved in the process of building. The WG contributes to the training school modules preparation by revising the material on a yearly basis and finally publishing the results.

WG4: UBH planning approaches. The WG defines a cutting-edge methodology, combining the HUL framework, the transition management approach, and the strategic stakeholder dialogue. At the beginning, with a socio-institutionalist approach, the WG will compare legislative and regulatory measures. Finally, it will promote in the case studies and in the training schools, a collective learning and planning method, based on the 'Living Lab' approach, that will aim to:

- empower local authorities, as enablers and facilitators, to play a more significant role in coordinating regeneration effort;
- target resources for the benefit of people in place with integrated programmes of physical, economic and social measures;
- create more effective coalitions of 'actors' within localities, by developing structures, which encourage long term collaborative relationships.

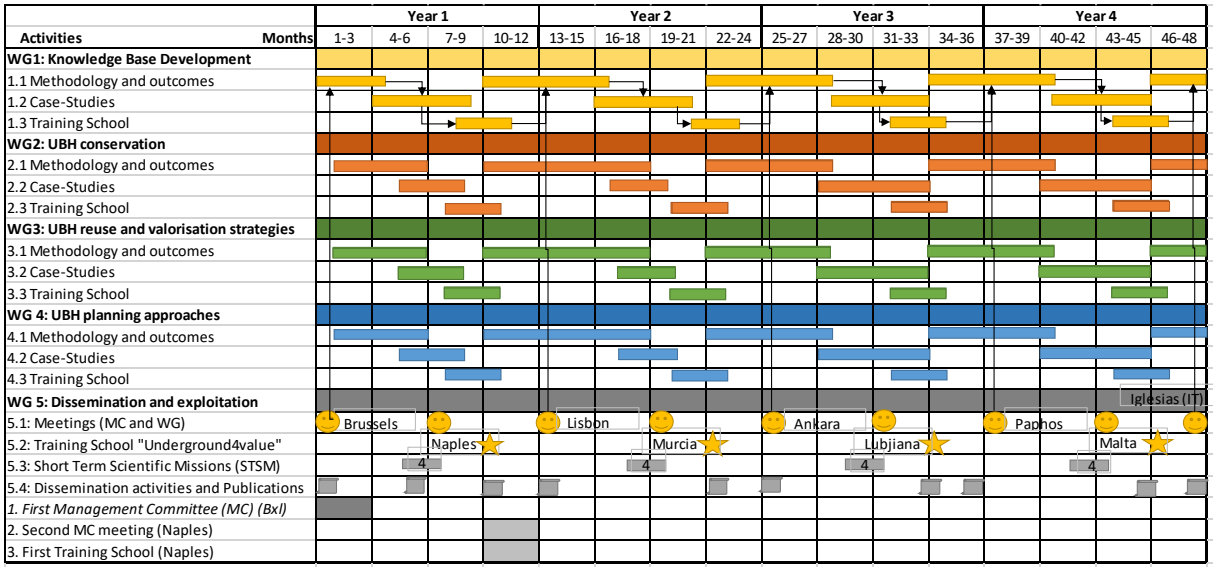
This WG pays attention to the necessary complementarities between functional approaches – at the level of regions and city – and social and cultural approaches involving citizens' engagement and empowerment – at the level of neighbourhoods. It also contributes to the case-studies assessment and defines the main training needs for planners and decision-makers.

WG5: UBH Dissemination and exploitation. The WG coordinates all dissemination activities including development and maintenance of the Action's website, publication of newsletters and articles, and organization of public engagement events. In addition, it develops and tests a methodological approach for UBH promotion – by setting up an initial dissemination package for the first four case studies – and then implementing it on yearly base. This WG will consolidate an exchange programme for members of staff, devise a specification of competences needs for the training schools, and put together all the findings and outcomes of the Action. The WG will complete the following tasks:

1. Dissemination and Exploitation Plan (A draft of this plan will be ready for discussion for the first Action meeting).
2. Dissemination Activities (webpage, newsletters, publication of articles and brief communications, attendance at congresses and symposiums, organizing and moderating special sessions on UBH in relevant events).
3. Public engagement events such as workshops, training schools and conferences to test and validate the outcomes from WG1 - WG4, enrich the scope of the Action and engage widely with relevant stakeholders from Europe and beyond.
4. Action's Handbook on the sustainable re-use of the Underground Built Heritage. This is envisaged to be a dynamic open handbook absorbing new material, ideas, information and expertise.

The training schools will integrate a procedure for testing and validating of new training and learning methods. Research-based training will be employed while engaging with young talents. Running Short Term Scientific Missions for supporting small teams in on-site assessments of case studies, in a close interaction with the local partner. Special attention will be paid to promote culture and gender balance, enabling early career investigators to learn, and broaden geographical inclusiveness.

3.1.2. GANTT DIAGRAM



3.1.3. RISK AND CONTINGENCY PLANS

A multi-location, multi-lingual, multi-discipline, and multi-partner network of this level of complexity will face a host of barriers and obstacles, few of which are likely to be of a technical or scientific nature. In particular, any potential risk is identified, assessed and listed with a specific plan on how to manage it.

To handle successfully any potential conflict among partners, the MC will set up a conflict-handling scheme and include it for discussion and approval on the agenda of the first management committee meeting. The general principle will be to try to achieve decisions by informal means and consensus, using formal procedures such as organising additional meetings only when indispensable. Nevertheless, all decisions that can have an impact on the progress of the Action (whether reached formally or not) will be documented, and distributed to ASO and MC members. Precise roles of MC, decision making and voting procedures will be distributed to all Action members.

Conflict Handling scheme		
Level/Management	***Decision mechanism***	***Go to next level if***
All Action Members	Verbal consensus only. *Meetings:* regular; as needed.	No consensus reached
Working Groups (WGs)	Verbal consensus only. *Meetings:* regular; as needed. Also meetings with other WPs.	No consensus reached
MC	Verbal consensus; vote if necessary. Simple majority. Meetings: would be convoked every 6 months if needed.	One partner insists
Intervention by external authority	Voting mandatory; simple majority. *Meetings:* Every 12 months or when needed	Intervention by the ASO, or legal action, is the only escalation possible; decision on this up to individual member.

Figure 2: Conflict Handling Scheme

Some critical risks are identified in the Fig. 3. However, adequate contingency plans will be prepared for a prompt identification of any emerging risk.

Risks	Mitigation
Organisation becomes too heavy	In the governance structure, we have emphasised agility incl. short and direct communication lines. Conflict handling scheme
Network is not harmonious	Most of the partners developed previous joint activities: there is a cohesive base. That should guaranty a general harmony
Network is disrupted	All partners have experience and proven track records in large collaborative R&D and infrastructure projects. All are motivated to reach the Action objectives, which have been defined in the common interest
Delays in the activity progress	Prevention: coordinator monitors activities and flag problems in a timely manner to enable harmonious mitigation. Mitigation: depending on activities interdependencies, a re-scheduling may become necessary
Local partner unable in engaging stakeholders for supporting case-studies and living labs	WG5 identifies target community and defines strategies for engaging stakeholders since the beginning, adapting the dissemination activity to their background and interests. Then the WG supports the local groups, and only in extreme cases the case-study is changed
Local partner unable to organise the Training school	The MC will have his meeting in the same city hosting the training four month before, in order to controll the organisational capacity and the struictures
Insufficient network ability to disseminate and exploit Action results	A dissemination plan will be developed in the beginning of the Action in order to define channels, tools and actions. The effectiveness of dissemination activities will be constantly monitored in order to assess whether any changes need to be implemented.

Figure 3: Critical risks for implementation

3.2. MANAGEMENT STRUCTURES AND PROCEDURES

The Action will be managed according to the structures and procedures listed in COST Vademecum, Section 2 COST Action Management. Specifically the Action Management will include: Action Science Officer (ASO), Management Committee (MC), Action Chair (AC), Action Vice Chair, Action Grant Holder, Working Group Leaders, Working Group Teams, STSM Coordinator, MC Observers, ERIs, Other Action Participants, Beneficiaries and Users. A Schematic presentation of the Action management structure could possibly take a stepwise form, as shown in Figure 4.The Action will be managed by a Management Committee (MC), which will be comprised of up to two management Committee Members per participating COST country. MC Members will meet every six months to coordinate and organise the Action activities in accordance with the Action objective, as specified in both the Action MoU and the Action approved Work and Budget Plan. MC members should include Action Chair, Action Vice Chair, Grant Holder, WG Leaders. MC, represented by Action Chair will report to Action Scientific Officer (ASO).

The budget will be set up in the yearly Work and Budget Plan (WBP), which has to be adopted before each Grant Period.

The progress of the Action will be monitored and assessed via three distinct reports, namely:

1) Progress Report 1 due at month 12, crucial for setting up the Budget and Action activities for the following grant period;
2) Progress Report 2 due at month 24, crucial for setting up the Budget and Action activities for the final grant period;
3) Final Report at month 48.

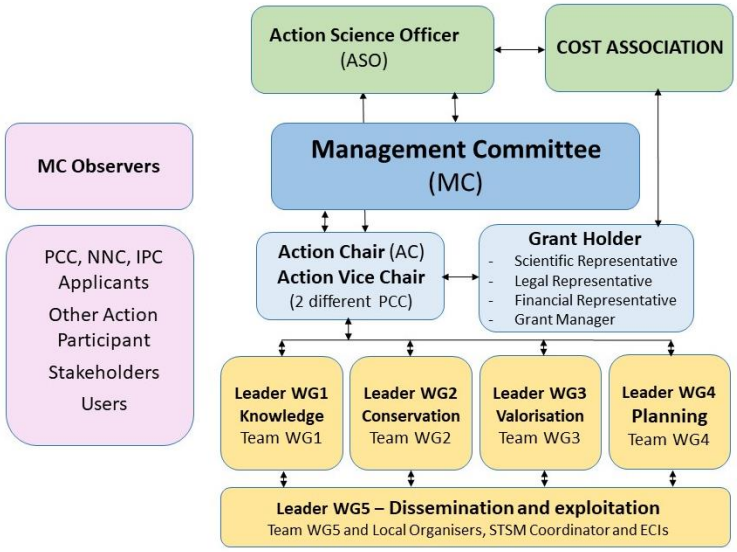


Figure 4: Action's Management Structure

Financial Scientific and Administrative Coordination (FSAC) will be organised and handled by the Action's Grant Holder, who will be elected during the First Management Committee meeting of the Action. This meeting will take place at the COST Association premises.

The main activities of the Action are detailed in the Action's Working Groups (WG). A WG leader coordinates each WG, which includes a working group team, i.e. WG Team. Organisation of co-located meeting and events are included in the WG5. For these purposes, Local Organisers will be elected to host a co-located meeting and/or an event. Co-located meetings and events will bring sound benefits to the Action as they will create a fertile environment for networking and public engagement; at the same time co-located meetings and event will help avoid both redundancies and incurring of unnecessary expenses. In addition to the First Management Committee Meeting, the Action will organise 7 co-located meetings (4 workshops, 4 training schools and 3 conferences). MC observers will be invited to attend the MC meetings to share their views with the MC members. Keynote speakers will be invited to talk to the Action's participants during the conferences planned. Experienced trainers will also be invited to organise and run training sessions during the Action's training school.

Short Term Scientific Missions (STSM) are also envisaged; therefore a STSM coordinator will be elected during the First Management Committee Meeting to design and implement an exchange programme for placements of investigators for a short period of time in organisations, companies and/or institutions located close to one selected case-study. After the completion of a scientific mission, the investigators will present the case-study assessment results during the Action's workshops.

The Action's Training Schools will be specifically organised with the purpose of developing new forms of training for planners. During the training schools, outcomes of WGs 1–4 will be tested and validated.

The Action's Conferences will act as a vehicle for networking, public engagement, dissemination, knowledge sharing and exchange of best practice and innovative concepts and ideas for future developments and joint ventures. Other Action participants, beneficiaries and users will be invited to take part in some of the Action's activities. Specifically when surveying the gaps in underground built heritage, the Action will seek engagement with local communities' leaders, professional associations, privates, universities, SMEs in Cultural Heritage, experienced professionals and other stakeholders. Senior research associates, members of local policymaking bodies and associations, experts in cultural heritage research, will be invited to contribute to the Action's activities and events, and benefit from the Action's outcome.

3.3. NETWORK AS A WHOLE

The Action applies a transdisciplinary approach, thus the network proposed is intended to achieve a wide disciplinary complementarity, coherent with the Action's knowledge needs, while respecting **gender equity and geographical balance**. Geographical coverage of the Action is quite well balanced, with participants coming from North Sea Region (Belgium), Mediterranean countries (Cyprus, France, Greece, Israel, Italy, Malta, Portugal, Spain, and Turkey), Eastern EU countries (Bulgaria, fYR Macedonia, Poland, Romania, Serbia and Slovenia, Moldova), and a Near Neighbourhood country (Russia). The Institutional distribution is dominated by research and education institutions, with an

initially small representative of non-for profit organisations, enterprises, and governmental bodies. This is clearly due to the need to develop a strong multi-disciplinary knowledge base and prepare a training programme for planners.

Some interesting facts for the proposed Action in numbers and percentages, at the time of writing, include:

- 49 proposers from 17 COST Country Institutions and 1 Near-Neighbourhood Country Institution
- COST Inclusiveness target countries make up 62,5% with gender distribution of 61,2% Males to 38,8% Females.
- Number of Early Career Investigators: 17
- Because of the Action will promote a change in perception of UBH exploitation, the institutional distribution of the 49 proposers shows a rather relevant prevalence of Higher Education & Associated Organisations (73,5%), few Government/Intergovernmental Organisations except Higher Education (10,2%), Private Non-Profit without market revenues, NGO (10,2%), and Business enterprises (4,1%).

The Action will work towards involving more organisations from COST inclusiveness countries, more SMEs and more females. More young talented professionals will be involved through the Action's training schools. The Action will also enlarge its coverage and scope by going beyond Europe and attempt to involve and learn from international experts from other corners of the world.