European Cooperation in the field of Scientific and Technical Research
- COST -

Brussels, 14 November 2014

COST 115/14

MEMORANDUM OF UNDERSTANDING

Subject : Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action TD1406: Innovation in Intelligent Management of Heritage Buildings (i2MHB)

Delegations will find attached the Memorandum of Understanding for COST Action TD1406 as approved by the COST Committee of Senior Officials (CSO) at its 191th meeting on 12-13 November 2014.

MEMORANDUM OF UNDERSTANDING

For the implementation of a European Concerted Research Action designated as

COST Action TD1406
INNOVATION IN INTELLIGENT MANAGEMENT OF HERITAGE BUILDINGS (i2MHB)

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 4114/13 "COST Action Management" and document 4112/13 "Rules for Participation in and Implementation of COST Activities", or in any new document amending or replacing them, the contents of which the Parties are fully aware of.

2. The main objective of the Action is to create a pan-European open network to achieve a unified common understanding and operation in the Heritage Buildings' domain, through a novel and independent global framework.

3. 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 68 million in 2014 prices.

4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.

5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Section *2. Changes to a COST Action* in the document COST 4114/13.

GENERAL FEATURES

Initial Idea:

Nowadays, Heritage Buildings' areas of knowledge and applications have been developed without a global seamless integration view.

Collaboration targeting the Heritage Buildings domain is actually focused on peer-to-peer partnerships, with a clear lack of integration and non-global interoperability. This imposes several constrains on Heritage Buildings, not only on scientific research but also on their daily operation.

Today, the main challenge is to overcome these confined collaborations, moving towards a global integrated scientific, technological and social multidisciplinary approach. A fundamental pre-requisite for good decision-making about the future of Heritage Buildings is, first knowledge and, then, knowledge sharing.

The objective of i2MHB Action is to create a pan-European open network to promote synergies between Heritage Science's specialists, industrial stakeholders and research/education players, to achieve a unified common understanding and operation in the Heritage Buildings' domain, integrating multidisciplinary expertise, technology and know-how through a novel and independent global framework.

The Action's outcomes will provide an inflection point in the Heritage Buildings' field, enabling global common practices usage and triggering global scale innovation and seamless operation, considering culture, place, technology and field of knowledge.

Sustainability is a very important issue, which is addressed in the Action at two levels: sustainability of the Heritage Buildings sector and sustainability of the network itself. The first level is deeply envisaged throughout the Action. The later would be accomplished by transferring know how and competences into municipalities and Heritage Buildings administrators and also by joint applications for funding to EU Framework Programme, Intergovernmental or National Programs and/or Agencies.

Keywords: heritage buildings; preventive conservation; economic efficiency; energy optimization; sustainability

A. CHALLENGE

A.1 EXECUTIVE SUMMARY

Europe is one of the World's regions presenting the richest cultural heritage. Among this cultural heritage, Heritage Buildings (HBs) play a major role. In any initiative involving HBs a multidisciplinary approach is mandatory. HBs are undoubtedly an area where multidisciplinarity is essential, being this multidisciplinary approach grounded on three major knowledge areas (pillars): scientific wisdom; systems and data; social engagement.

From the beginning, the European Union has strongly supported the preservation and conservation of HBs. EU Framework Programmes have supported more than 100 cultural heritage projects. Although many of them engage a multidisciplinary approach, mostly they present a limited scope and often each stakeholder (experts, professionals, curators, surveyors, architects, conservators, caretakers, end-users, stakeholders, general public, just to name a few) "speaks its own language".

This "Babel tower" of vast knowledge is a major drawback to achieve a fully integrated and systematic approach that promotes cross-sectorial synergies leading to a greater understanding of which methodologies and technologies are best positioned to impact on HBs.

Nowadays, HBs' areas of knowledge and applications have been developed without a global seamless integration view. Collaboration targeting the HBs domain is actually focused on peer-to-peer partnerships, with a clear lack of global interoperability. This imposes several constrains on HBs, not only on scientific research but also on their daily operation.

Today, the main challenge is to overcome these confined collaborations, moving towards a global integrated scientific, technological and social multidisciplinary approach.

The objective of the i2MHB Action is to create a pan-European open network, to promote synergies between Heritage Science's specialists, industrial stakeholders and research/education players, to achieve a unified common understanding and operation in the HBs' domain, integrating multidisciplinary expertise, technology and know- how through a novel and independent global framework.

The Action's outcomes will provide an inflection point in the HBs' field, enabling global common practices usage and triggering global scale innovation and seamless operation, considering culture, place, technology and field of knowledge.

This common vision is extremely relevant and timeless, because now is the time to gather HBs' knowledge and technology (in its different pillars – scientific wisdom, systems and data, social engagement) and develop a common framework that will help users and stakeholders to push HBs to the next generation through global interoperation. HBs related research projects have been working

on a confined peer-to-peer approach, whilst i2MHB Action will provide an inflection point in the HBs' field, enabling global common practices usage and triggering global scale innovation and seamless operation, independently of culture, place, technology and field of knowledge.
Ongoing and future research projects, and on-site novel approaches, would benefit from i2MHB Action's outcomes.
Sustainability is a very important issue, which is addressed in the Action at two levels: sustainability of the HBs sector and sustainability of the network itself. The first level is deeply envisaged throughout the Action. The later would be accomplished by transferring know how and competences into municipalities and HBs administrators and also by joint applications for funding to Framework Programmes, Intergovernmental Programs or National Programs or Agencies. The impacts of the Action will support local authorities in their effort while establishing community identities and creating a sound sense of place.
The proposers confirm that the Action's objectives will be achieved using own R&D funding and resources and that the performance of nationally/institutionally funded activities is required.

A.2 - STATE OF THE ART IN HBs RELATING INTEROPERABILITY

There are different expressions of Cultural Heritage, from natural to intangible heritage. In this Action's context, the term Cultural Heritage encompasses the main category of immovable Cultural Heritage such as buildings, monuments and archaeological sites.
All over Europe, HBs attract millions of visitors every year. Being a part of past heritage they are also an expression of continuous tradition and creativity. Furthermore, those HBs play a key role in harnessing economic activities and job creation, strengthening European social cohesion. Therefore, the conservation of these historical constructions is of extreme importance to preserve the cultural references of Europe's communities.
A multidisciplinary interoperable approach is mandatory regarding any HBs' initiative. HBs and their interiors form part of national heritage of every country and culture. They usually consist of multiple facets and materials often altering dramatically throughout their life span due to changes imposed by society, their environment and usage. It is through the conservation and restoration of these buildings, and the collections therein, that the cultural identity of our past can be preserved and transferred into our future. It is thus essential to consider these entities in a holistic manner using a multidisciplinary collaborative approach, without imposing any sense of hierarchy for their conservation or the conservation of the individual artefacts or collections housed within.

As for any other multidisciplinary approach HBs' topics are usually allocated considering the following closed-loop procedure:

... ⇒ Sensing ⇒ Understanding ⇒ Deciding ⇒ Acting ⇒ Sensing ⇒ ...

While the Sensing and Acting steps are rather consensual, the Understanding and Deciding steps are extremely area-dependent with a low level of interoperability. HBs' knowledge is basically materialized in the aforementioned three pillars: scientific wisdom, systems and data, social engagement; one of the greatest challenges regarding HBs is about making those pillars to exchange, in a confederated way, the relevant information and consequently, providing optimized decisions. This procedure is commonly known as interoperability, which can be described as the ability of two or more knowledge areas accurately exchange information and use the information that has been exchanged. Typically two kinds of problems can arise. First, the necessary awareness and agreement of the players about their behaviour for a given information exchange. This assumption is derived from their predefined motivation to interoperate. Secondly and even more general, they assume awareness of the coexistence of the several players that will interoperate.

In i2MHB Action, the previous three pillars will be the bases for a "rooftop" interoperability layer. Action members will be engaged in a common interoperable framework of knowledge. The Action will identify what is homogenous, heterogeneous and synergetic amongst the three pillars, highlighting interdependencies and gaps while identifying best approaches in order to progress towards this common interoperable framework.

Through its flagship initiative Europeana, the European Union has invested a great deal of effort and resources to facilitate the access to and the reuse of cultural heritage data. In this view, Europeana uses linked data and semantic technologies. The Europeana Data Model structures and represents data delivered by various contributing cultural heritage institutions, built upon established standards like RDFs, OAI-ORE, SKOS, CIDOC-CRM, Dublin Core. The Data Model acts as a common top-level ontology which retains original data models and information perspectives while, as the same time, aims enabling interoperability. In the meantime, numerous efforts have been initiated which aim at combining linked data with other data sources in the context of digital stories. In the cultural heritage domain, some authors combined linked data from different sources and used location - aware mobile devices for searching and browsing a large number of cultural heritage information repositories. However, despite the blooming research in the field, investigations disclosed that efforts to combine linked data and semantic technologies with storytelling, in the cultural heritage domain, are very few and still at an embryonic stage. Technological challenges coming from the linked data encompass:

entity recognition, efficient and effective linking, URI and namespace management, data quality and reconciliation, federated querying and query expansion.

A wide range of research effort has been done concerning data collecting and data storage systems in HBs. Most of the research has been materialized through Europe's Framework Programs. Some of them relate HBs and climate protection (3ENCULT), while others develop and demonstrate, through case studies, a methodology for assessing and selecting energy efficiency interventions (EFFESUS). Among the most addressed research issues are the use of multi-sensors, wireless sensor networks and cloud computing procedures for data storage (FIRESENSE, MUSECORR, SMooHS and SHBuildings). Most of the projects are either too focused on basic research or confined on high-level cooperation without a global interoperability approach.

HBs are, themselves, static denoting screenshots of the past. What makes them alive are the memories of the people who lived and worked in those buildings, the virtual roll back in time to an earlier period, or following traces of people and artefacts through a dynamically progressing event. The third pillar of i2MHB Action (social engagement) is strongly interconnected to the other two pillars through the knowledge framework built on interchangeable semantics as a fundamental layer for a common understanding. A significant amount of research has been carried out to promote 'social engagement' within the HBs arena, being European projects CHESS, CULTURA or PATHS an example. The current discussion on social engagement is usually grouped into two broad approaches. First, the consumerist approach views social engagement as a means to an end; a tool to achieve and / or improve efficiency, effectiveness, relevance or competence. In contrast, the second democratic approach stresses that social engagement is an end in itself and should be the aim (or one of the main aims) of the project in concern. However, a balanced prospective between both approaches is not usually considered and needs to be harmonized.

A.3 – RELEVANCE AND TIMELESS

A wide range of research and development effort has been done concerning HBs in its different areas (scientific wisdom; systems and data; social engagement). Nevertheless these efforts are, as a general rule, too focused on some confined research without a global seamless integration view.

The i2MHB Action is extremely relevant and timeless, gathering under the "rooftop" layer of interoperability the basic three pillars of HBs, bringing together that sparse knowledge and confined operations on HBs to develop a common framework providing an integrated multidisciplinary expertise, technology and know-how through a novel and independent global framework.

A.4 - ACTION OBJECTIVES

The objective of the i2MHB Action is to create a pan-European open network, to promote synergies between Heritage Science's specialists, industrial stakeholders and research/education players, to achieve a unified common understanding and operation in the HBs' domain, integrating multidisciplinary expertise, technology and know-how through a novel and independent global framework.

This implies the establishment of a multidisciplinary community to promote multidisciplinarity across the different areas, along with the ability to perform cross-sectorial assessment. This approach naturally leads to the establishment of a roadmap, outlining a common vision, producing a strategic research agenda and a set of procedures and recommendations for standards to address interoperability barriers in HBs, implementing an action plan for this multidisciplinary view of HBs. The objective will be achieved through the Action members' network efforts and materialized in the form of the following outcomes. For each outcome a risk level is associated.

- (Medium risk level) A common framework, which clearly defines:
    - Data collection and distilling (classification) of good and sound experiences related with preservation and rehabilitation of HBs. This implies the development of knowledge and data exchange between all Action members, having the main objective to assure the establishment of a common understanding regarding the complex problematic that must be solve in creating the HBs framework.
    - Development of common and adequate procedures in relation with the goal of the new framework. These correlated procedures will leverage the latent synergies between the different Action members. At the same time, these synergies will allow the coagulation of multi-criteria optimization procedures that should be included in the common framework.
    - Development of a clear "back-processing" system, able to organic contribute at the enriching of know- how in the field of HBs preservation and their social and cultural valorisation. The back- processing frame will allow not only the analysis and improving of data collections with good/bad examples, it also sources for new interoperability paradigms in development towards the creation of the common language. At the same time, this process will reveal better which is the impact on the full understanding of HBs rehabilitation and daily operation using the developed framework.

- (Low risk level) The Action will develop a proposal for a "white book" that will illustrate the synthesis of interoperability activities that will improve the sustainability aspects related with HBs

preservation. This white book will result from the collaboration with local, regional, countries and European authorities that will be attracted to actively participate. The aspects that will be tackled in this "white book" are very complex, because they will synthesize a large variety of aspects, from i) buildings energy efficiency, ii) zero-emission buildings, iii) preservation of sense and cultural role of HBs integrated into the urban and natural landscape and iv) evolution of HBs fund and its preservation at European level. In this sense, it will develop a roadmap of technologies suitable to be use in HBs rehabilitation and operation processes. An inventory register will be made regarding HBs' best practices related with i2MHB Action members' ongoing projects.

- (Low risk level) A Public Report will be produced regarding "Integration of HBs into their surroundings", which will focus on study and optimization of HBs integration into the urban and natural landscape. It will address preservation and valorisation of specific HBs' characteristics and features in order to preserve the original facet and make it as much as possible realistic concerning ages, history and other related characteristics.
- (Low risk level) A brochure will emphasize the social role played by HBs in leveraging the socio-cultural dimension in different European countries. A large exchange of experiences, that will include contributions from local, regional and national authorities, will assure a better understanding of the message transmitted by HBs to society. The work at this brochure will be the result of a systematic approach made by conceiving, spreading, collecting, analysing and synthesizing the results of questionnaires addressed to large target groups. This activity will provide a large database which, itself, will improve the framework.
- (Medium risk level) The Action will provide an open and extensible dissemination platform through which the new interactive, distributed and networked technologies deployed as mobile multifunctional devices will allow the extraction, exploration and collection of memories, actions and events. Managing actors can collaboratively pull apart and arrange memories, linking ideas, places, actions and events into meaningful historical stories, shaping and challenging individual understanding, comparing and contrasting their own individual stories. This platform will be available through the Actions' web portal, which also works as a virtual network connecting all Action partners.
- (Low risk level) Establishment of a web portal on "Innovation in Intelligent Management of HBs".

A.5 - CHALLENGE FEASIBILITY

The Action is quite ambitious, involving players from distinct HBs' areas of expertise and from different sectors (raging from specialists in the field of Heritage Science to industrial players, through research and education stakeholders). Addressing the proposed challenge it is feasible since it aims

at unifying already available solutions with the development of innovative approaches for the development and realization of measures to warranty the conservation status in compilation with the adequate consideration of security issues, resource efficiency and visitor or use management. As well, the Action will harmonize all the sparse available knowledge, where the common framework will provide the guidance to achieve the HBs' unified common understanding.

A.6 - RISK LEVEL

All Action's outcomes present a low/medium risk level (please refer to section A.4). In every Management Committee meetings the risk level will be re-evaluated and, if that is the case, a mitigation and contingency plan will be adopted. Further details are presented in the section B.3 "Networking and Risk Management". The Heritage Building community involved in the Action will be deeply engaged in the establishment of the global framework, through the pan- European Action network, thus obtaining a unified understanding that will produce a high impact on the HBs' domain.

A.7 - EXPECTED IMPACT

The Action foresees several impacts that can be catalogued into i) Strategic; ii) Scientific, technological and managerial; and iii) Societal.
Following each impact a timeframe expectation is presented. "Short-term" is used to denote an impact fully resulting within the Action's timeframe (4 years), while "Long-term" for an impact whose major benefits will materialise and last beyond the Action's timeframe.

<u>Strategic impact:</u>

- Delivery of new impulses for the establishment of a new cross-sectorial multinational cooperation. (Short-Term)
- Implementation of dissemination activities for the related community, policy makers as well as general public and school young generations. (Short-Term)
- Preservation, conservation, valorisation as heritage and identity in variety of unified Europe in consonance with sustainable development. (Long-Term)
- Effective increase of the economic potential of cultural HBs and added value to the cultural content in educational, scientific and leisure contexts. The Action will offer its end-users services which will enable an integrated management and exploitation of HBs as well as will represent a source of innovation and creativity for businesses, researchers, educational

organisations and the general public by adding value and new meaning to HBs and by improving social engagement with such cultural resources. (Long-Term)

- Transnational common and integrated approach, uplifting Europe's cultural heritage, generating value and adding new meaning to our cultural artifacts. (Long-Term)
- Establishment of a Pan-European and multidisciplinary communication platform to support the realisation of opportunities in the field of HBs. (Long-Term)
- Strengthening European's position in the field of HBs and related applications. (Long-Term)
- Formation of a sustainable European network of researchers, solution providers, end-users, authorities and industrial partners in the field of HBs. (Long-Term)

Scientific, technological and managerial impact:

- Effort coordination towards cross-disciplinary innovation and creativity, common standards development, deployment of services, communicating through open standards for Future Internet technologies and architectures, contributing to the definition and promotion of European positions within global forums and international standardisation bodies active in the Action's field. (Short-Term)
- Deployment of a common approach, methodology and user orientation, common platform and a set of related tools and services. (Short-Term)
- Creation of effective tools to improve heritage investment's efficiency, reducing restoration costs, improving energy efficiency and providing an optimized visitors' access to the monuments. (Short-Term)
- Identification of current knowledge gaps regarding expected scientific/technological levels to achieve the goals of European HBs policy, as well as detection of ways to overcome existing gaps. (Short-Term)
- Helping the Heritage Building sector to improve the degree of innovation and quality offered to society. The Action paves the way to face the societal challenges of Horizon2020 (e.g. the development of technologies enabling energy-efficient buildings). (Long-Term)
- Road mapping for scientific and technological development in the entire HBs field. (Long-Term)

Societal impact

- Harmonization of the commitment between heritage preservation and technical requirements related to its occupancy and use. (Short-Term)
- Increased inclusivity, establishing an adequacy with the perceiving of the physical environment and information contents. (Short-Term)

- Coordination and realisation of multidisciplinary training for Early Stage Researchers (ESRs) in the form of Short Term Scientific Missions (STSM). (Short-Term)
- Establishment of a platform for the active participation of ESRs supporting the position of young researchers in the field of HBs. (Short-Term)
- Promotion of women's participation in the related scientific and technological fields. (Short-Term)
- Engagement of tourist and tourism operators in HBs sustainability, thus "socializing the heritage" (Long-Term)
- Secure Europe's self-assertion in future scientific and technological development, through young researchers' integration. (Long-Term)
- Increased sustainability of the Heritage Building sector by knowledge transfer and deeply involving local authorities. (Long-Term)

B. ADDED VALUE OF NETWORKING

B.1 - NETWORKING AND ACTION OBJECTIVES

The objectives of i2MHB Action will be achieved by means of enhanced cross-sectorial cooperation of experts which is in line with to the international context of the COST framework, thus coordinating the work of different pan-European research groups and/or stakeholders. An improved transfer of knowledge between individual disciplines covering the whole chain related to the topic of Heritage Buildings will lead to the desired synergetic effects and herewith spark off innovative solutions, based on the interoperability paradigm.

Given the potential for wasteful overlap, which can create barriers to interoperability, and given the i2MHB premise, there is a justifiable need for a cross-sectorial effort in identifying complementary areas for research and implementation trajectories. The multidisciplinary community will encourage cooperation and co-ordination towards achieving a multidisciplinary common framework.

The three major knowledge areas of this Action (scientific wisdom, systems and data, social engagement) are crossed- linked with three major target groups that the Action aims to engage:

- Specialists in the fields of Heritage Science (museum curators and conservators, private collectors, tourism, governmental heritage agencies...)
- Industrial players (commercial developers and integrators of measurement systems and software applications)

- Research and education stakeholders (universities, R&D labs)

The backbone of the Action is created from more than 40 groups whose expertise largely covers all key theoretical, experimental and practical aspects of scientific and technological development in the field of Heritage Buildings. They are distributed between technology developers, Heritage Buildings specialists and research institutions, involving both public institutions (political decision makers and management bodies) and industrial stakeholders. This wide range of specialists (that the Action intends to actively expand) working towards the interoperability goal, can only be brought together under the COST framework. Their cross-sectorial Pan-European interaction will be essential to achieve the major goal of the Action. Heritage, and particularly HBs, has an interesting impact on Gross Domestic Product (GDP) and has helped to raise many specialized companies with high expertise that started to internationalize their know-how. SMEs integration in the i2MHB Action will be a lever to further increase their internationalisation.

Thus, the main objective of the Action will be achieved through gathering an interdisciplinary cooperation, on a concerted European level, to prepare a novel, reliable, independent and global interoperable knowledge base facilitating the research and daily operation of European Heritage Buildings. As stated, while the level of European technical competence is high, there are no common standards concerning Heritage Buildings exchange of information. i2MHB Action will provide a stimulating framework for articulating and clarifying problems, sharing solutions and skills, standardising methodologies and protocols, leading to a common interoperable framework, widening applications and dissemination.

There are a large number of public, commercial and voluntary organisations, which ensure that our heritage is cared for, appreciated and enjoyed. Often owners, individuals or local communities make the real difference. In the current economic environment all of these groups are short of resources, so it makes sense to involve them in the Action and deliver them the best available tools and work together identifying common priorities and pool efforts. The established network will deploy HBs' management tools with particular attention for local management. It also will raise awareness of existing techniques and improving methods, as it will provide access to information, assistance and recommendation.

The network efforts will be fully in line with i2MHB Action's objectives. It will support authorities' efforts to improve social capital, including community cohesion and social inclusion and to activate the process of the heritage-led regeneration (Heritage Economic Regeneration Schemes, economic benefit, catalysis of a social revitalisation etc.). The efforts will be aimed at quality of life improving

and, therefore, bear strong relation to social impacts, which can be considered as quality of life indicators.

The i2MHB common framework, resulting from the Action's network efforts, will accommodate national nuances in culture, place, technology and knowledge. This common framework will be subject to translation processes at a national level through localized social engagement. The concept of institutional translation understands that ideas and practices are interpreted and reformulated during the process of adoption. The translation processes in the diffusion and adoption of the common framework will be demonstrated by case studies that capture how relevant actors (within the Action's network) make sense of the common framework in their specific national contexts, how they adapt the framework and how they use the framework in practice. The case studies will also illustrate the symmetry of translation processes, i.e. how national-level interests and practices shape the form and diffusion of the common framework at the European level.

At the same time, the Action aims to act proactively as a community which is open to the integration of new partners from COST countries and COST International Partner Countries (IPCs) as well as to new ideas and prospects. Thus, i2MHB Action's network will be a birthplace of new projects and ideas, and will act as an "incubator for future cooperation projects".

Due to the improvement of already existing and the establishment of a new international multidisciplinary cooperative scientific and technological research, the Action will lead to a pioneering approach on the global issue of Heritage Buildings. Acting as a breeding ground for multidisciplinary multinational partnerships, it will effectively support the fundraising within the frame of both national and international programmes, which would be extremely hard outside the COST framework context.

It should be emphasized that several Action members are, or were, engaged in several projects addressing Heritage Buildings and Interoperability.

A particular aspect that would be engaged under i2MHB Action pan-European network will be the contribution of ESRs (Early Stage Researchers). The establishment of an ESR Think Tank will also assure that ESR contribute to the Action activities at an equal share compared to the contribution by other experts (this ESR Think Tank will come together in ESR workshops). Particular attention will be paid to the materialisation of Training Schools focused on the aspect of interoperability as well as on the exchange of the ESRs staff within Action partners by means of STSMs (Short Term Scientific Missions). Special outreach activities for women and especially for female ESRs will support the enforcement of the gender agenda.

It is also foreseen, in the context of the Action's network, the co-supervision of PhD students, by members of the Action. As well, the production of training and educational material regarding the

usage of the common framework in the field of Heritage Buildings is expected to raise from the Action's members collaboration. Particular attention will be paid to the production of surveys, which will be largely disseminated, even outside the Action.

The Action also envisages a number of dissemination measures: its own Action publications (white book, reports, and conference proceedings); member's joint peer-reviewed publications; presentations at international conferences and special presentations to the industrial community. These dissemination actions will aim thematically focused groups of experts, governmental audience or the general public.

Being a part of the Action's network, local authorities will benefit from i2MHB's outcomes by getting support in their struggle to create community identities and a sound a sense of place.

Besides the expected impact of the Action, some particular impact will result from the Action network itself, such as:

- Wider embracing of a common framework to suit the needs of conservators and scientists in Heritage Buildings;
- Standardisation of methodologies resulting in simplification and enhanced information exchange;
- Enhancement of the quality of research and related peer-reviewed publications;
- Dissemination efforts, which will result in enhanced communication between the several Heritage Buildings communities, adopting the common framework;
- Knowledge exchange, which should result in a more cost-effective use of individual national funds supporting the research activities of the Action;
- Newly established collaborations, which will promote joint submissions of innovative topics to future EU calls;
- Information exchange regarding Action members' ongoing projects;
- Inclusion of Action outcomes in Action members' ongoing projects, and vice-versa;
- Promotion of new interdisciplinary careers for Early Stage Researchers (ESRs), and training opportunities offered through their integration into the activities of the Action's Working Groups.

This would greatly enhance the research and daily operation of Heritage Buildings and is likely to reveal new frontiers that were not accessible due to some lack of mutual understanding.

B.2 NETWORKING AND COMPLEMENTARY INTERACTION WITH OTHER ONGOING INITIATIVES

There are a number of current research activities in Europe that are relevant to i2MHB Action. The Action will draw on their findings, complement them and, at the same time, avoid duplication of research activities. The main topic of liaison and interaction will be on the Action's agenda and will accordingly be considered in its management. In such manner the Action envisages to invite representatives of the other Actions to participate in its own meetings by holding relevant presentations (especially during Training Schools) and to give input for reports (ESR Think Tank). The Action network will co-operate with EU projects, European networks and other related COST Actions.

The project 3ENCULT bridges the gap between conservation of historic buildings and climate protection, managing energy efficient retrofit for structural protection as well as for comfort. The climate protection issue can bring useful insights for i2MHB.

The main goal of the EFFESUS project is to develop and demonstrate, through case studies a methodology for assessing and selecting energy efficiency interventions, based on existing and new technologies that are compatible with heritage values. It addresses part of i2MHB Action, being the information exchange useful to support energy usage aspects within i2MHB.

The project SASMAP aims to develop tools and techniques to survey, assess, stabilize, monitor and preserve underwater archaeological sites. Although particularly focused the interaction with this project will allow a useful extension of the i2MHB common framework.

The main target for project SYDDARTA is to develop a prototype that diagnoses the deterioration of movable assets through 3D-hyperspectral imaging. It addresses a small part of i2MHB Action. Nevertheless information exchange would be useful to support some analytical aspects within i2MHB.

The SHBUILDINGS project aims to generate integrated technological tools that help reducing government expenses in restoring, maintaining and managing heritage buildings and improving its energy efficiency, investing in preventive conservation and facilitating management regulated visits to monuments. This project is related with the technological part of i2MHB.

The i2MHB Action has among its member's representatives of Heritage related former European funded projects. Also representatives of former and ongoing European funded projects, addressing Interoperability, are included in the Action.

Contacts with on-running European networks will be established.

Relevant COST Actions will also be considered in the course of the i2MHB Action.

B.3 - NETWORKING AND RISK MANAGEMENT

Due to an envisaged large number of participants, risk management will be adopted to manage i2MHB Action's issues and conflicts. The challenging mission is to create a pan-European open network, to promote synergies between Heritage Science's specialists, industrial stakeholders and research/education players, to achieve a unified common understanding and operation in the Heritage Buildings' domain, integrating multidisciplinary expertise, technology and know-how through a novel and independent global framework. In this way, three main classes of risks will be considered:

- Internal: low commitment, availability and productivity, low quality, high geographical dispersion and multidimensional character of the consortium;
- External: significant changes in any technology involved in the project, introduction of new standards, law and certifications;
- Technical: restricted access to existing data and systems, system integration and interoperability problems, inadequacy of software developed.

Internal risks will be minimized and managed by using well-established methodologies for project planning and project control. Besides that, each Working Group Leader will be responsible for monitoring the quality of the produced work (appointing a quality assessment committee). All produced deliverables will go through a high quality internal review process before released.
External risks will be minimized by following closely Heritage Buildings' related developments as well as pertinent regulatory issues. The presence of different Higher Education and Associated Organisations, in several fields, will help reducing the impact and, if necessary, the required time to integrate new developments.
Technical risks will be minimized by taking all required actions to gain access to existing data or redesigning and amending necessary requirements whenever interoperability is endangered.

C. MILESTONES AND DELIVERABLES: CONTENTS AND TIME FRAMES STRATEGY

Objective 1 (B.13) - Type: Bridging separate fields of science/disciplines to achieve breakthroughs that require an interdisciplinary approach

1. Science and Technology Event or Meeting, Action Workshop.

2. Science and Technology Coordination, Short-Term Scientific Missions (STSM).
3. Handbook, Guidelines, Best Practices, for S&T purposes.
4. Internal and External Communication, Website.
5. Science and Technology Event or Meeting, Training School.

Objective 2 (A.1) - Type: Development of a common understanding/definition of the subject matter

1. Science and Technology Output, Prototype, Demo or Tool.
2. Science and Technology Coordination, Application for Framework Programme Funding.
3. Science and Technology Event or Meeting, Training School.
4. Science and Technology Event or Meeting, Action Workshop.
5. Handbook, Guidelines, Best Practices, for S&T purposes.

Objective 3 (A.4) - Type: Comparison and/or performance assessment of theory/model/scenario/projection/simulation/narrative/methodology/technology/technique

1. Scientific Publication (including Science and Technology study and excluding handbooks, guidelines and best practices. Excluding Joint Peer-Reviewed Publication), open access.
2. Science and Technology Coordination, Short-Term Scientific Missions (STSM).
3. Science and Technology Event or Meeting, Training School.
4. Science and Technology Event or Meeting, Action Conference.
5. Joint peer-reviewed publication, open access.

Objective 4 (A.7) - Type: Input to stakeholders (e.g. standardization body, policy-makers, regulators, users)

1. Documents to be used as Input to Stakeholders, to users/practitioners.
2. Book of Abstracts or Proceedings of COST Action Conference or Workshop, open access.
3. Action Science and Technology Meeting, Working Group.
4. Science and Technology Event or Meeting, Action Workshop.
5. Internal and External Communication, Virtual Network: any web-based resource needed for work coordination among Action Members.

The duration time of the i2MHB Action will be 4 years, whereas planned activities will be realised according to the following description taking into account eight semesters. To assure an open and flexible character the re-adjustment of the activities may become necessary and corresponding changes are subject to decision by the Action's Management Committee.

The main outputs of the Action will be fulfilled in the form of Deliverables. Those deliverables will

be the outcome of the Action's developed work through several Milestones that will be consequently achieved. The following tables (one per year) present the list of Meetings and Milestones that will feed the Deliverables production. The first column refers to the time frame (semester). The second column refers to Action meetings: Management Committee (MC) meeting, Working Group (WG) meeting and Core Group (CG) meeting. The third column refers to Milestones and the fourth to Deliverables. The fifth column indicates the inputs that will be considered to produce each Deliverable and the last (sixth) column the Action Working Group that is responsible for the coordination of each Meeting, Milestone and/or Deliverable.

Table I – List of Meetings, Milestones and related Deliverables (First year)

Semester	Action Meetings	Milestones	Deliverables	Inputs for Deliverables	Coordination
1	1st MC meeting				MC
1	Joint 1st WG meeting / 1st CG meeting				All WGs
1		M1 - Action's web portal set-up and functioning. Dissemination plan established			All WGs
2	2nd MC meeting				MC, All WGs
2	WG Meeting	M2 - COST meeting on interoperability			WG2
2	WG Meeting	M3 - 1st think tank and Action meeting on heritage buildings and their surroundings			WG3
2	WG Meeting	M4 - 1st meeting on Heritage Buildings social engagement			WG4
2	Action workshop	M5 - ESR workshop on Heritage Buildings			All WGs

2			D1 - WG report and Action report		All WGs

Table II – List of Meetings, Milestones and related Deliverables (Second year)

Semester	Action Meetings	Milestones	Deliverables	Inputs for Deliverables	Coordination
3	Joint 3rd MC meeting / 2nd WG meeting / 2nd CG meeting				MC, All WGs
3	Training School	M6 - Training School			All WGs
4	Joint 4th MC meeting / 3rd WG meeting				MC, All WGs
4	WG Meeting	M7 - Think Tank and Action meeting on Data collection and classification (Common Framework)			WG1
4	WG Meeting	M8 - Extended meeting with local, regional, countries and European authorities			WG2
4	WG Meeting	M9 - 2nd Think tank and Action meeting on heritage buildings and their surroundings			WG3
4	Action Workshop	M10 - ESR workshop on Common Framework			All WGs

4			D2 - WG report and Action report		All WG
4	Industrial Day	M11 - Industrial Day			All WGs

Table III – List of Meetings, Milestones and related Deliverables (Third year)

Semester	Action Meetings	Milestones	Deliverables	Inputs for Deliverables	Coordination
5	Joint 5th MC meeting / 4th WG meeting / 3rd CG meeting				MC, All WGs
5	Training School	M12 - Training School			All WGs
5	WG Meeting	M13 - Think Tank and Action meeting on Common procedures (Common Framework)			WG1
5			D3 - Report on the social engagement questionnaires		WG4
5			D4 - Public Report on Integration of Heritage Buildings into their surroundings (Draft version)	M3, M9	WG3
6	6th MC meeting				MC, All WGs
6	WG Meeting	M14 - Think Tank and Action meeting on New paradigms			WG1

		(Common Framework)			
6		M15 - Public discussion on the Draft Version of the Public Report on Integration of Heritage Buildings into their surroundings			WG3
6	Action Workshop	M16 - ESR workshop on Heritage Buildings social engagement			All WGs
6	WG Meeting	M17 - 2nd meeting on Heritage Buildings social engagement			WG4
6			D5 - WG report and Action report		All WGs
6			D6 - White book for interoperability	M2, M7, M8, M13	All WGs

Table IV – List of Meetings, Milestones and related Deliverables (Fourth year)

Semester	Action Meetings	Milestones	Deliverables	Inputs for Deliverables	Coordination
7	Joint 7th MC meeting / 5th WG meeting / 4th CG meeting				MC, All WGs
7	Training School	M18 - Training School			All WGs
7	Industrial Day	M19 - Industrial Day			All WGs

7			D7 - Common Framework (Draft version)	M7, M13, M14, D4, D6	WG1
7			D8 - Proposal for specific standards / protocols	M2, M7, M13	WG2
7			D9 - Public Report on Integration of Heritage Buildings into their surroundings (Final version)	M15, D4	WG3
7	Action Conference	M20 - European conference on Heritage Buildings social engagement	D10 - European conference on Heritage Buildings social engagement printed proceedings	M4, M17, M20	WG4
8	Joint 8th MC meeting / 6th WG meeting / 5th CG meeting				MC, All WGs
8	Action Workshop	M21 - ESR workshop			All WGs
8			D11 - WG report and Action final report		All WGs
8	Final Action Conference	M22 - Final i2MHB Open Conference	D12 - Final i2MHB Open Conference printed proceedings	M22	MC, All WGs
8		M23 - H2020 collaborative or network project proposal	D13 - H2020 collaborative or network project proposal	M23	All WGs

8			D14 - Common Framework (Final version)		All WGs

Table V – List of Meetings, Milestones and related Deliverables (Throughout the Action time frame)

Semester	Action Meetings	Milestones	Deliverables	Inputs for Deliverables	Coordination
Through out the Action time frame		Short Time Scientific Missions	STSMs reports		WG5
Through out the Action time frame		Joint peer-reviewed publications	Joint peer-reviewed publications		All WGs
Through out the Action time frame		Dissemination platform in the web portal	Dissemination platform in the web portal		WG5

Below follows a brief description of the Action's major outputs.

The common framework (Deliverable D14 – semester 8) will be based on the development of knowledge and data exchange between all target groups (specialists in the fields of Heritage, industrial players and research and education stakeholders) by WG meetings, "think tank" workshops. These activities have as main objective to assure the formation of a common understanding of the complex problematic that must be solve by creation of the heritage buildings framework. The "think-tank" workshops having as principal participants young researches involved in one of above mentioned domains, will be especially encouraged.

The Public Report on Integration of Heritage Buildings into their surroundings (Deliverable D9 – semester 7) will focus on the study and optimization of Heritage Buildings integration into the urban and natural landscape. This activities will involve a study of preservation technologies, an analysis of technologies and know how necessary to assure the preservation of original aspect; emphasizing at the same time the most valuable elements with historical, artistic or social significance. Innovative technologies such as new multimedia technologies, augmented reality technologies and artistic initiative will be discussed and will be considered for selected rehabilitation works. Regarding exterior landscape integration, architectural studies will be encouraged in order to better emphasize the role of Heritage Buildings in preserving or improving landscape splendour. As for the case of

interior rehabilitation, augmented reality methodologies will be encouraged in order to generate “new face", more in line with historic and specificity. Two extended think tank meetings will be organised focusing on selected rehabilitation projects. The first draft of the report will subject to a public discussion, before the final version being issued.

The white book for interoperability (Deliverable D6 – semester 6) will be the result from the collaboration of the Action members with local, regional, countries and European authorities whose active participation will be encouraged.

The social role played by Heritage Buildings in leveraging the socio-cultural role in different European countries will be discussed in two extended Action meetings and at one European conference (Milestone M20 – semester 7), organised by the Action, where all Action members and also a big number of invited personalities (local, regional, countries and European authorities) will debate and will finally develop and provide a printed volume (Deliverable D10 – semester 7) including a selected collection of papers presented in the frame of conference. Also a brochure addressed to decision makers will include selected good practices in the work of rehabilitation of heritage buildings.

At least one proposal for specific standards/protocols (Deliverable D8 – semester 7) relating principle and regulations that should govern the preservation and rehabilitation process of heritage buildings is foreseen to be produced, under the roadmap for interoperability.

In the frame of Horizon 2020 it is expected to developed, at least, one collaborative or network project proposal (Deliverable D13 – semester 8) that will try to promote as trials, appropriate and practical applications denoting the actual materialization of the Action debated and synthesized ideas.

It is foreseen the organisations of, at least, two Training Schools (Milestone M12 – semester 5 and Milestone M18 – semester 7). These Training Schools will be oriented towards the realisation of a multidisciplinary approach by inviting ESRs and PhD, not exclusively from the institutions belonging to the circle of the Actions members.

The active participation of relevant industrial partners, in particular SMEs, is essential to demonstrate the Actions findings and to achieve the expected practical impact. As stated before, the Action aims at a strong participation of industrial partners by encouraging a direct involvement of potential users in the Action or in the Actions activities. Besides that, two industrial days are foreseen (Milestone M11 – semester 4 and Milestone M19 – semester 7) during the Action time frame, being a privileged way of exchanging ideas with industrial stakeholders.

To support the presentation of Actions activities and results to the industrial community as well as to the general public and decision makers, a dissemination plan will be further detailed within the first semester of Actions implementation, whereas its updating during the course of the Action with

consideration of the progress of the Action will be accomplished at least annually.

Institutions with specialized expertise and facilities will share their knowledge by hosting Short-Term Scientific Mission (STSMs). Particular attention will be paid to the exchange of the ESRs by means of STSMs, to be organised throughout the Action lifetime.

To effectively disseminate to a broader audience, the Action is oriented towards active use of the opportunities, following the intention to organise the Action events in conjunction with other international events and actively supporting such events as initiator and co-organiser as well as to organise Action meetings in conjunction with relevant national events. The Action will further contribute in organising dedicated sessions at major European events and invite external experts in order to enhance collaboration with the institutions both from and outside of Europe.

Besides the Milestones/Deliverables list presented in the previous tables, a large deployment of COST Action activities will be sustained by periodical newsletters issues (every 6 months), leaflets (one/year) and other material (occasionally) that will be produced and distributed by printed means and also in electronic form using the Action's website. In order to assure the large penetration of i2MHB Action meetings with potential interested social categories will be organised, such as: local authorities, that also will be encouraged to actively participate in the Action; young people; NGOs having as goal the preservation of cultural and building heritage; artists interested in development and improvement of the urban landscape; industry stakeholders that are interested to adapt and promote the new technologies in rehabilitation, preservation and operation of Heritage Buildings.

The deployment strategy will be monitored, eventually adapted or corrected during the Action time frame. The following instruments are also foreseen for dissemination purposes: questionnaires; "round tables"; permanent contact with the local, regional and national authorities involved in promotion and preservation of cultural heritage; integration of urban and rural architecture experts; integration of arts specialists; workshops organised with professionals associations the promote i2MHB Action and obtained feedback. Occasionally, information about the Action outcomes will be transmitted to the press, audio-visual providers (Radio and TV stations) in order to inform and actively control the Action evolution.

D. ACTION STRUCTURE AND PARTICIPATION – WORKING GROUPS, MANAGEMENT, INTERNAL PROCEDURES

As i2MHB Action involves groups from different sectors, it achieves a "critical mass" to cover the whole range of expertise required to accomplish the Action's scientific and technological goals. This

multidisciplinarity empowers several distinct ways to set up the Action, each of them eventually producing distinct concepts based on the selection of priorities. An obvious choice would be to outline the Action with several Working Groups, each of them related with a particular area of expertise; however this would not fit the Action goals of interoperability. Thus, the Action will be organised accordingly to its major outcomes, implying a strong interdisciplinary commitment between all players. One can state that the Action's Working Groups will act as a "transfer function" between the Action member's expertise and the Action's outcomes.

The Action will be composed of 5 Working Groups (WG) interoperating and providing mutual feedback between themselves:

WG 1: Common framework

WG 2: Interoperability roadmap for Heritage Buildings' sustainability

WG 3: Integration of Heritage Buildings into their surroundings

WG 4: Social dimension of Heritage Buildings

WG 5: Policy Coordination and deployment

Working Group 1 (Common framework) will be responsible for the establishment of the Heritage Buildings' Common Framework. This WG will consider several aspects raging from data collection and classification to the establishment of common procedures through the development of a clear processing system enabling the preservation of Heritage Building along with their social and cultural valorisation.

Working Group 2 (Interoperability roadmap for Heritage Buildings' sustainability) will be responsible for the development of a roadmap of technologies and interoperability procedures that enhance the Heritage Buildings rehabilitation and daily operation.

Working Group 3 (Integration of Heritage Buildings into their surroundings) activities will be focus on the study and optimization of heritage buildings integration into their urban and natural landscape.

Working Group 4 (Social dimension of Heritage Buildings) will focus its activities on to the social role played by Heritage Buildings in the social landscape of different European countries.

Workgroup 5 (Policy Coordination and deployment) will be formed with the task of taking care of coordination and deployment of COST policies as decided by the MC. These include outreach and dissemination, training activities, gender balance issues, involvement of young researchers and participants from COST Inclusiveness Target Countries (ITCs). This WG will coordinate its actions with other groups' achieved outputs, being this coordination task of primordial importance.

The management and organisation of the Action has a clear structure to enable the accomplishment of the Action's objectives according to the "Rules and Procedure for Implementing COST Actions". The Action will have the following aspects of coordination: management, networking, dissemination activities, ESRs and gender-related activities.

The Management Committee (MC), chaired by the Chair, will coordinate and supervise the implementation of activities and ensure that the goals of the Action are met. The MC will install a Core Group (CG) which will be responsible for the operative management work.

The CG will assist the MC and will be composed of the Chair and the Vice-Chair of the Action, the WG leaders and the Coordinator of the ESRs Think Tank. The CG will have dedicated meetings whereas the main focus of the CG activities is on the support for the MC while it assures an unobstructed cooperation between WGs, monitors the quality of work, sets clear milestones and prepares MC meetings. The CG activities will take special care of the cooperation with other COST Actions as well as with relevant national and international organisations and industrial partners. The gender-balance coordinator within WG5 will take care of appropriate consideration of the gender agenda in the Actions activities.

The Coordinator of the ESRs Think Tank will coordinate activities aimed at an active involvement of ESRs into the definition process of the Action's strategy, work plans and activities. Being supported by the Action community, the Coordinator of the ESR Think Tank will be a key person to put into practice all ESR-related measure such as STSMs, Think Tank meetings and at least three Training Schools. The gender activities and the ESR coordinator will be appointed by the MC with the latter being chosen by the MC following the suggestion of member of the Think Tank.

WG Leaders will be appointed during the first MC meeting. They will be responsible for the coordination of activities within WG and report to the CG and MC. The dissemination coordinator, appointed by the MC, will coordinate the dissemination/outreach activities while being assisted by the MC and the WG members.

The three major knowledge areas the Action (scientific wisdom, systems and data, social engagement) are crossed- linked with three major target groups that the Action aims to engage: specialists in the fields of Heritage Science, industrial players, and research and education. A major objective will be to achieve a balanced participation of these three major target groups through all the Action's Working Groups. In case on unbalanced Working Groups, measures will be taken in order to involve relevant participants suitable to meet this goal.

Particular focus will be given on industrial companies specialized in Heritage Buildings rehabilitation and maintenance, energy efficiency and technological integrators. Direct involvement of potential users into the Action's activities will help to focus on highly demanded scenarios of a practical

implementation of the Actions results. Industry partners will be invited to participate in the Actions events (or even join the Action), to improve the common framework view. The Action plans to organise, at least, two “Industrial days“.

Nevertheless, it is foreseen that the Action will grow along with its developed work. In case of Action growth, a further enhancement in human and technical means will assure that the Actions goals are achieved in accordance with the schedule.