COST Action TD1406 i²MHB

Innovation in Intelligent Management of Heritage Buildings (i²MHB)

edited by
João Martins

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Innovation in Intelligent Management of Heritage Buildings (I^2MHB)

DISSERTATIONES ET MONOGRAPHIAE 13

INTERNATIONAL RESEARCH CENTER FOR LATE ANTIQUITY AND THE MIDDLE AGES MOTOVUN, UNIVERSITY OF ZAGREB

Innovation in Intelligent Management of Heritage Buildings (i²MHB)

Publisher:
University of Zagreb - International Research Center for Late Antiquity and the Middle Ages, Motovun, Croatia

For the publisher:
Miljenko Jurković,
University of Zagreb, Croatia

Series *Dissertationes et Monographiae* created and edited by:
Miljenko Jurković

Reviewers:
prof. dr. Pedro Pereira, Faculty of Sciences and Technology, Univeraside NOVA de Lisboa, Portugal
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Graphic design and computer layout:
Boris Bui

Language consultant:
prof. dr. Vesna Mildner, University of Zagreb

Printing:
Tiskara Zelina, Sv. Ivan Zelina, Croatia

ISBN
978-953-8250-04-0

CIP zapis dostupan u računalnom katalogu Nacionalne i sveučilišne knjižnice u Zagrebu pod brojem 001029446

Cover photo:
Dubrovnik, Croatia © T. Gazdek

Circulation:
400 copies

This publication is based upon work from COST Action TD1406 i²MHB,
supported by COST (European Cooperation in Science and Technology)

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Zagreb – Motovun, 2019.

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1. Foreword

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DOI 10.1484/M.DEM-EB.5.118093

There are different expressions of Cultural Heritage, from material to intangible heritage, whereas the term Cultural Heritage many times encompasses the main category of immovable Cultural Heritage (buildings, monuments, archaeological sites...).

All over Europe, Heritage Buildings (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 creating, strengthening the Europe social cohesion. Therefore, the management and conservation of these historical constructions is of extreme importance to preserve the cultural references of Europe's communities.

There is no common definition regarding "Heritage Buildings" and the term is not necessarily associated to some statutory legal protection. The term is often associated with the terms "historic buildings" (in countries such as Cyprus, Italy, Portugal or UK), "historic monuments" (in countries such as Romania or France), "buildings in a historical/traditional or conservation area" (in countries such as Cyprus, UK or Turkey), or "listed buildings" (in countries such as Cyprus or UK). When a building is listed it can get, depending on the country of location, distinct levels of legal protection regarding its preservation and conservation. In order to be listed, the rules also vary from country to country and they are related with the building itself and with its location. These rules can consider architectural or rarity issues, historical or memorial values, representativeness or uniqueness features.

From the COST Action TD1406 point of view a "Heritage Building" is not directly related with listing, age or statutory protection. "Heritage Building" will take a broader vision, considering it as a building, a structure or an ancient monument that has particular significance (special architectural, historic, artistic, or archaeological interest) or where it is located in a place presenting significance (e.g. conservation / historical / social). In this way term "Heritage Building" is not restricted to the building itself but also comprises its social dimension and its integration into the surroundings.

Europe is also one of the World's regions presenting the richest cultural heritage. Within this cultural heritage, Heritage Buildings play a major role in the richest cultural heritage that Europe holds as one of the World's finest regions. HBs are undoubtedly an area where multidisciplinarity is essential, with this multidisciplinary approach being grounded on three major knowledge areas (pillars), as presented in Figure 1.1.

Figure 1.1. Heritage Building's major knowledge areas

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 changing 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 closed-loop procedure presented in Figure 1.2.

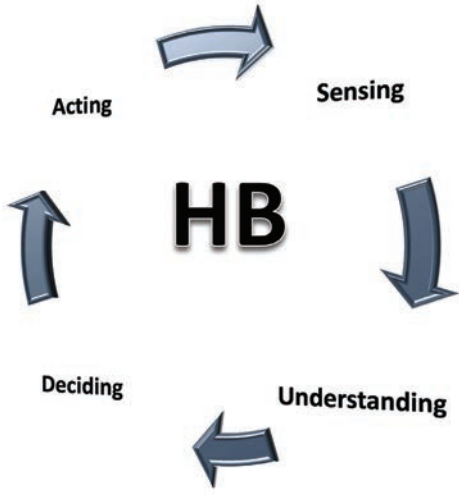

Figure 1.2. Multidisciplinary approach closed-loop

While the sensing and acting steps are rather consensual, the understanding and deciding steps are extremely area-dependent with a low level of interoperability. Since 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 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 to 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.

The aforementioned three pillars should be the bases for a "rooftop" interoperability layer. It is mandatory to 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.

In this context COST Action TD1406 (Innovation in Intelligent Management of Heritage Buildings - i^{2}MHB) was 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.

The objective of the i^{2}MHB Action was thus to create a pan-European open network, to promote synergies among 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.

2. Acknowledgements

The making of the **Innovation in Intelligent Management of Heritage Buildings** is the result of valuable contributions from several people, whom all of us were fortunate enough to meet within the COST Action TD1406 network. This book intends to make public the result of four hard working years coming from several Training Schools, Short Time Scientific Missions and Meetings. The contributors to this book, coming not only from different countries but also from different backgrounds and disciplines, bring diverse viewpoints into questioning the standard way of looking into Heritage Buildings. Special thanks to all people inside and outside the i²MHB network that share to a great extent such a viewpoint and our interest to track and foster the understanding of contemporary urban digital culture as territory of mutual reactivity between technology, space and human.

The first acknowledgement goes to the contributing authors of this book: João Martins, Stella Sylaiou, Gumersindo Bueno, Alice Tavares, Dalik Sorjef, Shu-Ling Lu, Christian Degrigny, Andrina Granić, María José Merchán, Goran Zaharija, Piero Tiano, Andrej Tibaut, Branko Kaučič, Ricardo Jardim-Gonçalves, Hervé Panetto, Anna Lobovikov-Katz, Miljenko Jurković, Ognjen Čaldarović, Jelena Behaim and Ivor Kranjec. Secondly a great and deep appreciation to every Colleague, Stakeholder, Early Stage Researcher, Expert, PhD or MsC student, Trainer or Trainee from all over Europe, that enthusiastically participated in the valuable COST instruments providing great ideas and insights.

Other specific acknowledgments are also due: supplementary project to COST Action TD1406, supported by Bulgarian Research Fund, "3D documentation and virtual restoration of selected examples of Bulgarian traditional housing architecture" (DCOST 01/20); Portuguese grants SFRH/BPD/113053/2015; project IB16162, funded by the Junta de Extremadura and the European Regional Development Fund (ERDF) "A way of making Europe". Funds from the European Cooperation in Science and Technology (COST) helped to deliver this book.

3. COST Action TD1406 – i²MHB

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COST Action TD1406 was about creating a Pan-European network aggregating different fields in the Heritage Building (HB) domain, integrating multidisciplinary expertise, technology and know-how. The Action officially started on 6th May 2015 and lasted through very active four working years. During that time, researchers, early stage career investigators, professionals from different fields, from 26 countries all around Europe, worked together, in order to achieve a unified common understanding and operation in the Heritage Buildings' domain. During that period COST Action TD1406 fostered innovative solutions by unifying already available methods, combined with the development of active and effective tools as well as measures to guarantee the conservation status in compilation with the adequate consideration of security issues, resource efficiency and visitor or use management.

Keywords: *heritage buildings; conservation; efficiency; optimization; sustainability, empowering.*

3.1. Introduction

The initial vision of COST Action TD1406 (Innovation in Intelligent Management of Heritage Buildings - i²MHB) was to unify and bring together the vast and disperse knowledge in the area of Heritage Buildings. 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. The main challenge was to overcome already existing confined collaborations, moving towards a global multidisciplinary, integrated scientific, technological and social approach.

Initially, the Action emerged from the background and experience of its partners, who had already implemented a previous project addressing Smart Heritage Buildings [1]. That project was funded by INTERREG SUDOE IV Interregional Cooperation Program, and it was based on the following premises:

- There are a lot of interesting heritage buildings.
- The best practice to increase durability is preventive conservation.
- Technology can support preventive preservation in an effective and efficient way.

When proposing COST Action Innovation in Intelligent Management of Heritage Buildings, the theoretical basis was decisive, taking the previous premises as given. But also, it was considered necessary to stress three main lines of action in order to advance in the transformation of cultural heritage management methods:

1. To give up the reactive management methods and replace them with a proactive methodology. Unlike what was past practice (to restore the buildings after the damage) monitoring the natural and anthropic processes that can deteriorate cultural assets should be considered

in order to act before damages are irreversible. This preventive conservation would also entail a restoration costs reduction.

2. To involve experts from other knowledge areas to collaborate in the management of cultural assets. For that purpose, it is necessary to build a common language of mutual understanding and facilitate interoperability amongst the disciplines traditionally associated with cultural heritage (restorers, architects, archaeologists or historians…) and new specialties that are incorporated from other scientific or administrative areas.
3. To strengthen and to increase technologies usage within the heritage sector. Usually considered a traditional and immobile area of knowledge, in recent years, humanities degrees have gradually begun to incorporate tools offered by the new technologies. Nevertheless, their entry in the heritage field is not happening at the pace and intensity that would be required.

With this declaration of intents, this COST Action intends to create a common operative procedure and understanding in the intelligent management of the immovable heritage. This is an enormous task, even more so, if we take into consideration that the number of buildings in Europe listed as "Cultural Heritage" is the largest in the world and that it keeps on growing.

3.1.1. Cultural heritage management

The concept of Cultural Heritage has evolved throughout the centuries, in such a way that various definitions have been emerging, not to replace the previous ones, but to complement them in many cases. At the onset, Cultural Heritage was considered to be a set of elements without connection that has the value of the age-old, the exotic, the commemorative or the aesthetic. This vision was typical of antiquaries and aristocratic collectors who were the seed of the museums. It was not until later when its historical value was shown, as a useful tool to reconstruct the history. From it arose the scientific collecting and the creation of archaeological museums. Subsequently, Cultural Heritage was considered a symbol of the societies, guarantor of the spiritual, national, political or cultural values that define them. In the fourth revision, its educational virtues and its capacity to increase the culture of the different social groups stood out. It is no longer just a matter of reconstructing History, but also of understanding it to educate the nations. Finally, Cultural Heritage can also be regarded as a tourist attraction and, therefore, as an economic resource of great importance for the area in which it is located.

Nowadays, to make a new revision through a critical perception is needed to adapt the concept to the 21st-century realities. In this sense, it is expected that Cultural Heritage will provide added value to previous definitions, such as being a source of inspiration and of social integration, as well as helping both economic dynamism and resilience, besides enhancing the capacity of urban and rural regeneration. Altough current legislation usually tends to incorporate a wider vision (with strong socilological perspective of cultural heritage), these values require focusing on new heritage management approaches and change the parameters that have been used until now to foster the desired impact on society (see Table 3.1).

Table 3.1. Evolution of cultural heritage values and relation with management and impact.

Phase	Values	Type of management	Social Impact
1	Exoticism, antiquity, aesthetics	Private collecting, looting	Limited to aristocracy
2	Scientist, exceptionality	Collecting, proto archaeology, Museums	Limited to privileged circles of scholars
3	Spirituality, identity, politics	Museums, Restoration of significant elements	The population is ideologically indoctrinated
4	Culture, education	Museums, Restoration of significant elements	The population is educated
5	Tourist content, audience attraction	Expansion of the number of protected elements, World Heritage list, "Touristification"	It offers entertainment, culture, social relevance
6	Inspiration, social integration, regeneration capacity	The concept of heritage is expanding. The concept of adaptive reuse arises	It is considered a driver for economic, social and cultural revitalization

3.1.2. Special consideration on Cultural Heritage Buildings

The number of buildings protected by its singular values, and considered as Cultural Heritage elements, is growing. At the same time, we are facing the decline of hundreds of buildings due to natural or human factors. Wars, climate change, abandonment of rural areas and lack of use are the main driving causes that allow saying that losses are more plentiful than new incorporations to the protected buildings list. Our society is forcing the protection of Heritage Buildings (HBs), as well as collections, movable items, cultural landscapes and immaterial heritage, to preserve the collective memories, to reinforce the identity of people and to create foundational discourses.

In Europe, public administrations guarantee the protection and also have the commitment to increase and improve the cultural heritage. It means that, in most of the countries, public resources are being applied to safeguard the inheritance. But, as a consequence of the recent economic crisis, public funding for the conservation of heritage buildings has been reduced. This implies a new cause of deterioration of HBs and an increase of the risk of their loss. Many voices rise up asking for a rational application of resources in such a way that an acceptable state of maintenance of the buildings is achieved and that the maximum number of them is reached maintaining their integrity, identity and values as much as possible.

On the other hand, there are also voices questioning the protection of patrimonial assets when those are not particularly singular and therefore could be considered redundant. They argue that it is not reasonable to dedicate public resources if there is not an adequate analysis of the impact of the investment.

But, linking with the new Cultural Heritage vision, experts from both public and private sector have realized that it is a really powerful source of incomes that could work as a driver for the local development. Following this line of thought, the European Commission's 2014 Communication "Towards an integrated approach to cultural heritage for Europe" underlined the importance of maximizing the intrinsic, economic and societal value of cultural heritage, in order to promote cultural diversity as well as economy and the intercultural dialogue. More focused on economic development is the document "Getting cultural heritage to work for Europe Report of the Horizon 2020 Expert Group on Cultural Heritage", where it is stated that cultural heritage is a significant force for 21st century Europe . Not only is it at the heart of what it means to be European, it is being discovered by both

governments and citizens as a means of improving economic performance, people's lives and living environments. Furthermore, ICOMOS Declaration of 1st December 2011, entitled "On Heritage as a driver of development", states the clear relation between cultural heritage and regional development, sustainable tourism and local economy.

One of the most relevant groups within the legal umbrella of Cultural Heritage are Heritage Buildings, including a wide range of building types as well as monuments and, sometimes, even archaeological sites. The Cultural Heritage building is not an isolated entity, it is inserted in a relational system in which we can identify the connection with the accessory elements it contains (furniture, paintings, frescoes...) and the links with its surroundings and environment, which can be an urban, peri-urban or rural landscape. In addition, it can give support or be related to certain cultural practices that could become intangible heritage. Their usage is the main key to ensure the durability of these buildings and, therefore, of all the Cultural Heritage, considering that its usage is compatible with the building itself.. Using them is to know them. Thus, through the use, society feels HBs as their own (appropriation) and learns to appreciate them for their usefulness as well as for their historical, aesthetic, cultural, symbolic values, etc. Benefits derived from use can be grouped into different categories, as shown in the Figure 3.1.

To overcome the presented critical approaches, as well as to increase the benefits derived from the use of heritage, it is necessary to develop heritage management that combines the knowledge provided by specialists from various knowledge areas and supported on available techniques and technologies.

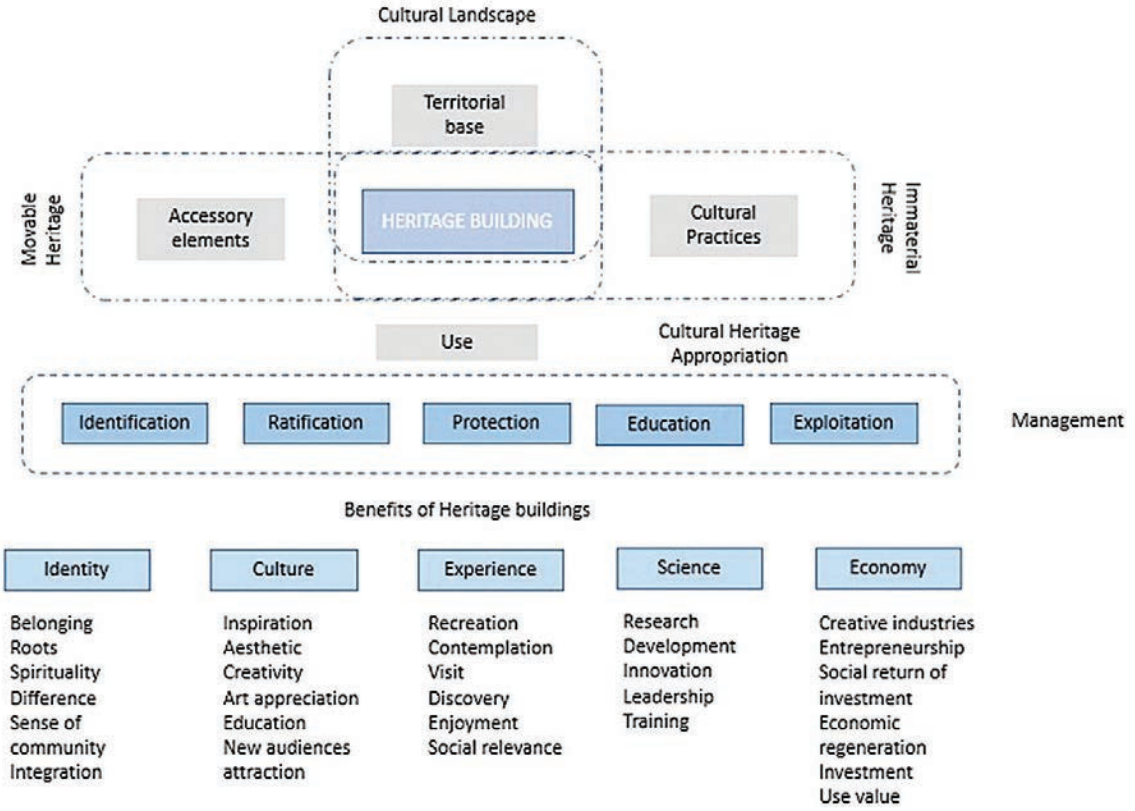

Figure 3.1. Benefits of Heritage Buildings

3.2. Initial network of proponents

The Action was proposed in 2014, and a wide range of research effort had already been done concerning data collecting and data storage systems in Heritage Buildings. Most of the research had

been materialized through Europe's Framework Programs. Some of them relate Heritage Buildings and climate protection , while others develop and demonstrate, through case studies, a methodology for assessing and selecting energy efficiency interventions. Among the most addressed research issues are the use of multi-sensors, wireless sensor networks and cloud computing procedures for data storage. Most of the projects were either overly focused on basic research or confined to high-level cooperation without a global interoperability approach.

COST Action TD1406 proposed to change that scenario and engaged, from the beginning, several groups from different sectors, in order to achieve a "critical mass" covering the whole range of expertise required to accomplish the Action's scientific and technological goals. This multidisciplinarity empowered several distinct ways to set up the Action, each of them producing distinct concepts based on the selection of priorities. The initial network of proposers gathered specialists from distinct fields, such as electrical and electronic engineering, information engineering (28.9%), civil engineering (15.6%), computer and information sciences (15.6%), economics and business (6.7%) and history and archaeology (6.7%). This multidisciplinarity is well illustrated in Figure 3.2, where it is possible to see the participants coverage across distinct areas of knowledge, by the end of the Action.

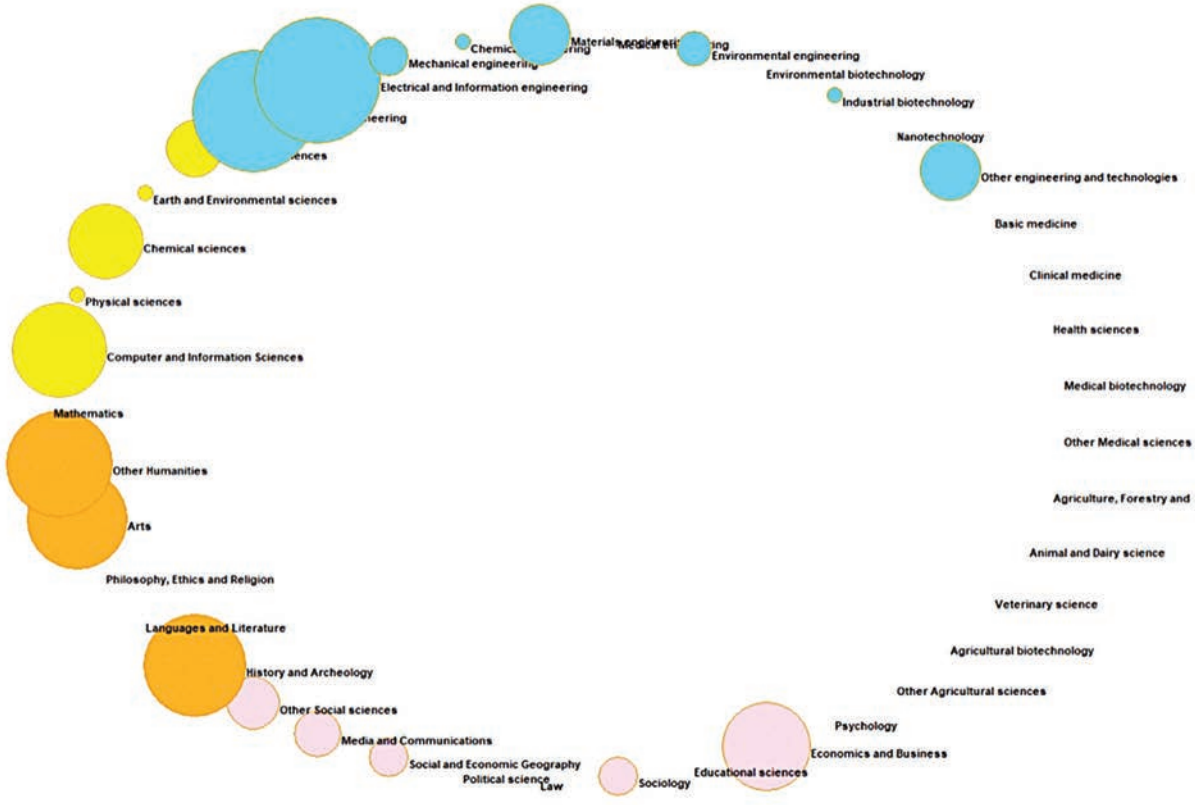

Figure 3.2. Multidisciplinary coverage of COST Action TD1406 (COST Association data, January 2019)

These groups of specialists were gathered from a distinct set of organizations, for example, higher education and associated organisations (66.7%), business enterprises (15.6%), private non-profit without market revenues or NGOs (11.1%) and government/intergovernmental organisations (6.7%). All together 17 countries were represented in an initial network of 45 proponents: Portugal, Switzerland, Germany, Spain, Estonia, France, United Kingdom, Greece, Croatia, Italy, Romania, Serbia, Turkey, Slovenia, Ireland, Norway and Latvia. Out of the 45 proponents (68.9% males and 31.1% females) eight were early stage researchers.

3.3. Action's objectives

The main objective of the COST Action TD1406 was to create a Pan-European open network, to promote synergies between Heritage Science's specialists, industrial stakeholders and research/education players, achieving 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 implied the establishment of a multidisciplinary community to promote multidisciplinarity across different scientific areas, along with the ability to perform cross-sectorial assessment. This community would establish a roadmap, outline a common vision, produce a strategic research agenda and a set of procedures and recommendations to address interoperability barriers in Heritage Buildings, implementing an action plan for this multidisciplinary view of Heritage Buildings. This main objective was divided into a set of goals lending to the desired common vision:

- Establish a framework to clearly define data collection and classification of good and sound practices and experiences related with preservation and rehabilitation of Heritage Buildings, to define common and adequate procedures and to develop new interoperability paradigms in development towards the creation of a common language.
- Synthetize interoperability activities that will improve the sustainability aspects related with HBs preservation.
- Study and discuss Heritage Buildings' integration into the urban and natural landscape.
- Emphasize the social role of Heritage Buildings in leveraging the socio-cultural dimension in different European countries.
- Provide an open dissemination platform through which new interactive, distributed and networked technologies deployed as mobile multifunctional devices will allow the extraction, exploration and collection of memories, actions and events.

3.4. Organizational structure

The Action was organized according to a strong interdisciplinary commitment among all participating stakeholders. It was composed of five (5) Working Groups (WG) interoperating and providing mutual feedback among themselves:

- Working Group 1 (Common framework) was responsible for the establishment of the Heritage Buildings' Common Framework, considering 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) was 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) with activities focused on the study and optimization of heritage buildings integration into their urban and natural landscape.
- Working Group 4 (Social dimension of Heritage Buildings) focused its activities on to the social role played by Heritage Buildings in the social landscape of different European countries.
- Working Group 5 (Coordination and deployment) was mainly responsible for dissemination and stakeholder's engagement activities.

The COST Action was coordinated by a Management Committee (composed of two representatives of each participating country), chaired by the Action Chair and Vice-Chair, who coordinated and supervised the implementation of activities and ensured that the goals of the Action were met. A Core Group was established comprising the Action Chair and Vice-Chair, Working Group leaders and vice-leaders, Short Time Scientific Mission and Early Career Investigator Think Tank

coordinator, and a Communication Officer. The Core Group was responsible for the operative management work.

The three major knowledge areas of COST Action TD1406 (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 Cultural Heritage science, industrial players, and education. This was achieved by a balanced participation of these three major target groups through all the Action's Working Groups.

3.5. Action network and instruments

From the initial network of proponents, the Action expanded itself into twenty-six participant countries (with forty-nine representatives in the Management Committee): Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Estonia, France, Germany, Greece, Ireland, Israel, Italy, Latvia, Lithuania, Malta, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland, United Kingdom and Former Yugoslav Republic of Macedonia (please see Figure 3.3 for geographical distribution).

Figure 3.3. COST Action TD1406 participating countries

Throughout the Action timeline a set of network tools were established, in order to better achieve its goals. Amongst these tools one can consider meetings, workshops and conferences; short-term scientific missions (STSMs); training schools and conference grants.

Management Committee meetings are very important in the scope of COST Actions because they coordinate and organise the Action's scientific and networking activities. It is their role to ensure that the specified objectives are met and the Budget Plan fulfilled. The decisions of the Management Committee bound the path taken by the Action. These decisions follow the opinions and requests of the majority of the Action Management Committee members, thus being the decisions taken by a voting procedure. Since MC meetings are the best place for all members discussions, live and in

person, the Action progress, COST Action TD1406 held one Management Committee meeting per Grant Period. Management Committee meetings were held in Brussels/Belgium (2015, February 20), Porto/Portugal (2015, October 7), Nicosia/Cyprus (2016, November 3), La Valetta/Malta (2017, September 26) and Rome/Italy (2019, February 19).

COST Action TD1406 members participated in several related international conferences, promoting and enhancing the COST Action's visibility. The Action itself also organized one workshop (Advances in Digital Cultural Heritage) and two special sessions ("Intelligent Heritage" on the 9th International Conference on Intelligent Systems IS'18, Funchal, Madeira; "EU COST Action TD1406, 4D-CH-WORLD and EU H2020 INCEPTION joint session" at the 6th International Euro-Mediterranean Conference – EuroMed 2016, Nicosia, Cyprus).

Short-Term Scientific Missions (STSMs) are exchange visits of researchers involved in a COST Action, allowing scientists to visit an institution or laboratory in another COST Member State. These scientific missions may last up to six months in another COST Member / Cooperating Member or Near-Neighbour Country joining the Action. Their aim is to foster collaboration in excellent research infrastructures and share new techniques that may not be available in a participant's home institution or laboratory. COST Action TD1406 supported more than 50 STSMs involving the following countries: CY, DE, EE, EL, ES, FR, HR, IL, IT, LT, MK, MT, PT, RO, RS, SI, UK. Figure 3.4 presents the huge interaction and the large country dispersion provided by COST Action TD1406 STSM.

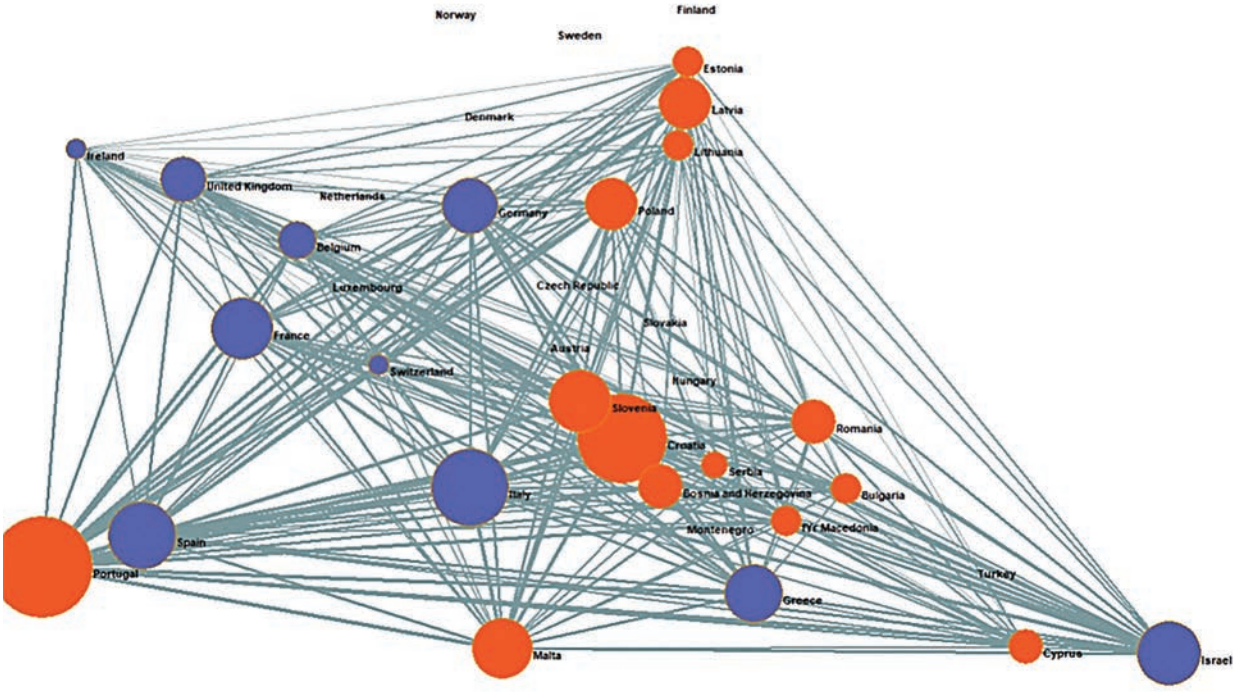

Figure 3.4. STSM coverage of COST Action TD1406 (COST Association data, January 2019)

Three conference grants were used by early-career investigators, from participating Inclusiveness Target Countries, to attend international conferences.

COST Actions are supposed to promote knowledge sharing and support collaboration through training schools. They offer intensive training of up to 15 days on a COST Action topic, on the premises of one of the Action participants. COST Action TD1406 organized 5 training schools: Aguilar de Campoo, Palencia, Spain (January 2016), Poreč, Croatia (September 2016), Rome, Italy (October 2017), Olimje, Podčetrtek, Slovenija (April 2018) and Chalon-sur-Saône, France (April 2019). These training schools involved around 100 trainees and more than 20 external trainers (outside the Action).

3.6. Conclusions

COST Action TD1406 had a positive impact on scientific, technological and managerial as well as societal level. From the strategic point of view, it potentiated new impulses for the establishment of a new Heritage Buildings' cross-sectorial multinational cooperation, establishing a sustainable European network of researchers, solution providers, authorities, industrial partners and end-users in the field of Heritage Buildings. At the same time, it enhanced preservation, conservation and heritage valorisation as an identity within the variety of unified Europe, in consonance with sustainable development. From the scientific and technological perspective, there was a huge coordination effort towards cross-disciplinary innovation and creativity, common developments and architectures, contributing to the definition and promotion of European Heritage Buildings' excellence. Action members, within the various working groups, established a common approach and methodology, in order to develop related tools and services. From the societal point of view, the Action secured Europe's self-assertion in future scientific and technological developments, through young researchers' integration. Coordination and realisation of multidisciplinary training for Early Career Investigators in the form of Short Time Scientific Missions were of outmost importance.

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4. Heritage building / site use cases' STSMs: Early Stage Researchers' perspective

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Use case applications are presented through the point of view of young researchers, through the analysis of their feedback and reporting of Short-Term Scientific Missions developed under COST Action TD1406 framework. The work of young researchers, coming from different fields, obeyed to specific objectives according to the tasks of each Working Group and took place in different countries. This chapter presents the results of a comparative analysis of those STSMs, highlighting transversal objectives, preliminary topics of approach chosen by the young researchers, their debate around trial of evidences and dilemmas and finally their selection of new challenges for a better awareness in protecting and preserving Heritage Buildings and sites.

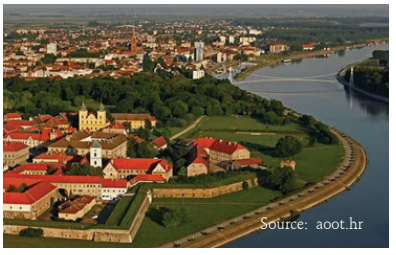
Keywords: *Early stage researchers (ESRs), Short-Term Scientific Missions (STSM), Heritage Buildings (HB), Heritage knowledge, HB challenges, COST TD1406, interoperability.*

4.1. Introduction

The overall results of COST Action TD1406 use case applications is debated through the overview analysis of ten Short-Term Scientific Missions (particularly dedicated to specific use cases), taking in account the rest of the Action STSMs and Think Thank sessions developed by young researchers. As mentioned before COST STSMs are extremely important instruments to foster collaboration in excellent research infrastructures and share new techniques between partners. STSM can also be used to promote applied field research, applying new methodologies and tools in new contexts.

Thirty-seven Heritage Buildings (HBs) and sites (use cases), from countries represented in COST Action TD1406, were initially selected mainly to illustrate Working Group 3 (Integration of Heritage Buildings into their surroundings) activities (see Chapter 7). In the end, nine HBs/sites were carefully selected to ensure that they were representative in terms of characteristics such as size, ownership (private, public or mixed), location (urban, rural), level of restoration/reconstruction, country, documentation level and usability across the Action.

The selected nine HB/sites were specifically used as 'physical space' to host STSMs and as a focus point to engage with key stakeholders involved in the preservation and conservation of HBs/sites. Those HBs provided the necessary background of analysis of STSM proposals to be developed by ESRs, from which 3 HBs were given a deeper and wider focus. Figure 4.1 summarizes a general and very brief description of the nine selected use cases. The use cases were used to present different perspectives and background of the main challenges involving the conservation and preservation of HBs/sites in urban areas, social and economic development, and positive and negative issues in HB/sites interventions. Each use case compiled a synthesis of their characteristics and the main issues under debate, which are presented in the Annex of this book.

Château de Germolles Mellecey, France **1**	Listed, private but open to public, Best preserved, cultural tourism **Main issue:** Historical value	 © Germolles
Temple- Cathedral Pozzuoli, Italy **2**	Listed, shared ownership Restoration and reconstruction strategy in debate **Main issue:** Compatibility new/old	 ©Dezzi Bardeschi
Baroque city-fortress Croatia **3**	Listed, property ownership (public and city) Preservation of the place **Main issue:** Maintenance	 Source: aoot.hr
Baroness' house Maribor, Slovenia **4**	Listed, public building Reuse strategy **Main issue:** Reuse	 © Bogdan Dügonik
Santa Maria la Real Palencia, Spain **5**	Listed, public Long term conservation intervention Local economic development **Main issue:** HB as an anchor	 © Fundación Santa Maria la Real 2

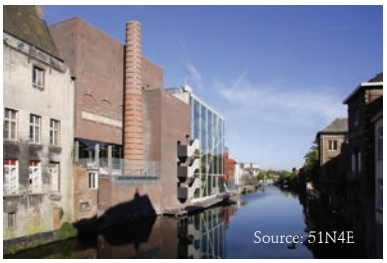
Lamot brewery Malines, Belgium **6**	Listed, balance between old industrial place with new architectural changes **Main issue:** HB change	
Kalemegdan, Belgrade fortress, Serbia **7**	Listed, public enterprise, 2 million visitors, **Main issue:** risk of mass tourism	
Romanesque Route *Rota Românico*, Portugal **8**	58 public and private monuments Engagement of the local population, Engine of promotion of the region **Main issue:** HB Route as anchor	
Valletta Waterfront Pinto stores, Malta **9**	Listed, government owned, reuse into a public use, risk of mass tourism (cruise liners) **Main issue:** Impact of cruise liners	

Figure 4.1. Use case applications

The importance of the role of ESRs in the promotion of interdisciplinary knowledge and new international opportunities for the future is recognized by the Action. This was demonstrated by Prof. Dr. Sierd Cloetingh, COST President, who stated that: *"COST's interdisciplinary bottom-up networks are bridging the innovation divide in Europe and provide a large spectrum of opportunities for young generations of researchers and innovators."* As mentioned before, one instrument that support this purpose are STSMs. During this Action, more than 50 STSMs were carried out.

Considering the importance of the outcomes from STSMs, the last ten STSM reports were analyzed to better understand and gain feedback from the ESRs involved in this Action. They were chosen because these STSMs were developed to focus on three representative use cases (out of the nine): Case 1: Château Germolles, France; Case 2: Pozzuoli Domus; and Case 9: Valletta Waterfront, Malta). These STSMs were particularly devoted to test COST Action TD1406 methodologies and tools (developed under the Action Working Groups) in three selected use cases. The objective was to adopt an interdisciplinary approach, providing an opportunity to ESRs from different fields to understand the impact of interventions on heritage buildings (HBs). The involvement of stakeholders, combined with public interaction or social engagement in the technical and scientific fields, was also analyzed.

In this sense, the STSM reports were valuable for the debate of the position of ESRs in facing new challenges about HBs, to constructively compare and contrast the reality of her/his own country and that of the visited country. Therefore, the main purpose of this chapter is not to simply present a summary of the STSM reports, but to show the expectations of ESRs with respect to the HB or site, its present background of protection and support, as well as the common links between all the STSM reports in terms of what they looked for in their analysis.

The basis of this chapter is supported in the following ten STSM reports, provided by the ESRs of COST Action TD 1406:

- WG3 From management and implementation of strategies of protection to technologies and applications (in ESALA, University of Edinburgh, UK), by Dr. Alice Tavares Costa (RISCO – Civil Engineering Department, University of Aveiro), under the guidance of Dr. Dimitris Theodossopoulos, ESALA, 2017;
- WG2 Cultural Heritage Ontology (in University of Lorraine/TELECOM Nancy, Centre de Recherche en Automatique de Nancy - CRAN), by Prof. Andrej Tibaut (University of Maribor Faculty of Civil Engineering, Transportation Engineering and Architecture), under the guidance of Prof. Hervé Panetto, 2017;
- WG1 Development of the database with good practices (in Fundación Santa María la Real del Patrimoni Histórico), by Jelena Behaim (University of Zagreb), under the supervision of Dr. Gumersindo Bueno Benito, STSM at Aguilar de Campoo, Spain, 2017;
- WG3 Integration of Heritage Buildings in their surroundings (in Château Germolles, France) by Dr. Alice Tavares Costa (RISCO – Civil Engineering Department, University of Aveiro), under the guidance of Dr. Christian Degrigny, 2018;
- WG2 STSM COST TD1406: Pinto Stores, Valletta Waterfront, WG2 Interoperability, Floriana, Malta, by Cristiano Riminesi, under the supervision of Prof. Shirlei Cefai, University of Malta, 2018;
- WG1 Validation of a system to collect good practices in heritage management (in Château Germolles, Chalon-sur-Saône, France), by Goran Zaharija (WG1) under the supervision of Dr. Christian Degriny, Château Germolles, 2018;
- WG4 Social dimension of Heritage Buildings – testing the accomplished work (Pozzuoli Domus site), by Ivor Kranjec under the supervision of Prof. Luisa Migliorati, Sapienza Università di Roma, 2018;
- WG4 Social dimension of Heritage Buildings – testing the accomplished work (in Château Germolles, Chalon-sur-Saône, France), by Jelena Behaim (University of Zagreb), under the supervision of Dr. Christian Degrigny, 2018;
- Validation of a system to collect good practices in Heritage management (Pinto Stores, Valletta Waterfront, Malta), María José Merchán (School of Industrial Engineering - UEX), under the supervision of Dr. Shirlei Cefai, University of Malta, 2018;
- WG3 Integration of Historic Buildings in their surroundings – The case study of Pozzuoli, by Prof. Shirlei Cefai (University of Malta), STSM about *Tiempo-Catedral* in Pozzuoli, Italy, under guidance of Prof. Luisa Migliorati, Sapienza Università di Roma, 2018.

The results from the analysis of STSM reports presented in this chapter, are organized into the following topics:

- general STSM objectives
- background of the HB or site
- stakeholders and the public
- trial of evidence
- dilemmas
- new challenges.

4.2. General STSM objectives

The mentioned STSM reports had specific purposes according to the work topic of each working group (WG) or the individual purposes in line with COST Action TD1406. The technical research results of this work are expressed in the outputs of each WG and in the chapters of the book. In this sense, the analysis of the STSM reports takes a different approach, emphasizing common concerns, to collect information or understand the reality behind each Heritage Building or site. In general, ESRs developed their work considering the following objectives:

- Comparing theory and intervention ethics
- Identifying positive and negative aspects of HB interventions
- Identifying which good practices could be globalized
- Verifying the potential of the use of new tools on HB
- Understanding which social stakeholders can support the HB
- Understanding social engagement dynamics.

The STSM objectives attempt to take a wider approach, combining specific background skills with the responsibility to understand the impact of the technical action in the social environment, in culture, and in the preservation or enhancement of heritage values of authenticity and integrity. This is in line with a recent document prepared by the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) [1] which noted that existing indicators primarily based on publication citations provide a rather incomplete picture of impact. For example, citation metrics may indicate the awareness of new knowledge by other scholars, but do not measure its uptake outside academic communities or its influence on practice [1]; this is why STSMs, training schools and Think Tank sessions are important to promote open mindedness and the exchange between academia and stakeholders. This engagement is necessary to achieve the goal proposed by The United Nations Educational, Scientific and Cultural Organization (UNESCO) of including the protection of cultural heritage in United Nations (UN) sustainable development goals [2,3].

4.3. Background of the HB/site

The starting point of each STSM for ESRs was to understand the background of the place, the HB and its surroundings, the site and the closest region. This goes beyond the technical field and the debate around the best techniques of conservation or communication. In this way, the ESRs understood that intervention quality, sustainability or consistency are dependent on issues at the level of urban management, public and private stakeholder actions, the type of financial support provided, and the awareness of values around the HB and site.

The topics commonly used by ESRs to understand the background of HBs/sites were:

- Motivations for the intervention (e.g. tourism, cultural promotion)
- History of the HB/site
- Social problems in the surroundings of the HB/site
- Funding versus level of transformation of the HB/site.

The above discussion recognized the importance of an integrated intervention, in which the technicians or experts are not isolated in their decisions, but should premarily understand the social dynamics or the expectations of the population, or even those of HB supporters. These should be combined with the full knowledge about the history of the HB and the location.

4.4. Stakeholders and public

The guidance of the STSM work by each host provided the applicant with contact with different types of stakeholders, from academia to public bodies, with local or regional responsibilities, as well as the owners or managers of each HB/site. Indeed, ESRs proactively contacted other stakeholders or the public through mechanisms such as questionnaires. For this reason, the STSM reports that

involved mostly academia or laboratories presented almost exclusively inputs of technologies and the development of tools focusing on the relation with future users. In contrast, STSM reports more strongly associated with different levels of management showed a wider range of contact with stakeholders and the public, for example, in the case of the evaluation of social engagement. These findings are complementary and enrich the final conclusions of COST Action TD1406. This purpose needs to continue to be pursued, since a gap still exists in the co-working platforms between research agencies and other stakeholders, as shown in Figure 4.2 [1].

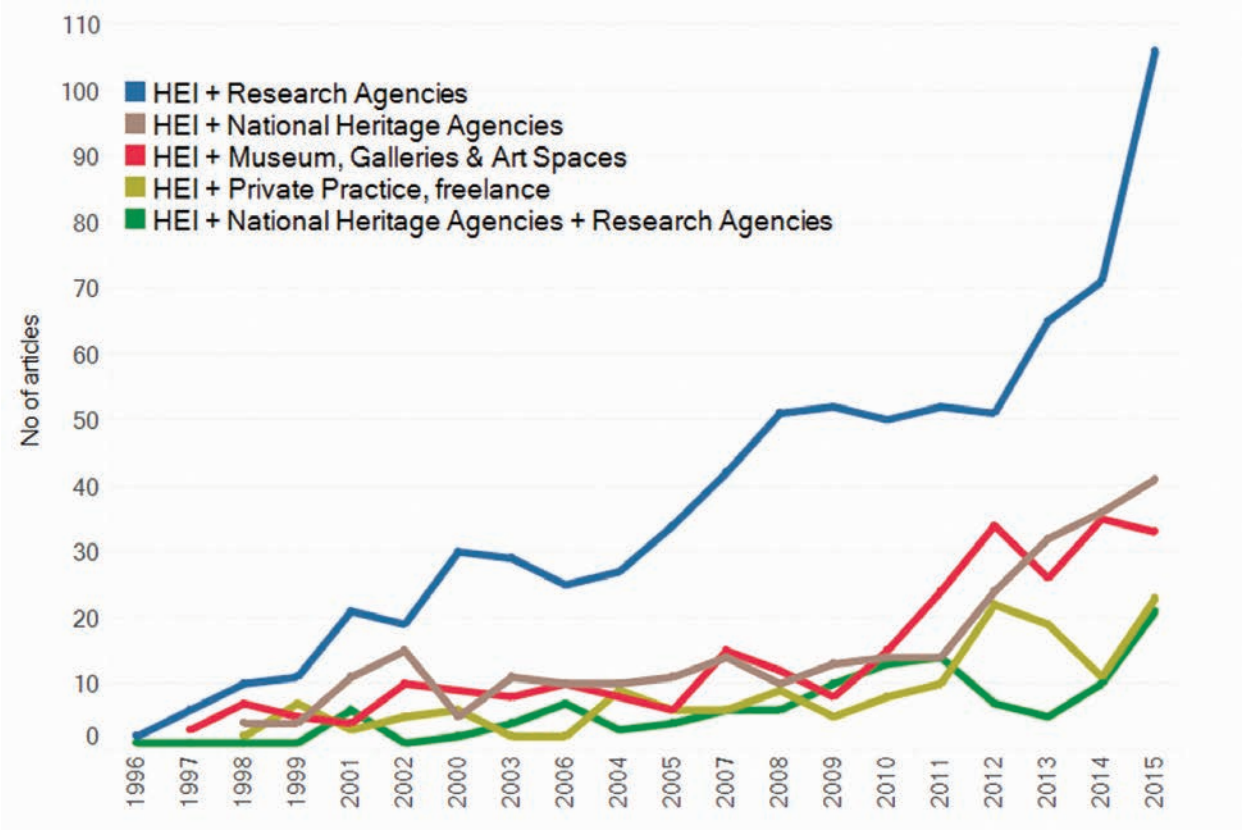


Figure 4.2. Most prevalent collaboration among different types of institutions over time (1996-2015) [1].

4.5. Trial of evidence

The work developed during the STSM was compared to theories and practices, as well as the "day after" interventions. The results, however, were in conflict with the previous expectations among the key stakeholders. This has led ESRs to further identify five main problems that should be debated again: two at the intervention level, one at the urban management or heritage building (HB) management level, and one concerning the population.

At the intervention level, ESRs emphasized that, regarding the strategy of intervention, there is no simple distinction between new additions in relation to the old parts of the HB to qualify the intervention or to assume that as a good practice. Although the principle can be widely accepted, some of the case studies showed sensitive criteria, which could compromise the integrity of the HB and their cultural values and perception of the past legacy. This preliminary conclusion should be emphasized, since it assumes the difficulty of controlling the excessive introduction of changes in HB, involving the balance between new additions and pre-existing sections. This is again a subject of

international debate, due to a questionable excessive confidence in new materials and technologies that in fact are not durable or compatible with HB fabric.

A second debate, again at the intervention level, is the evaluation of criteria used to select new materials and techniques for the intervention, and the identification of practices that should be accepted as European good practices. Although a need for the global acceptance of criteria was not a conclusion, since even the Eurocodes should be adapted as the reality of each country rather than the opposite, a platform to share and debate good practices can bring good orientations for the future.

At the level of urban management or HB management (involving stakeholders, entities and technicians), ESRs identified there a lack of an interoperability framework. This is partially responsible for the gap between the needs identified by HB private stakeholders for promotion and HB maintenance, and the lack of financial or technical support provided by the entities. This can compromise the enhancement and use of the HB as anchors for local or regional development. This means that private stakeholders are not sufficiently supported to keep public interest above their own interests, which in some cases can result in interventions or uses that damage the authenticity and integrity of the HB / site.

The ESRs also analyzed the attitude of the public towards new interventions in HB; this work was developed with the objective of understanding the reasons why the public rejects interventions and identifying the expectations that these local populations had prior to the intervention. The STSM reports show that the timely communication of the need for intervention and opportunities to participate in the debate were not widely promoted. This was considered to be the reason behind the separation of people and the HB / site after an intervention, since a decrease in the recognition of past values and the sense of place were neglected. On the contrary, greater acceptance of HB interventions was observed when the public had confidence in the decision makers and regular interactions between them, or even when the recognition of the benefits to the population were known.

4.6. Dilemmas

The STSM work was developed combining different kinds of interdisciplinary debates, considering the contact with the local or regional stakeholders and several visits to analyze the HB or site. From these tasks, the ESRs noted the following dilemmas:

- Which preliminary procedures should be guaranteed and implemented prior to any HB intervention?
- Considering that demolition is an irreversible action, why is it so often used?
- How balanced is the equilibrium of the transformation of the HB surroundings?
- How far should the transformation of a HB or HB site go?
- If some regions show a continuous transformation of the social structure, who should manage the sense of the place?
- How can the expectations of the public be taken into consideration in the HB intervention?
- Is the distinction criterion between the new additions/changes and the pre-existing fabric sufficient enough to guarantee the preservation of the HB values?
- How confident is the technical and research field in compatibility and durability of the new materials and techniques?
- Should we accept that enabling global common practice usage and triggering global scale innovation can be done independently from the culture, place, technology and field of knowledge?

Independently of the complementary aspects of some of these questions, the fact that ESRs highlighted them for continuous debate again shows that young generations are not concerned with only seeking more expertise, but are also interested in an integrated approach for their future action in the HB field. The need of a framework of shared responsibilities is another mandatory aspect that was emphasized.

4.7. New challenges

STSMs reports show positive aspects, as well as unbalanced situations, which allowed for a rich debate to challenge the ESRs and the conservation or promotion practices of a HB or site in a different country. Considering that each STSM was debated within each working group of COST TD1406, it is interesting to note which new challenges were identified in the STSM reports, since they represent a preliminary analysis and the points of view of new and young generations. The new challenges and issues of interest emphasized by ESRs can be divided into five main themes. Each of them is discussed in detail in turn.

(1) Ethical issues: a continuous focus should be done to achieve a better strategy to balance the introduction of new material, elements or spaces to old HB or sites; this should be done to accomplish the objective of the enhancement of authenticity and cultural values implicit to HBs or sites. The methods to support the meaning should also address the knowledge of traditional techniques.

(2) Natural risks: there was a main emphasis on the importance of the promotion of the interoperability between actors, fields of expertise and theory and practices. The evaluation of the aspects responsible for the lack of these interoperabilities should be promoted after natural events. An in-depth knowledge of natural risks should be supported, involving academia, technicians and entities.

(3) Development of tools (mainly software): considering the need for compatibility between several software programs belonging to different fields of expertise, it is a challenge to increase multidisciplinary interoperability through these tools. Nevertheless, the understanding of the present limitations of the tools (such as building information modeling, BIM) should be understood for its proper use, as well as for easy access to them. A special emphasis is oriented to the separation between modeling and reality in terms of a deeper knowledge of the "structural behavior" of a HB or the prediction of the future state of conservation without a complete expertise detailed survey *in situ*. Again, although the importance of the development of 3D modeling or virtual reality is recognized, the emphasis should be that the main object is to preserve the real HB and not the 3D image of the HB. This requires responsible financial support with the equilibrium for each area.

(4) Interaction between the technical field and HB management / urban management: the importance of improvements at the level of their shared responsibilities and technical engagement, in opposition to the isolated focus of HB as an "object" for intervention or transformation, was highlighted.

(5) Social engagement: the need for the promotion of concrete benefits for the supporters of HBs or sites, including the stakeholders as well as the prior evaluation of the impact of HB interventions at the level of cultural value preservation, was emphasized. Furthermore, a preliminary analysis of the impact of the interventions in social terms and later monitoring should be promoted. Taking into account the conclusions of ICCROM, more rigorous processes are required to link research needs assessments with the real word challenges experienced by users, with a greater emphasis on evaluating research outcomes rather than counting outputs [1].

4.8. Conclusions

The involvement of early stage researchers (ESRs) is highly important for the future, as recognized by COST and other entities such as ICCROM and UNESCO, to support the in-depth knowledge and preservation of heritage buildings (HBs) and sites. COST Action TD1406 has promoted several Think Tank sessions, more than 50 scientific missions (STSMs) and five training schools in several countries. Among these networking tools, the contents of ten STSTs were analyzed in order to understand ESRs' expectations and what they identify as the key issues to consider for the future. From this analysis, the conclusions were divided into the following topics: general STSM objectives; background of the HB/site, stakeholders and the public; trial of evidence; dilemmas; and, new challenges. Tripartite responsibilities were identified, including three main groups: technicians and researchers, stakeholders and entities, and the local people and visitors in general.

At different levels of decision, the success of the promotion, enhancement and sustainable use of HBs and sites is dependent of the interoperability between all three groups along with a good framework and shared responsibilities. The trial of evidence and the recognition of present dilemmas were highlighted through the identification of contradictions or drawbacks between theories and practices involving HBs, sites and their HB surroundings. An integrated vision of the action of the technician in the HB field was also emphasized in the STSM reports. the ESRs showed a desire to increase the sense of exigency of intervention at different levels of decision. Finally, new challenges to pursue in the future were identified, including ethical issues, natural risks, the development of tools, interaction between the technical field and HB/urban management, and social engagement.

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5. Good practices in Heritage Buildings' Management

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The number of buildings protected under the name of "Cultural Heritage" is growing at an accelerated pace in recent years. But, equally, they are constantly exposed to risks of loss or deterioration. Europe today expects a series of benefits of Heritage Buildings that goes from aesthetic enjoyment to economic development. All of which implies a planning and an economic investment in the sector by different governments that are not always easy to achieve. Given this situation, changing management models is necessary both for the sustainability of heritage and for obtaining the expected benefits. The intelligent management of heritage buildings involves the participation of professionals from different knowledge areas as well as the use of available technologies. Combining this with the consideration of the historic building as part of a larger patrimonial system that implies the social participation and the enhancement of the socio-economic impact, the development of a new model of heritage management seems to be more than necessary.

Keywords: *Intelligent management, heritage building, smart heritage, database, practices, preventive preservation.*

5.1. Introduction

How can a historic building, a castle, for instance, help citizens to have a better life? This question is on the table nowadays. There are many open lines of research as well as a series of European calls for projects trying to answer it. It is agreed that Cultural Heritage assets help to generate identity, values and culture, to propitiate cohesion and even to support people experiences. The social effects of heritage buildings can be diverse even more if they are well preserved, restored and studied.

In recent years, we have witnessed restorations that put at risk the good itself; interventions that have denatured the assets after breaking their authenticity; public investments that have been an important expenditure without a clear analysis of the return on investment; buildings closed to the public after restoration. But, on the other hand, there are plenty of successful interventions that assure the preservation of the Cultural Heritage asset values. Even the small ones can help create local spots of attraction that become touristic brands to attract visits.

One of the essential keys to reaching excellence is the proper management of the heritage building. This management must begin even before establishing the investment priorities by designing projects in which the population is involved, taking into account the environment, and, above all, planning the social impact of the intervention projects. The population must be aware that cultural heritage is more than inheritance, that it is a resource in the present and should continue to be so in the future. That is the reason why it is necessary to change many paradigms and generate manage-

ment models that are capable of satisfying a multifaceted reality where the edges are the needs of different social environments.

5.2. Approach to a holistic management of Cultural Heritage

This change of focus on Cultural Heritage value, from assuming it is a burden to considering it as an important asset for society, must be accompanied by educational actions and successful practices. It is not enough to have a coherent discourse repeated until accepted. It needs to be supported by empirical evidence and practical demonstration of its impact on the economic, cultural and social improvement of the environment where located. This can only be achieved through efficient management.

The concept of management is embedded in our daily activities and it is being applied in many different spheres of life. However, it is just starting to be used in the heritage sector. Within this field, good management is understood as the ability to link processes and operations to administer the inherited resources from past generations. A good manager does not only keep the received assets but is capable of increasing their impact. Therefore, cultural heritage management has to both work on the asset conservation, as a guarantee of its transmission to future generations, and to ensure its potential use. The use of heritage, either as a tourist resource or in any other possible form, is the proper way to guarantee the utility of the received goods and thus assure their conservation.

Cost Action TD1406 goes a step further, introducing the concept of intelligent management. This concept is equivalent to the term Smart that has been used in literature and varied sectors in recent years. Smart City may be the most relevant case where this concept is here to stay.

As it was aforementioned, some of the organizations participating in this Action had coined the Smart Heritage Building concept in 2012 within the SH buildings project [1]. The aim of this project was to attract the existing technology to support managers and users of Heritage Buildings. Later, almost in parallel to COST Action TD1406, the Smart Heritage City project was launched, with its consortium also participating in this Action. The SHCity project tries to show that Smart Cities pilot projects forgot that most European towns have a historic city as their core and origins. And a historic city has specific problems that need customized solutions.

Within the line started in 2012, it was assumed that technology supports and guarantees the intelligent management of historic buildings and heritage cities to deal with the present and future challenges related to conservation, efficient use and positive impact on society. This can be achieved through monitoring, data collection and management, information analysis, use of artificial intelligence, digitization, ICT, etc.

This project is focused on one specific field: the smart (intelligent) management of heritage buildings. Although the patterns followed in this case are very similar to those applied in Smart Buildings, we must take into account that the requirements and restrictions of CH Buildings and conventional buildings are different. For the first ones, their historic, artistic and cultural background needs to be preserved, in many cases, combined with the new functionality that they receive after their restoration. Traditionally, the management of Heritage Buildings has simply consisted of keeping the building in use. Nowadays an intelligent management of these buildings also implies their monitoring by means of sensors that measure the ambient conditions (humidity, temperature, air currents, lighting) as well as parameters related to structure, use, security and consumption (although the legal requirements in the field of energy efficiency are different for historic buildings). The idea is to control and modify these values, if necessary. It is also necessary to control all processes supported on the CH Building. All the data provided by the monitoring system can be used by specialists, owners and managers in the process of making decisions for preservation purposes.

In Figure 5.1 the flowchart related to the HB's parameters and decision system is represented. The main process consists of managing data acquired, on the one hand, from specialized monitoring networks located inside the building and from different public networks; on the other hand,

data are obtained from all the parts involved with the HB: experts, end users, managers and, finally, owners, who are the main stakeholders. The outputs of this flow are different tools which in turn produce data in a constant feedback process. This is how managers take advantages of a preventive preservation tool with which plan the HB's conservation processes. This tool is complemented with a Decision support system that can be used to balance incomes and outcomes, facilitate the prediction of different scenarios and anticipate the solutions. Another tool is intended to be developed so the visitors can enjoy the most their experience with the building.

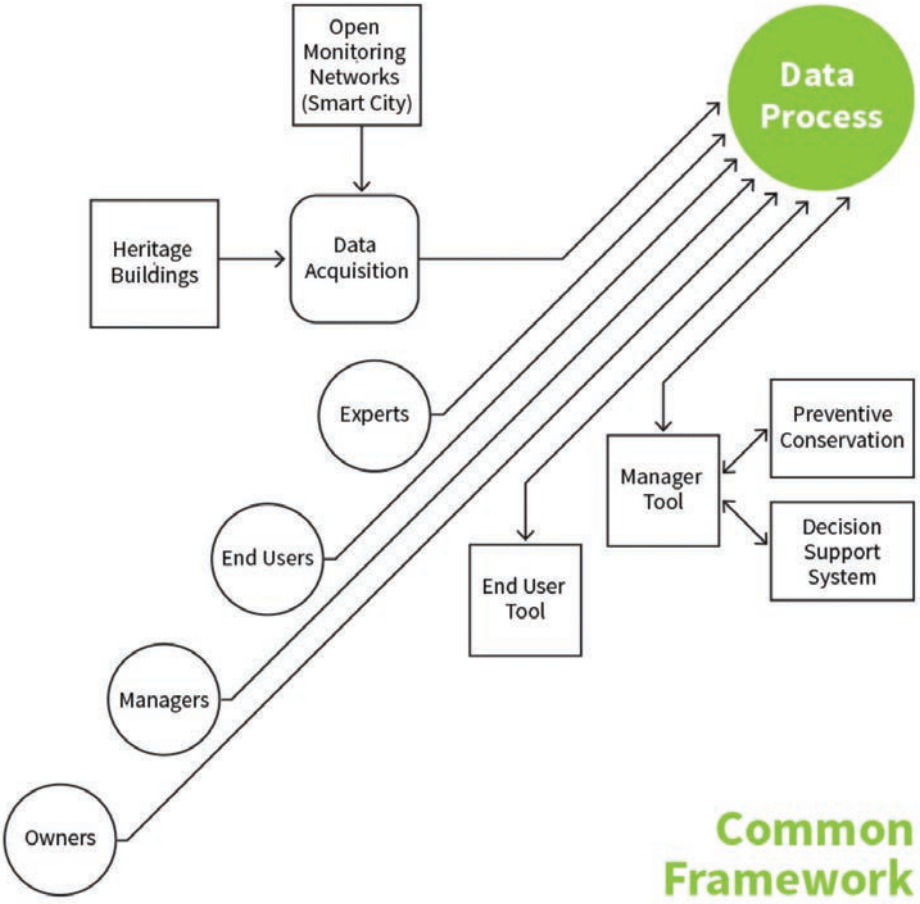

Figure 5.1. Data acquisition and decision making processes for Smart Management of Heritage Buildings

5.2.1. Related works

There are already projects following this line of Action, but all of them are focused on some aspects of the intelligent HB´s management or in developing some useful techniques. Here some of them are mentioned:

- EUCHIC: Its objective was to set-up a "Cultural Heritage Identity Card" through which developing and testing guidelines for the efficient compilation of data concerning sustainable maintenance, preventive conservation and rehabilitation of historic sites and monuments [2].
- SASMAP: It is a holistic approach to locate, assess, monitor and safeguard underwater cultural heritage [3].
- SMARTCULTURE: Its aim is to provide a sustainable access to cultural heritage while reaching a wider audience using digital technologies [4].
- 3ENCULT: This project is about energy and comfort in heritage buildings [5].

- EFFESUS: It develops technologies and systems for the improvement of the energy efficiency of European historic urban districts [6].
- SHBuildings: It consisted of creating a system of integrated management of historic buildings based on technological advances such as the use of sensors, preventive conservation, cloud computing and energy efficiency [1].
- HeritageCARE: This project tries to improve heritage management methods through developing protocols for preventive conservation in three different levels of effort [7].
- SYDDARTA: It develops a prototype for diagnosing the deterioration on movable assets by the acquisition of 3D-hyperspectral imaging through non-destructive scanning techniques [8].
- PROMET: It consisted of the development of new analytical techniques and materials for monitoring and protecting metal artefacts and monuments from the Mediterranean region [9].
- SHCity: Its purpose is developing a unique open source tool to manage historical urban centres and to facilitate work for the relevant authorities [10].
- INCEPTION: The main aim of this project is to innovate in 3D modelling of cultural heritage through an inclusive approach for time-dynamic 3D reconstruction [11].
- RENERPATH: It looks for establishing a European pre-standard for the energy rehabilitation of heritage buildings both for public and private use by using technologies developed in such a purpose [12].

From all of these projects, it can be concluded that some efforts are being made to adapt or to develop certain technologies for their application to heritage specifically. Nevertheless, it is observed that many of them only seek to solve a specific problem or an isolated need. It is necessary that there be positive evidence in the cost-benefit ratio so that their application and use by experts is generalized.

5.3. Holistic Cultural Heritage management framework

One of the tasks assigned to Work Group 1 within Cost Action TD1406 was the establishment of a framework for the intelligent management of heritage. But, as said above, that heritage management is smart is not a matter of technology only. It must be considered as a support factor and as a tool to be applied only when its usefulness is demonstrated.

Hence we start to use the concept *holistic*. Holistic heritage management involves numerous knowledge areas with active stakeholders' participation.

The management begins with the selection of the heritage assets that must be safeguarded. Although citizens have a broad concept of what heritage is, only a part of these assets can actually have legal protection. In addition, this management is necessary to select investment projects and essential during the full life of the historic building, which includes all the necessary operations for its conservation and enjoyment. That is so because holistic management takes into account all the aspects that affect the heritage assets.

In the following table, a first approximation of what we consider a comprehensive management framework for Heritage Buildings is included. If we combine the essential management phases with a set of actions to be carried out on immovable assets, we obtain a matrix with several processes that must be orderly applied. The obtained result will be good practices for the holistic heritage management.

Table 5.1. Heritage buildings management phases

	Heritage Buildings Management Phases					
Heritage Buildings actions	Identification	Ratification	Protection	Education	Exploitation	
Valuing	• Identify values • Study and documentation • Characterization	• Coherence of values with legal framework	• Preservation of values	• Transfer of values • Transformation of values	• Respect of values	Heritage Buildings Management Processes
Curation	• Delimitation • Protection		• Conservation		• Preventive conservation • Maintenance	
Connection	• Analysis of context • Association with movable and immaterial heritage • Interrelation with landscape	• Creation of heritage systems • Environmental assessment	• Promotion of integrated protection strategies	• Inclusion on the curricular design	• Design of holistic plans of exploitation	
Participation	• Analysis of perception • Stakeholders and civil society involvement	• Democratization of heritage nomination	• Involvement of citizens and stakeholders	• Engagement of students • Integration	• Transfer of benefits to citizens	
Appropriation	• Creation of discourse		• Communication plans	• Attraction of new audiences		
Use of technology	• Use of open repositories		• Digitalization • Preventive conservation	• Promotion of R&D applied to HB	• ICT dissemination • Reutilization of digital assets	
Regeneration	• Analysis of regeneration strategies	• Prioritization of heritage buildings adaptive reuse	• Participative plans • Adaptive reuse plans	• Promotion of entrepreneurship		
Finance	• Social return of investment analysis	• Public procurement	• Investment planning • Participative budgets		• Heritage Business models • Participative funding	
Quality	• Q Analysis of Characterization		• Q Analysis of protection plans	• Capacity building	• Q Analysis of exploitation plans	
Impact	• Planning of impacts / Impact assessment	• Prioritization of high impact projects			• Analysis of impacts	

5.4. Best practices on Heritage Buildings management

When facing such an evident paradigm shift in heritage management, it is necessary to start from some references. However, there are no standardized criteria for defining which practices in heritage management are good, and which are not. Subjectivity in these cases plays an important role and makes the formulation of guidelines a very difficult task. In this way, it is essential to set up some common patterns that allow defining in the most impartial way possible whether a practice is good or not. But, as stated before, the process of establishing these indicators is quite complex and, although some attempts have been made up to now, neither of them have been imposed on the others yet.

After a first attempt performed at the European Convention on the Protection of the Archaeological Heritage, some principles that promote new practices in heritage management were collected in the ICOMOS Paris Declaration of 2011 and in the Guidelines for the European Cultural Heritage Strategy for the 21st century (Namur Declaration, Council of Europe) [13]. Some years later, the Committee Ministers adopted the Recommendation CM/Rec (2017) on the "European Cultural Heritage Strategy for the 21st century", in order to enable every member state to face the new challenges [14].

While preparing documents for proposing COST Action "Innovation in Intelligent Management of Heritage Buildings", a quest of the current databases was undertaken. However, it was a really difficult task due to the shortage of that kind of documents available on the Internet. The results of research are presented below, but they are not focused only on the theme of intelligent management since the range of the search had to be widened. Thus, the topics treated go from cultural management to sustainable development through innovation. Some examples are given below:

- Best practices in World Heritage Management UNESCO (2011-2012) [15];
- Good practices database inside the Habitat programme promoted by United Nations [16];
- Database of good practices carried on in Ibero-America [17];
- Good practices database, belonging to the INTERREG INNOVATION AND ENVIRONMENT programme [18];
- Good practices catalogue about social sustainability in historic districts (UNESCO, 2008) [19];

- Good practices catalogue about culture and social sustainable development (Culture 21) [20];
- Indicators and good practices on the management of cultural sites [21];
- Lists of immaterial cultural heritage and registration of the best safeguard practices [22].

Since then, some projects have been updated whereas some other initiatives have emerged focused on the definition of best practices when facing Cultural Heritage. For instance, UN-Habitat, the United Nations programme that works towards a better urban future, has been constantly renewed. Concerning the branch of Best Practices, UN-Habitat's Unit coordinates, identifies, documents and disseminates best practices and enabling policies on urban development [23]. In the same way, both the Good practices catalogue about culture and social sustainable development (Culture 21) and the Best Practices related to Underwater Cultural Heritage continue the work that started at the beginning of the century [20] [24].

EU has been also fostering this kind of initiatives in the last years, and thus, some projects appeared: URBACT, which intends driving changes for better cities, has a line to collect and validated good practices, previously defined, and is now in its third programme. Although it is not focused only on the Cultural Heritage, it has to take into account historical city centres and heritage buildings [25]. Lastly, inside CultRIng "Cultural Routes as Investment for Growth and Jobs", a good practice database has been implemented [26]. Another current INTERREG project, CRinMA, pursues the protection of the cultural heritage in the mountain areas as a way to save and preserve local traditions and customs for the next generations. It has also put into practice a database of good practices in environment and resource efficiency [27].

As it can be seen above, the number of databases with examples accessible on the Internet is constantly increasing but they were few when we planned this Action. On the contrary, there were several forms, manuals and papers as indicators that allow to measure or identify good practices on cultural management:

- The book "Manual of Heritage Management", published a long time ago, is a good starting point [28]; papers like "Towards an Internet Database for Better Management of [World]Heritage Sites" [29] or the statements of intent made by UNESCO [30].
- The good practices Decalogue on traditional architecture conservation on the CAMP area (East of Almería) [31];
- A questionnaire to elaborate a database of good practices on cultural and development projects (Spanish Agency for International Cooperation) [32];
- INCEPTION questionnaire and web page (Inclusive Cultural Heritage in Europe through 3D semantic modelling) [33];
- A good practices guide on cultural heritage management [34].

Nevertheless, it was not a trend too extended in the field of the cultural heritage. In these last years, some new books, papers, Decalogue and documents have been published all around the world, as a result of the projects aforementioned or as independent research. They are general manuals of best practices [35] or works focused on any particular matter, mainly inspired by cities development: "Management documentation. Indicators & good practice at cultural heritage places" [36], "Good practices in cultural heritage management and the use of subsurface knowledge in urban areas" [37], or "Measuring links between cultural heritage management and sustainable urban development: An overview of global monitoring tools" [38], among the latest.

Therefore, even though it is true that there are several previous works available, it is also a fact that the information is really scarce, partial and much unconnected for such an important matter as Cultural Heritage and that a lot of effort should be made to obtain useful information. As it has been said above, creating a common framework of reference that anyone can turn to is the main aim of COST Action TD1406.

5.5. Database on heritage management practices

As seen, there are some previous works to identify good practices, but they are incomplete or focused on some specific aspects of the Heritage Buildings management. However, it is necessary to have references on practices that serve as a model for managers in the future when creating a common framework for the management of Heritage Buildings. Firstly, a strategy for the reception of practices, without distinguishing between good or bad, of patrimonial management based on concrete cases had to be defined. Secondly, it was decided to create and test an online questionnaire to feed a database of practices with the following premises:

- The questionnaire will be completed by experts;
- The information will be uploaded online;
- A self-evaluation process will be carried out.

Given the difficulty to evaluate the practices presented, it was decided to create a self-evaluation model. This implies a high degree of subjectivity in the answers, but we consider it is inevitable in this first approximation. However, the personal appreciation of the management made by the informants is always useful, even for a database with multiple entries. An example of a part of the online questionnaire is shown in the Figure 5.2.

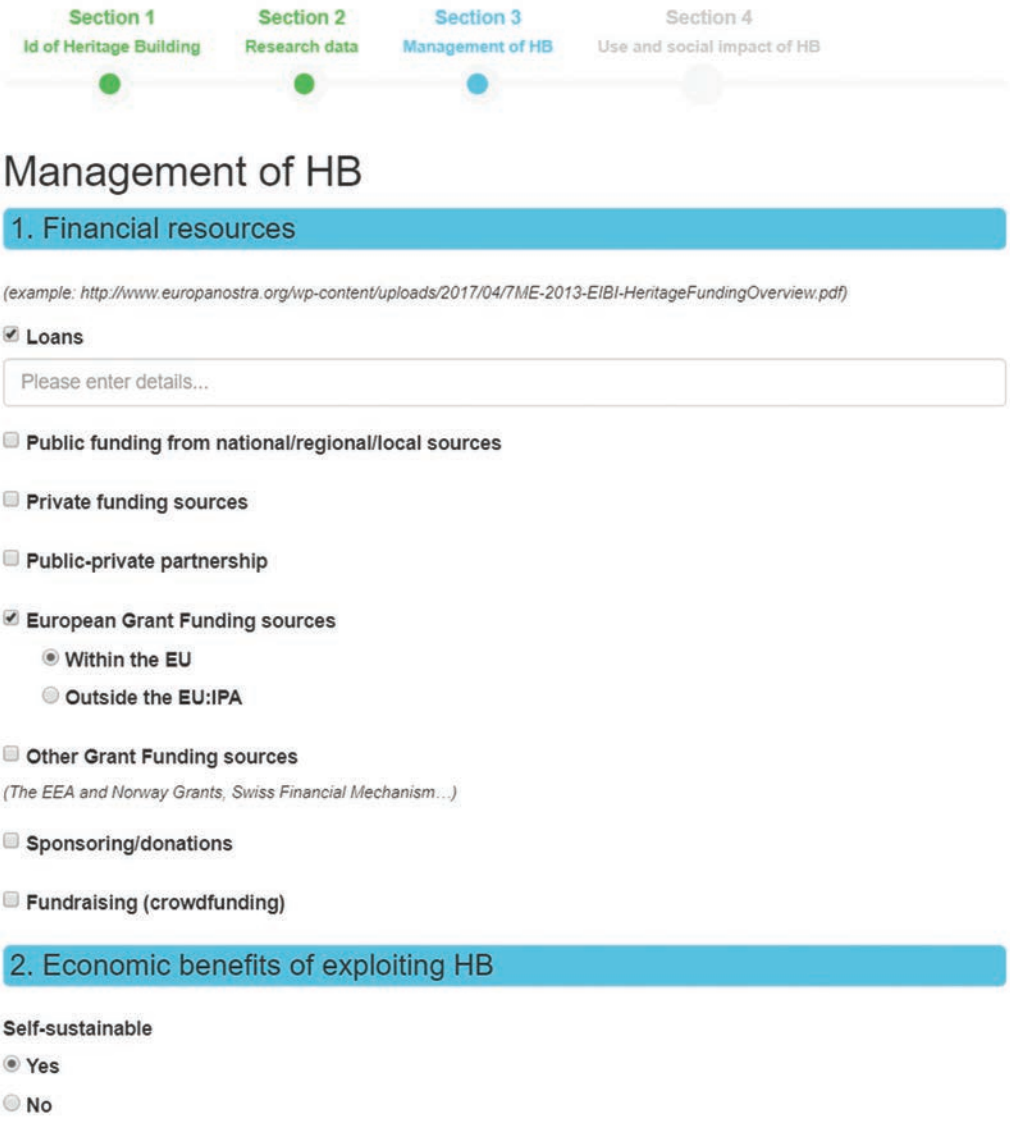

Figure 5.2. Part of the online questionnaire.

The questionnaire is divided in four sections. Collected data is grouped in four separate categories (as shown in the database scheme related to the best practices presented in Figure 5.3):

- ID of Heritage Building: the first part is focused on the main identifying features of the HB, like the type of building, its condition and location, the level of protection and similar information that helps to identify the HB uniquely.
- Research Data: the second part concerns the scientific knowledge related to the HB. This includes various research data (for example, structural analysis, archaeological excavation, spatial context analysis and the like), a detailed description of the HB and the gather of documentation regarding any conservation or restoration actions. Users can select what data is available for the specific HB and also upload the link to the document.
- Management of Heritage Building: the third part refers to the management of the HB. Data saved in this part describe different available financial resources for the HB, its potential economic benefits, its presentation and its promotion. Data is entered as a series of Yes/No choices and a value range from 1 to 5.
- Use and Social Impact: the last part of the database contains the information regarding the use and social impact of the HB, including data about various indoor and outdoor facilities and user experience during the visit (for example, opening hours, level of comfort, immediate surroundings and the like).

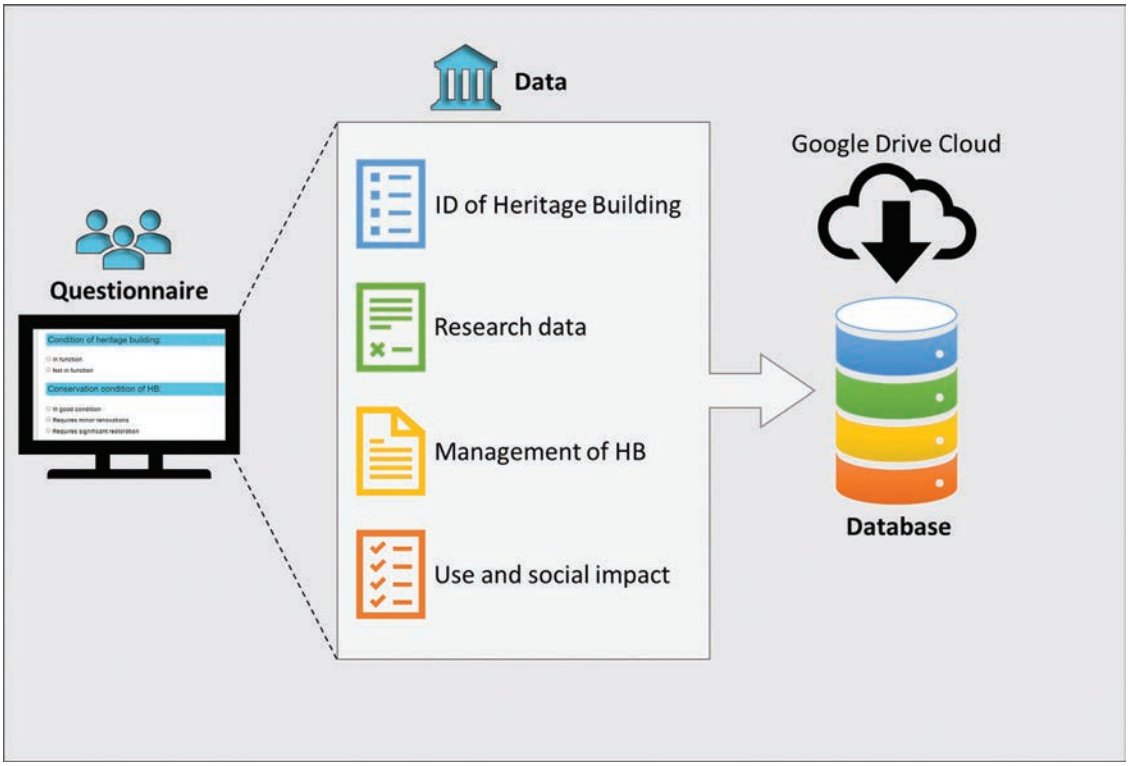

Figure 5.3. Good practices database schema

5.6. Heritage Building use cases analysis

The initial testing of the database and questionnaire was carried out on nine cases involved in the testing activity. Experts connected with the case studies were given a link to the questionnaire along with informative short instruction on how to fill it.

After the experts filled the questionnaire, the gathered data was analysed and assigned each case with a score in an attempt to quantify the good practices carried out in these cases. As previously mentioned, collected data can be divided in four distinct groups (see Figure 4). The first part of the

data is related to the general information about the heritage building, and it does not affect the final score in any way. The other three parts match the database schema; each part of the questionnaire corresponds to one of the three score columns (research, management, social). The final score represents the sum of all three parts.

Questions in the questionnaire corresponding to these three "Yes" answer was counted as 5 and "No" as parts were mostly presented with a Likert Scale with field values between 1 and 5 (where 1 means the lowest score while 5 is the highest), in addition to some questions presented as Yes/No choices. There are 24 scoring questions in each category, making the total of 72 questions, which at the same time also represents the minimal score, with the maximum score being 360. Using these criteria and assigning calculated score, it is possible to conduct some kind of simplified "evaluation" of the nine use cases. The calculated scores are shown in Table 5.2.

Table 5.2. Use Cases Scoring

SITE	NAME	RESEARCH	MANAGEMENT	SOCIAL	SUM
Use Case 1	Château de Germolles	105	79	73	**257**
Use Case 2	Pozzuoli temple-cathedral	99	64	80	**243**
Use Case 3	Tvrđa Osijek	83	70	71	**224**
Use Case 4	Baronesses Hause	74	62	87	**223**
Use Case 5	Monastery of Santa María la Real	74	66	95	**235**
Use Case 6	Lamot	61	67	104	**232**
Use Case 7	Belgrade fortress	75	70	91	**236**
Use Case 8	Rota do Românico	106	97	108	**311**
Use Case 9	Malta Waterfront	87	68	92	**247**
	MAX:	**120**	**120**	**120**	**360**

As previously mentioned, the collected data could be considered as subjective, but it still could be used as a reference point. Separating acquired data in three distinct categories provides better insight, to owners as well as stakeholders, into potential aspects/areas related to the management of Heritage Buildings which could be improved.

Furthermore, most of the Likert Scale and Yes/No questions in the questionnaire are paired with the comment field, so the database also encompasses several noted observations regarding some specific cases of heritage management. This allows not only comparison of the scores, but also the possibly to gain new information and/or insights on potential improvements. Given the relatively small sample of database entries (i.e. questionnaire responses), it was not possible to conduct any detailed statistical analysis of the results; however, the validity of the data should not be questionable because the entries were not randomly selected.

It should be emphasized that the main goal of the online questionnaire is not to compare the individual cases (i.e. collected best practices) between themselves and rank them according to some criteria. On the other hand, the main purpose of the questionnaire is to highlight the positives of

each case, namely to detect and identify specific examples of good Heritage Building management. That is one of the reasons for dividing the score in three separate categories. Each case is only compared to itself, to better identify the positive aspects of that particular HB. For example, one of the cases has a considerably higher score in the third category (social) than the first one (research), compared to itself; this implies that in that particular case it can be expected to find good management practises in the answers regarding the social aspect of the HB management. It could also be used as an indicator of which areas of the HB management could be improved and could present a kind of repository of examples of good practices which would enable efficient search for specifics offered regarding the particular category.

One of the possible future improvements would be implementing an automatic system which, upon entering the data about heritage building, could provide the user with the list of entries with higher scores in a specific category. Those entries could also be filtered to match different criteria so the user can, for example, compare only Heritage Buildings of the same type or placed in the same country.

Given the subjective nature of the answers, these scores should not be used as a definite score of quality of Heritage Building management. They should be regarded as a self-assessment value that helps users identify certain aspects that could be improved, and the database should help in providing some good examples in those same aspects.

5.7. Conclusions

Throughout these pages, it has been seen how the concept of Cultural Heritage has evolved over time and how the new definitions have imposed, in turn, new ways of dealing with their management. The current tendency is to carry out intelligent management of the heritage, that is able to incorporate from a holistic point of view the tools that technology offers. This paradigm shift requires previous references on which to lay the foundations to be followed. Given the partiality of the studies that confront the task of defining a Decalogue of good practices in the intelligent management of buildings, it is necessary to involve the work of a group like ours, that aims to create a framework of actions to facilitate the work of the managers from the future.

Based on what has been said, the following conclusions can be outlined:

- Heritage is expected to offer more than aesthetic, cultural or enjoyment benefits. Today it is requested to be an element of economic revitalization, of regeneration of rural and urban spaces, an integration tool, etc. The definition of the services provided by Cultural Heritage is essential if we wish to claim that it has a prominent position in our society. Likewise, this is useful for coordinating protection and conservation efforts and ensuring that adequate resources are allocated.
- The heritage management must adapt to the changes that are taking place in its definition and in the available technology, as well as in the perception that society has of it.
- The real estate should not be an isolated item. It is related to other patrimonial and natural elements, as well as to a concrete and changing society. The value and usefulness of the patrimonial good vary with the course of generations.
- An emergent figure appears in this context, the heritage manager, who is the hub of interconnection among the various disciplines involved in the custody, conservation and management of the patrimonial asset. For this reason, the creation of professional training itineraries with European projection is essential.
- The heritage managers and the rest of agents that take part in the life cycle of the patrimonial element have at their disposal more and more available technological tools, that must be always used as a means and not as an end. Delimiting a positive cost-benefit relationship is essential for the application and development of the most beneficial technology in every case.

- It is necessary to face the definition of all the processes that make up the heritage management to establish the common framework sought in COST Action TD1406.
- Having a frame of reference on good practices in the field of intelligent management of the immovable Cultural Heritage is essential to guide future managers. Any further recommendations about best practices should always be built on the conclusions drawn from the database. It will be equally important to incorporate the body of knowledge developed from the contributions that various project directors related to heritage throughout the world make voluntarily.

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6. Knowledge based IT platform for Heritage Buildings

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DOI 10.1484/M.DEM-EB.5.118097

Due to the huge and complex pool of data about heritage buildings, the sustainable management of heritage buildings calls for an appropriate support system. Data collected must be analysed and then an appropriate approach for conceptualization, structure and organization must be applied along with the use of an IT platform for their intelligent management.
The innovative IT platform for heritage buildings based on knowledge-based system can support a heritage buildings expert to aggregate data into meaningful information that supports any of the heritage buildings lifecycle activities: first expertise analysis, documentation, preventive conservation, restoration, social and economic aspects of heritage buildings, use and management. For example, a heritage buildings expert specialized in biodeterioration wants to evaluate the state of conservation of a heritage building and therefore asks the platform about abiotic and biotic factors, which determine physical and chemical deterioration of stone materials. The expert may also ask the platform how biotic factors affect durability of stone. Answers to these questions are expected to properly address preventive conservation and restoration strategies. Similarly, stakeholders preparing investments into heritage buildings have to consider different approaches and scenarios and the platform can provide important answers or directions.

Keywords: *Heritage Building; Interoperability; Heritage Buildings Core Ontology; Knowledge based management system; Intelligent Management.*

6.1. Introduction

Typical heritage buildings' (HB) processes like reconstruction, restoration and use change, create huge amounts of data coming from different stakeholders. The intelligent management of HBs requires semantic consolidation of data. Literature (Akoka, Comyn-Wattiau, & Laoufi, 2017) shows that semantic data are best managed with a Knowledge Based System (KBS). Such KBS integrates heterogeneous information sources and domain ontologies to organize information and direct the search processes. Existing knowledge about HBs must be captured to serve the expert's demands. The knowledge capturing process is part of knowledge engineering research where the task of identifying categories, subcategories and their relations is often referred to as constructing an ontology. As defined in literature (Akoka, Comyn-Wattiau, & Laoufi, 2017), ontology represents knowledge as a set of concepts within a domain, and the relationships between those concepts that enable meaningful search without in-depth knowledge about a specific domain area. Although some ontologies coming from construction domain (e.g. construction defect ontology, e-COGNOS project, etc.) and

some that consider parts of HB exist (Boochs & Trémeau, 2014) (e.g. European project ARIADNE with its CIDOC CRM Reference Model (Doerr, 2003), region-related cultural heritage ontology, building-shape ontology, etc.), there is a lack of comprehensively constructed ontologies for HB. As a solution a comprehensive ontology-based data HB-IT Platform (Tibaut, Kaučič, Dvornik Perhavec, Tiano, & Martins, Ontologizing the heritage building domain. V: IOANNIDES, Marinos (ur.). Advances in digital cultural heritage : International Workshop, Funchal, Madeira, Portugal, June 28, 2017 : revised selected papers, 2018), (Tibaut, Kaučič, & Dvornik Perhavec, Ontology-based data collection for heritage buildings. V: IOANNIDES, Marinos (ur.). Digital cultural heritage : Final Conference of the Marie Skłodowska-Curie Initial Training Network for Digital Cultural Heritage, 2017) suitable for trans-disciplinary domain experts and stakeholders is proposed based on real-world HB requirements. The platform could enable proactive reduction of time for searching solutions, reduction of risks involved, reduction of unexpected surprises related to impact of costs, time, materials and human resources.

6.2. Interoperability for Heritage Buildings

Innovation in the intelligent management of HBs should demonstrate intelligent, dynamic and self-organizing capabilities for understanding and responding to the shifts that impact the networks they belong to. To have seamless access to the available global (across borders) multi-lingual distributed data is fundamental to achieve this goal. Reconfiguration and reprioritization of HBs management processes, information models, and even terminology is now seen as a requirement for survivability, which means that HB related software systems need to become more interoperable and supported by open data. Hence, software adaptor technologies are gaining momentum due to the potential to define and regulate the peer-to-peer data access among networks of heterogeneous enterprise systems. At present, solutions based on de facto standard for transformations within the framework of Model-Driven Interoperability (MDI) have been put in practice in several application domains, including some for HBs [6]. Nonetheless, even those still lack the dynamism required to streamline complex systems in multi-lingual and large amount of data.

Although seamless data exchange and understanding is a key factor for innovation in the management of the HBs sector, it is almost impossible for the HBs stakeholders to capture the relationships among all those factors and turn data into valuable, actionable information. This cannot be done by using on-hand database management tools or traditional data processing applications. The use of data mining technologies will enable the HBs stakeholders to get actionable insights in the data resulting in smarter decisions and better business outcomes. They will be able to look at past performance and understand that performance by mining the related data (i.e., production, environment) to look for the reasons behind past success or failure and take better decisions for future. In order to improve the ability of the HB European stakeholders to develop innovation across their operating chain, there is the need to make available fully interoperable multi-lingual HB data products and services. To achieve this, it is necessary to have a framework for the interoperability between the heterogeneous source of information (data, knowledge, models, languages), supported by a reference ontology management system for big data mining and analysis [7]. In the core of this framework, there are the methods for semantic interoperability in assorted contexts of usability, comprising ontology harmonization of blended application context. This will result in the mining of large volumes of heterogeneous data (including multi-linguistics) into semantically interoperable data assets, and knowledge libraries for holistic management of the big data HB environment in terms of in/outs, along their life cycle, i.e., adaptation, feedback, monitoring, update, prune, merge, etc. For the sector, this is ground breaking and novel.

Interconnection with standards for data models and knowledge representation is necessary to fully achieve this objective. Model, data and knowledge morphisms and respective transformations are required for the adaptation and then global knowledge usage depending on language and user

profile (very important in this project context, considering the large number of different potential users and applications profiles that will use the data.

In the specific case of the HB sector, interoperability and (seamless) integration of data is very important considering that most of the sources/consumers of such big data are dispersed and not adopting standardized modelling. This would represent a set of heterogeneous source/consumers of heterogeneous data, as most of them will have their own data model representations. They need a suitable framework to assist them to access the data in the same way, independently of the data model, semantic and language (as many sources of data is stored in native language). Nevertheless, most of the applications store the data in local native language, even under a specific reference model. To be interoperable and manageable in a seamless way on a global scale (e.g. big data in the "HBs Cloud"), such harmonization and are required for a common understanding of such data in an independent but holistic form [8].

This framework will provide the data-mining platform as a cloud service that will be accessible by all the HB community, with its architecture for innovation in the intelligent management of HBs depicted in Figure 6.1. Nevertheless, by collecting and managing the data mining results from many HB stakeholders with full respect to confidential data; it will generate a knowledge base that will be of maximum usefulness for the HB sector. The stakeholders' applications will be able to transform data to knowledge and use this knowledge to improve efficiency, increase profitability and do business in a sustainable, environmentally friendly way. To support this, a tool will be specifically designed for the HB sector.

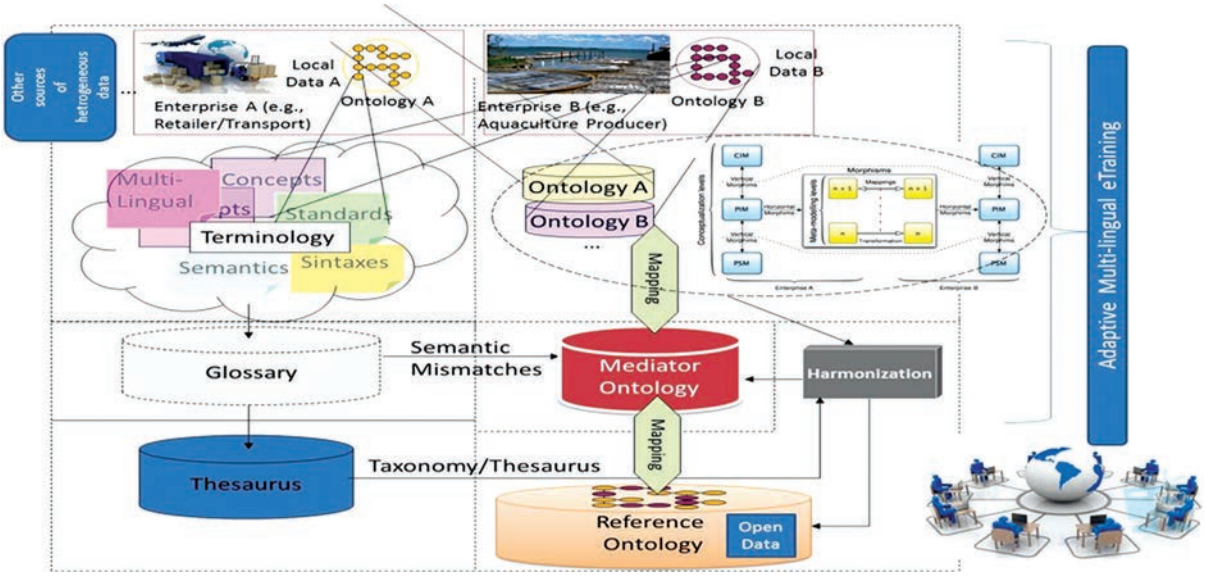


Figure 6.1. Interoperability Architecture for innovation in the intelligent management of HBs

Although software tools exist in the market no such tool is available for the HB sector. The proposed HB framework delivers a cloud-based HB framework (i.e. product, service, training,) supported by an intelligent business model for the analytics of HB data to enable much benefit to be derived in the HB sector. The introduction of an innovative multilingual knowledge base capacity suitable for the HB sector, which would enable large volumes of data to be accessible as semantic interoperable data and knowledge will improve significantly the sector and ultimately the EU's competitiveness.

Anonymous data from the stakeholders can be seamlessly imported onto the framework that will incorporate an integrated cloud based data mining services to provide unique data mining insight. This enables the improvement of the knowledge of the system and makes it universal, i.e., the more companies using the framework, the more intelligent the framework becomes.

6.2.1. Requirements

Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged. This includes two separate ideas:

1. The exchange of information, which is technical interoperability,
2. The ability of the recipient to use that information, which is semantic interoperability [9].

The attempt to solve this problem was in the past the "Rosetta's stone" in which the meaning of the message is precisely the same in each language, but the notation is quite different.

More recently Zamenhof (1887) created the "Esperanto", an easy-to-learn, politically neutral language that would transcend nationality and foster peace and international understanding among people of different languages.

Applications interoperability is not only a technical problem but it deals also with organisational issues. These aspects of interoperability are coherent with the definitions proposed by the European Interoperability Framework [10], which considers three aspects of interoperability:

- *Organisational Interoperability*: This aspect of interoperability is concerned with defining business goals, modelling business processes and bringing about the collaboration of administrations that wish to exchange information and may have different internal structures and processes. Moreover, organisational interoperability aims at addressing the requirements of the user community by making services available, easily identifiable, accessible and user-oriented.
- *Semantic Interoperability*: This aspect of interoperability is concerned with ensuring that the precise meaning of exchanged information is understandable by any other application that was not initially developed for this purpose. Semantic interoperability enables systems to combine received information with other information resources and to process it in a meaningful manner. Semantic interoperability is therefore a prerequisite for the front-end multilingual delivery of services to the user.
- *Technical Interoperability*: This aspect of interoperability covers the technical issues of linking computer systems and services. It includes key aspects such as open interfaces, interconnection services, data integration and middleware, data presentation and exchange, accessibility and security services.

The more we understand about the three types of interoperability, the less likely we are to underestimate the work required to make heritage building management intelligent and interoperable. These types of interoperability are interdependent, and all three are needed to deliver significant business benefits.

A Heritage Building and its location is a complex issue and in its management are involved different stakeholders: International Heritage Organizations; National Heritage Authorities, Institutions and Associations; Local and Regional planning authorities; Superintendence; Standard bodies, Pollution agencies, University & Research, Owners; Private, Public and; Religious; City Manager; Landscape architects; Risk and Security management; Economists; Fundraising company, Conservation scientist; Engineers; Architects of historical monuments; Archaeologists; Art Historians, Urbanists, Conservators, Construction and restoration Companies & consultants; Craftsman, Book sellers; Catering, Social media; Sponsor; Bank's foundation and Private trusts, Users; Visitors; Tourists Guides; Volunteers, Neighbours.

Problems begin because every computer system stores data internally in a different way. This means that to communicate, data has to be translated from one format or internal language into another. The solution involves translating to a standard wire format (a lingua franca) that is understood by each party, but in computer interoperability, each and every message has to be translated from one format to another without error. The choice of interchange language is not sufficient to ensure Technical interoperability.

Each transaction needs to be defined in unambiguous detail as part of a complete, consistent, coherent, and computer- readable set of specifications for that transaction to ensure interoperability between the machines and minimize any possibility of error.

A related problem arises when the domain experts (such as architects, scientist, managers, etc.) are unable to fully understand these specifications due to the complexity of language or simply the time it takes to read them. As a consequence, these specifications may not be reviewed at the specification stage as thoroughly as is required.

Computer processing is essential when data has to be identified, matched, retrieved, or counted. For computer processing, the information needs to be structured, complete, unambiguous, and validated.

One way to simplify the problem is to distinguish between information that needs to be processed by computer and that needs to be read and understood by human users.

What are the semantic differences that should be addressed in constructing data sharing environments and developing cross-standard exchange mechanisms? [11]. Data sharing depends on reconciling different meanings (or semantics) and needs to consider the different standards that are now in circulation.

Interoperability is not only a technological issue, but a confluence of social and economic issues as well. This system should answer to queries based on established common requirements (Figure 6.2, Figure 6.3).

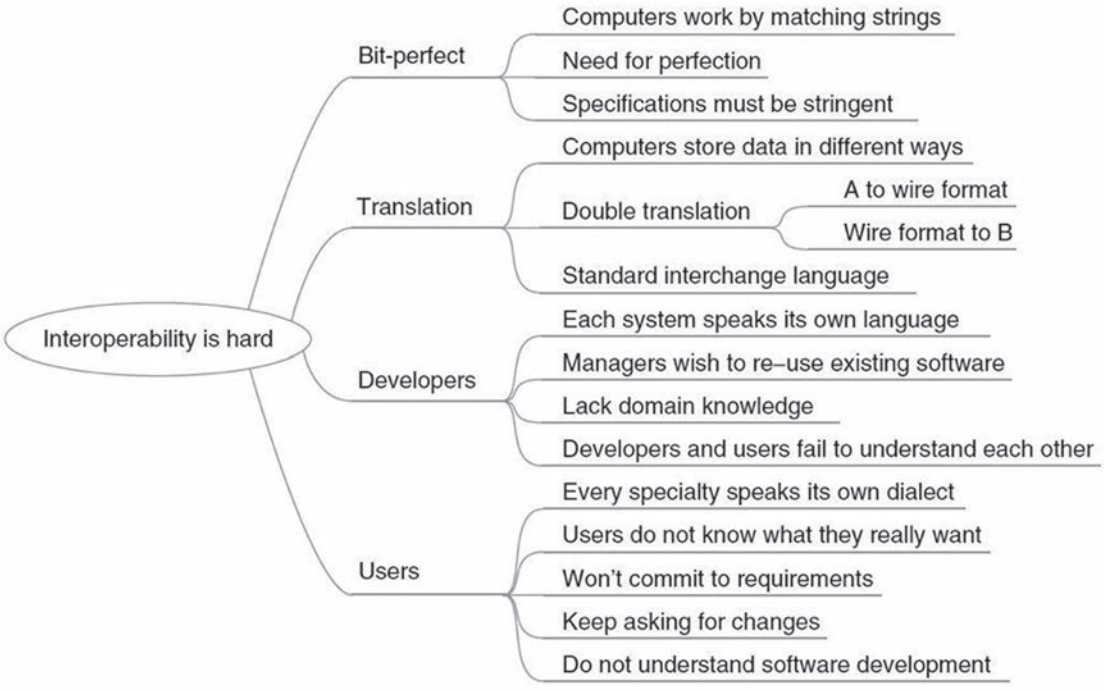
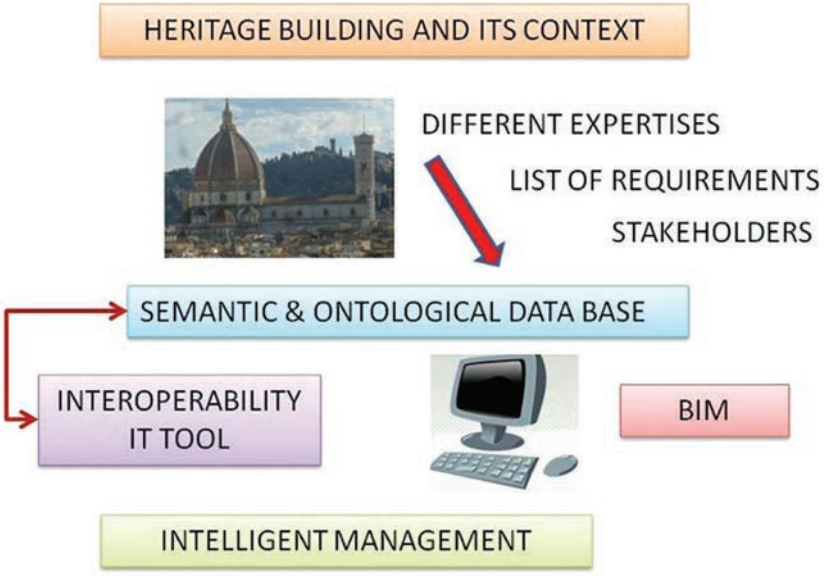
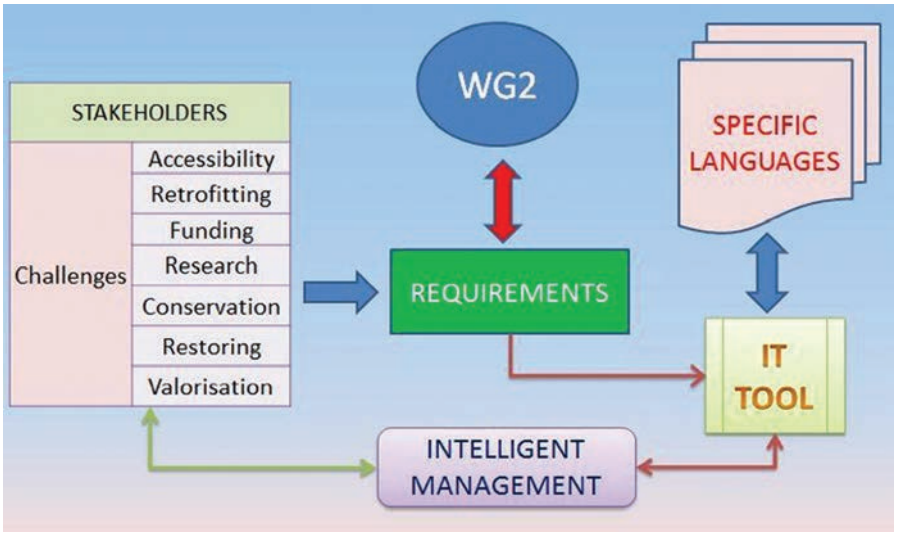


Figure 6.2. Interoperability constraints



(a)



(b)

Figure 6.3. Interoperability workflow

We need to appoint a set of common requirements that everyone agrees on in full consultation with all concerned interests. These do not have to be highly structured, although it needs to be easy to read and accompanied by supporting contextual data specific of what domain is concerned. The complexity of a Built Heritage unit can incorporate several addressable requirements in the field of Conservation, Maintenance and Valorization with all related specific technical languages.

We should consider the wider concept of cultural significance [12]. For this we have to take into consideration how and why cultural significance is assessed and how it can be used as an effective focus and driver for management strategies and processes.

Effective management of the built cultural heritage requires a clear understanding of what makes a place significant and how that significance might be vulnerable and to ensure that what is important about the place is protected and enhanced.

6.2.2. Parameters

The main parameters that influence interoperability in the HBs domain are:

Objectives
- Upgrade to modern needs
- Define the interests of each organisation towards the heritage building concerned
- Define data about the nature and subject derived from research, such as comparison with similar places or features
- Collect archive items (photos, documents, plans), will most frequently contain inherent information and context – for example, within a collection – to allow them to be documented appropriately
- Existence of information standards
- Urban planning

Methods (Enablers T and NT)
- Life Cycle oriented approach which includes preventative management
- Understanding the building before carrying out the upgrading works
- Assessment of existing performance of the building, materials, Monitoring, Testing, Calculations
- Assessment of construction of the building
- Assessment of services.
- Assessment and evaluation of expected risks to renovation; calculations
- Assessment of user's needs
- Assessment of building preservation status
- Planning maintenance management, alterations and intervention strategies, upgrading energy efficiency; Computer Modelling
- Impact Assessment of the chosen strategy
- Inspection Activities
- Diverse organisations to commit for working together and to embed their technical solutions in real-world working practice
- Technical development of tools for interoperability
- Existence of "information ecology". The ecology metaphor emphasises that information systems and data standards can only succeed where they also relate to the needs and experience of all parties involved. As in a biological community, no one organisation can predominate to the exclusion of others without an ensuing catastrophe.
- Existence of "Standards of standards"
- MIDAS XML is a set of World Wide Web Consortium compliant Extensible Markup Language (XML) schemas, based upon the MIDAS data standard
- CIDOC Conceptual Reference Model (ISO 21127)
- The Data Validator Tool (DVT) is an application developed to validate the content of MIDAS XML files; this tool will check the content (i.e., presence or absence) of the elements in MIDAS XML data against defined standards
- Structure of residential quarters, public spaces, the scale of the building and its architectural features (color, windows, doors, balconies, and other details)
- Landscaping and surroundings

Indicators
- Energy Consumption, Environmental impact of the construction and of the Demolition phases
- Evidential value, Historical value Aesthetic value, Communal value, Environmental value; Character and significance; Sensitivity of the buildings

- Energy efficiency, dynamic behaviour, latent heat, permeability, moisture barriers, hydro thermal behaviour, pores and capillarity, decay description
- Type of Construction, special elements, Thermal bridging
- Heating, Ventilation, Electronic control systems, Energy sources
- Fire, Security, Construction risks, Hazardous materials, Technical conflicts between traditional construction and required changes, Material compatibility
- User requirements, Function of the building
- Restoration of original performance, Conservation, Alteration, Maintenance, enhancement, removal of damaged alterations, Upgrading building elements
- Energy, Heating, Ventilation, Adding Insulation, Draught proofing, Repairs, Electronic control systems, Energy sources
- Users and Functions of the building
- Data accuracy and consistency
- Data availability and accessibility
- Degree of portability and scalability
- Sustainability indicators (environmental indicators such as energy consumption, presence of on-site renewable energy)
- Grids and numerical scales and other features identification

Barriers
- Leading professional body doesn't have a strong focus on the building fabric
- FM qualification structure doesn't explicitly refer to historic buildings
- Lack of conservation awareness across other professions involved with FM - e.g. building control, structural engineers
- Lack of property data
- Lack of Formal Guidance from Contractors, Trade literature, Certification Schemes, Building Regulations
- Work to be done: best way to measure the energy performance of older buildings (now are not measured)
- Good practice in retrofitting are not communicated well
- Impact of retrofitting and the resulting environmental changes on older materials and finishes are not assessed
- Information about properties is often not collected in one place
- Computer-based solutions are frequently home-made and based on the IT knowledge of one person
- Poor communication skills - facilities managers may not be good at sharing information.
- Hard to find examples of full open BIM implementation for historic buildings (HBIM)
- Lack of understanding that there is a difference between full open BIM and 3D surveys
- Lack of a common language among different experts
- Lack of standard and optimal electric/electronic products/systems for heritage buildings in some areas (as renewable energy generation, mainly photovoltaic)
- The existence of recommended practices when doing engineering in HBs, with the aim of adding facilities related with comfort, security or lighting for maintenance or adaptation to tourist visits

Errors
- The probability of misunderstanding any part of the requirement depends on difficulty of language and domain and technical knowledge of participants (people with high levels of both technical and domain knowledge are rare)
- The length of requirement. In a long requirement, exactly the same idea may be presented in different ways in two places, but each may be understood differently; if large blocks of infor-

mation are replicated in different sections, with small but important differences, these differences may be missed
- The number of options permitted; optionality greatly increases the chance of error
- The number of times different implementations to be made; each implementation involves mapping or translating the specification into the local implementation language.

Misunderstanding inevitably leads to error. Errors increase costs and reduce quality, create delays, and hit profits and reputation. Successful specifications avoid errors by limiting scope, being easy to understand, relatively short and simple, with few if any options. Many problems could be avoided by adequate thought and preparation by both users and suppliers. If time is running out, it is all too easy to be vague in a specification or offer the implementer a choice of options depending on the local context.

6.3. Conceptualization of the Heritage Building domain

The conceptualization process was realized through the following steps:
- research of the archived plans belonging to HBs
- identification of HBs basic structural elements
- development of an ontology for HBs.

Based on research of archived documentation about HBs the conceptualization process started with the extraction of the most common concepts contained in archived documentation.

Mostly mentioned methodologies for building ontology are Uschold's and Grunninger's Skeletal methodology, Grunninger & Fox's TOVE methodology, METHONTOLOGY [19], Noy & McGuinness's Seven-Step method, and a 5-step recipe by Gavrilova et al.

METHONTOLOGY rests on three flows: management phase, development phase and maintain phase all in 6 steps: 1) specifying the purpose of the ontology, the level of formality and the scope of the ontology; 2) collecting all the knowledge; 3) conceptualization phase, first building a glossary of terms with all possibly useful knowledge for the treated domain, grouping these terms according to concepts and verbs and gather them in tables, formulas and rules; 4) checking if there are any existing ontologies that can and should be used; 5) implementation phase producing ontology defined in a formal language that can be evaluated according to some references; 6) documentation of the ontology developed so far.

In the ontologization process all six steps of the METHONTOLOGY approach were applied.

6.3.1. Heritage Building core ontology

A goal in the development of knowledge model was the design of an OWL (Web Ontology Language) ontology using an open source ontology editor and framework for building intelligent systems Protégé.

While creating the ontology we researched appropriateness of inclusion of existing common terminology and ontologies:
- buildingSMART Data Dictionary, a standardized data dictionary for AEC domain [13] and existing ontologies
- Ontology FOAF Vocabulary Specification, FOAF language [14], defined as a dictionary of named properties and classes using W3C's RDF technology; FOAF is a project for linking people and information using the Web
- Ontology ISA Programme Location Core Vocabulary [15]. The ISA Programme Location Core Vocabulary provides a minimum set of classes and properties for describing any place in terms of its name, address or geometry
- ISA Programme Person Core Vocabulary [16]. The Person Core Vocabulary provides a minimum set of classes and properties for describing a natural person, i.e. the individual as opposed to

any role they may play in society or the relationships they must other people, organisations and property; all of which contribute significantly to the broader concept of identity
- Time Ontology in OWL [17]. The ontology provides a vocabulary for expressing facts about topological relations among instants and intervals, together with information about durations, and about temporal position including date-time information
- The ISO 21127:2014 - reference ontology for the interchange of cultural heritage information (CHO) [18] is currently the furthest developed ontology for the integration of cultural heritage information and is intended to promote a shared understanding of cultural heritage information by providing a common and extensible semantic framework to which any cultural heritage information can be mapped.

The result was a general knowledge model (ontology) that can be applied to historical buildings.

Transformation of information contained in the documentation into ontology started with the creation of initial class hierarchy where classes represent most relevant concepts in the archived documentation. The current set of concepts is shown on the Figure 6.4.

Figure 6.4. HB Core Ontology - concepts

Visualisation of historical buildings ontology shows semantic hierarchy between various concepts in the ontology. The main concepts subgroups are the location, time, geometry, management, FOAF and CHO related concepts.

First, the documents were compared according to their table of contents to align the conceptually similar chapters (i.e. description of the construction object) and their related chapters were aligned first. In the next step, most relevant (and frequent) terms were identified as candidates for common concepts in the planned ontology. These concepts were defined in a class hierarchy and the various classes and concepts were linked via object properties and data points were set for various members using the data property functionality (Figure 6.5.).

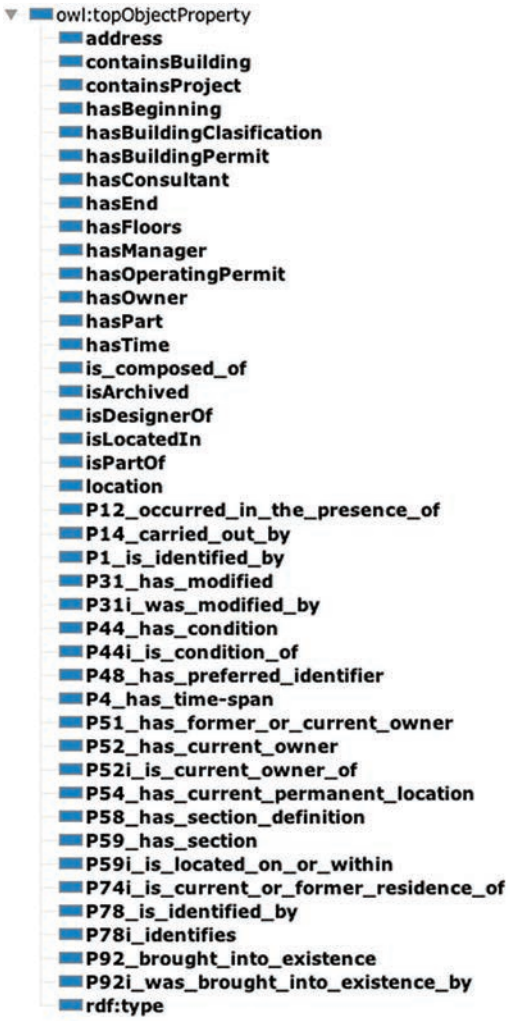


Figure 6.5. HB Core Ontology - object properties

Analysis of the historical buildings ontology in this development stage shows following ontology statistics:

- 87 concepts (classes)
- 43 object properties and
- 18 data properties.

Software tool Protégé was used for development of ontologies. Ontology contains information about location, ownership, thickness of the main load bearing walls, material of main walls, levels of floors and thickness of walls in each floor and the characteristics of buildings material. SPARQL language was used to query the ontology.

Reconstruction project for a heritage building called Baroness´ House (in Maribor, Slovenia) was used for validation of the conceptualization approach.

The following SPARQL query example displays existing knowledge related to the Baroness´ House:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX hbco: <http://kgpi.fgpa.um.si/ke4aeco/hbco#>
SELECT DISTINCT *
WHERE { hbco:Baroness_House ?p ?o.
MINUS { hbco:Baroness_House rdf:type ?o. }
}
```

With the result, we can consistently support the reconstruction project of the historical building. An architect can use the HB-IT Platform to obtain information about buildings, which decreases the number of physical inspections on-site.

Figure 6.6 shows how the HBCO can be populated with data about a heritage building. The use case is made with data derived from the Château de Germolles. Similarly, other data about other heritage buildings can be inserted.

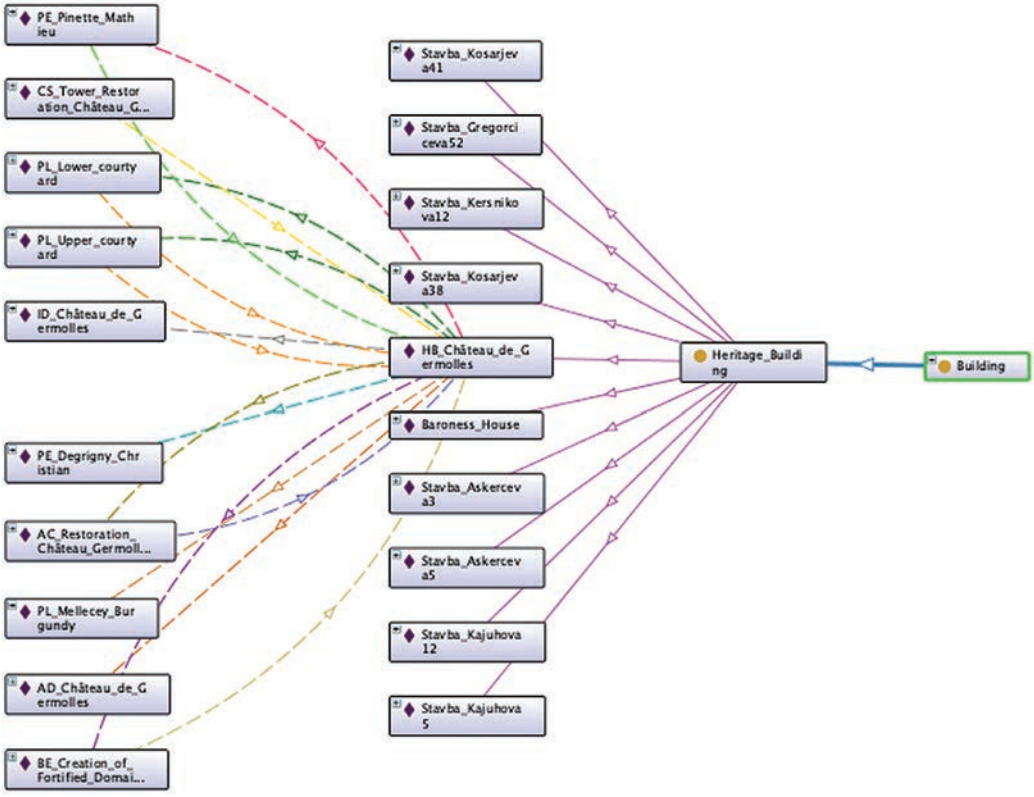


Figure 6.6. Ontology use case for Château de Germolles

6.4. IT Platform for Heritage Buildings

New and innovative semantic applications (i.e. Semantic MediaWiki) can utilize knowledge-bases with the advanced searching and querying mechanisms provided by SPARQL. One such SPARQL example is to query knowledge-base for historical buildings where specific type and dimension of brick was used for walls. Since masonry brick is found on nearly every continental historic building, the query results can be used during a restoration project to learn from another previously completed restoration projects.

In addition to that, semantic applications can also employ reasoning mechanisms to infer logical consequences from asserted facts in knowledge-base. Semantic reasoning is an advancement to what was previously referred to as case-based reasoning approach. For semantic reasoning a knowledge base composed of ontology (or many interlinked ontologies) and semantic rules is needed.

In consequence, proper knowledge engineering in construction projects related to HB results in KBS acting as a consultation system, which supports more effective management of HB projects.

6.4.1. Concepts

Conceptually, the HB-IT Platform consists of two parts, a process "HB data capturing" and an architecture "Knowledge based system" which are interconnected with the ontology (Figure 6.7).

Main objective of iterative "HB data capturing" process is to produce "final" ontology representing HBs and HB related processes and activities. "HB documentation" exist in various formats and levels of digitalization, e.g. paper documents, voice recordings, video materials, images, database records, etc. forming data collections. HBs as main objects of interest are not necessarily entirely treated in sense of documentation and still represent valuable source of new information that can be organized

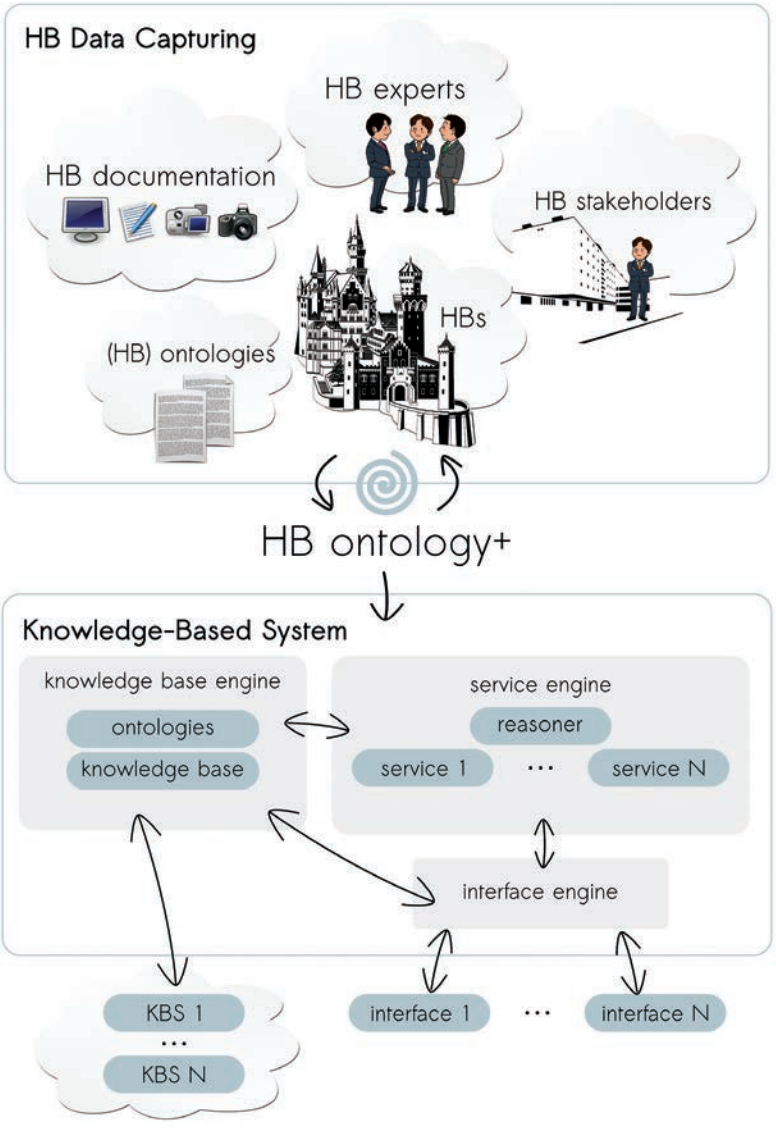


Figure 6.7. Conceptual framework of the Heritage Building IT Platform

and documented. The HB documentation is usually prepared and/or used by various HB experts (e.g. from fields of reconstruction, renovation, conservations, bio-deterioration, etc.) and stakeholders. In general, stakeholders have some influence or relation toward HB and vice-versa (individuals, groups and organizations, e.g. owners of heritage buildings or lands, private funders, finance institutions, legislation institutions, data providers, HB service providers, and other various HB related stakeholders).

In the process of producing "final" ontology, not all the work needs to be done from the scratch. Usually ontology experts search for related ontologies and include them into final result "HB ontology+". Some ontologies can be directly connected to HB, some indirectly (e.g. ontology about building materials, which is useful for all types of buildings and therefore also HBs), and some serve as supporting or core ontologies for representation of core elements (e.g. time, location, person, etc.). In addition, some ontologies are appropriate entirely, some only partly, some need some changes or improvements, or some are inappropriate. All participating ontologies contribute to the "final" ontology.

When a version of "final" ontology is produced in current process iteration, that ontology is usually revised by experts and interested stakeholders. Based on the review feedback a new iteration of the process might start. For example, experts may identify missing chunk of information, some HB related service provider will provide that information (e.g. by analysing HB and preparing documentation) and new information and knowledge will result in new "final" ontology. Several methodologies for preparation of ontologies exist to produce best possible ontologies with minimal iterations. The same process is also used when new requests or demands about some HB process or activity are identified. Continuously improving ontology according to new tacit and explicit knowledge corresponds to well-known knowledge spiral.

Regardless of the process's iteration number, "final" HB ontology is the most appropriate ontology that is then used in architectural part on Figure 6.6. Architectural part provides system intended for use by end-users. It consists of three main parts: knowledge base engine, service engine and interface engine.

Knowledge base engine consists of knowledge base, which is triple store (subject-predicate-object) containing all gathered knowledge objects about HBs according to the schema induced by one or several ontologies from the HB data capturing process. In addition, it consists of core functionality for accessing and manipulating triple-store data.

Different interfaces can exist for different end-users and areas of usage. All requests for retrieval or manipulation of HB information are channelled through interface engine. Interface engine can directly use knowledge base engine for retrieval and manipulation of data or can use service engine for more complex usage. Similar to different interfaces, service engine also can consist of different services for different usage. Core part of service engine is also reasoner for advanced usage of knowledge based HB data (e.g. using rules, fuzzy conditions, etc.).

Lastly, according to the "final" ontology and actual implementation of knowledge base engine, not all existing HB knowledge data may exist in this knowledge base system. Related knowledge data may exist in one or several other KBs, and therefore knowledge base engine is able to communicate and exchange knowledge with these KBs.

6.5. Conclusions

In the chapter requirements and parameters for interoperability for heritage buildings were presented. A solution for intelligent management for HBs named HB-IT Platform was proposed. The platform uses knowledge engineering approach resulting in an innovative Heritage Building Core Ontology (HBCO). As part of the Knowledge Based System (KBS) in the platform, the ontology sustains "why and how" queries in the lifecycle of HBs, i.e. exchange of knowledge on-/off- HB site. The ontology is a prerequisite for automation of semantic reasoning thru semantic links. Results from the chapter have proved that ontology development is an ongoing spiral and iterative, back-and-forth process, which must allow enough time for participation of different stakeholders' views.

Usage of such platforms enables simple, quick and smart access to information about the HB project through user's custom semantic queries.

Use of the platform leads to an intelligent management of HB knowledge and facilitates its sharing and reuse among all personnel involved in HB projects.

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7. Integration of Heritage Buildings and sites within their surroundings

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The challenge to integrate heritage buildings (HBs) and sites within their surroundings is broad and multifaceted. The aim of this chapter is to develop appropriate strategies to optimize the management of HBs/sites through their integration within their surroundings. To achieve this aim, key challenges of preservation, conservation and valorisation of HBs/sites are first presented, followed by proposing optimized strategies to address these challenges. Recommendations are then made to promote a better and more efficient integration of HBs/sites within their surroundings. This chapter ends with the validation of the key issues and recommendations through a number of short-term scientific missions and a public debate within a non-profit organization.

Keywords: *Cultural heritage, heritage buildings (HBs) and sites; optimized integration; optimized strategies; surroundings*

7.1. Introduction

When studying the optimized integration of heritage buildings and sites (HBs/sites) within their surroundings (urban, rural or natural landscape), all the diverse aspects of HBs/sites should be considered. These aspects include, but are not limited to, the following. HBs/sites may be either historical or archaeological, public or private, listed or not, or belong to different periods. They are not necessarily fully authentic; they may be partly or entirely restored, well maintained, physically protected, located in an outstanding position, accessible, illuminated and exposed to natural aggressive environments (seaside, windy area, etc.) or human pollution (industries, traffic, etc.).

Although the previous chapters have demonstrated that some good practice for the better management of HBs/sites are already in place, a number of key issues which put HBs/sites at risk of damage are still not well tackled.

Due to the complexity of situations, this chapter will focus on providing an overview of the main problems raised by the management of HBs/sites within their surroundings. A multidisciplinary team comprising conservation professionals, art historians, archaeologists, architects, biologists, civil engineers and information technology experts from the different EU countries represented in the Action have joined forces to provide their expertise and experience on the risks to which HBs/sites are exposed (urban development, infrastructure works, demographical changes, natural and technological hazards, bio-deterioration, lack of cultural heritage education and technical knowledge and skills, etc.). Traditional and new approaches to manage the principal risks are then developed. Fol-

lowing this, a number of recommendations to better integrate HBs/sites within their surroundings are presented. The chapter ends with the validation of the key recommendations through a number of short-term scientific missions (STSMs) (see Chapter 4) and through a public debate with non-profit organisations.

This chapter highlights the key outcomes of a larger work presented in the public report "Integration of heritage buildings and sites within their surroundings" [1], carried out through interviews, questionnaires surveys and focus group meetings using the nine case studies.

7.2. HBs/sites within their surroundings: key challenges for their preservation, conservation and valorisation

7.2.1. Key challenges

A number of key challenges listed below have been identified in the public report [1] that characterize HB/sites and ensure their protection or threaten their survival. The report clearly shows that these challenges are expressed, tackled and implemented differently from one EU country to another.

- **Legislation**: different levels of protection of HBs/sites at the national, regional or local level [2]; integration of authenticity and integrity criteria [3]; integration of the surroundings;
- **Protection and prevention of damage:** urban development, demographical changes, major infrastructural works, wars and ethnic confrontations are still the cause of colossal damages. Anthropological disasters also include dramatic climate change and the consequences of the world-wide pollution of air, water and land; including the destruction caused by pollution of monuments built of raw materials as metal, wood and stone which in some cases have deteriorated at a faster rate in the last decades than in the previous centuries;
- **Conservation[1] policy**: maintenance and conservation/restoration policies (minimum intervention as primary consideration, including maintenance);
- **Use or reuse**: compatibility with pre-existent parts with regard to international conservation principles;
- **Rehabilitation and reconstruction**: preservation and legibility of original parts;
- **Interaction between HBs/sites and their surroundings**: accessibility, signage, illumination, etc.;
- **Stakeholder engagement**: communication between the different actors, motivation of young generations, education for heritage protection/preservation/conservation, sourcing of financial capital to support activities, development of 'heritage skills' to effectively investigate, manage and conserve HBs/sites;
- **Sustainability and management policy**: integrating social, environmental and economic criteria.

7.2.2 Examples of good practice and critical issues of integration of HBs/sites within their surroundings

The combination of legislation and planning which identify a clear structure of responsibilities plays a key role to achieve good practices to maintain HBs/sites. Similarly, well thought interventions (maintenance, conservation, rehabilitation and partial reconstruction) are essential for their better preservation while efficient signage and highlighting might contribute to their better visibility and valorisation.

The sustainability and management of HBs/sites within their surroundings is based on social, economic and environmental criteria and a good balance between valorisation and preservation/conservation strategies. Figures 7.1 to 7.3 show three representative examples of how the level of

[1] Conservation involves treatment and preventive care. It differs from preservation, an action taken to prevent further changes and deterioration (Getty Research - Art & Architecture Thesaurus Online, http://www.getty.edu/research/tools/vocabularies/aat/ [Accessed 17.07.2018].

integration of HBs/sites within their surroundings, and their associated status and characteristics are interconnected (see Table 7.1).

Table 7.1. Characteristics of three of the nine I2MHB cases studies

Cases	Status	Characteristics	Integration within the surroundings
Case 1 Germolles, FR	Private, listed, in use	Authentic, well maintained, ethical conservation policies, development of a cultural tourism policy	Very good (rural)
Case 2 Temple-Cathedral, IT	Public, reuse	Neither a Temple or a Cathedral, different conservation and reconstruction strategies, risk of development of mass tourism	Very good (urban)
Case 9 Valletta waterfront, MT	Private, reuse	Front of the structures preserved and backyards demolished, mass tourism, risk of over commercialisation	Poor (urban)

(a) Château de Germolles (1381-1400) within its surroundings, © Dufour

(b) The entrance gate and the upper chapel (on the left) after conservation/reconstruction, © Germolles

Figure 7.1. A very good integration of Case 1 Germolles, FR within its surroundings in rural area

(a) Temple-Cathedral within its surroundings in Pozzuoli, © De Caro, Gialanella 2002

(b) The reconstruction project in progress, www.marcodezzibardeschi.com/index.html/portfolio/opere/Pozzuoli

(c) The space between the original Cathedral façade and the current one corresponding to the Temple access side, www.marcodezzibardeschi.com/index.html/portfolio/opere/Pozzuoli

Figure 7.2. A very good integration of Case 2 Temple-Cathedral, IT within its surroundings in urban area

(a) Pinto stores (1752), now known as Valletta waterfront, within their surroundings, severed from their original context and direct link with Valletta Grand Harbour due to the marina which serves as a cruise liner terminal, © S. Cefai

(b) View of the reconstructed walls which were damaged due to the Second World War as well as the pedestrian street, © S. Cefai

Figure 7.3. A poor integration of Case 9 Valletta waterfront, MT within its surroundings in urban area

7.3. Optimization strategies

7.3.1. The need for multi-criteria optimization procedures

Following UNESCO recommendations [4], multi-criteria decision analyses (MDCA) have been developed to facilitate the decision makers in the process of safeguarding, urban planning and making decisions about the possible reuse of HBs/sites: the management of buffer zones[2] [5] which are essential for the better integration of HBs/sites within their surroundings; or, the decisions about financial supports to energy efficiency applied to HBs/sites combined with accurate planning of preservation.

The use of MCDA to HBs/sites and surroundings in practice is however still scarce. The existing limited studies tend to focus on choosing which unoccupied HBs/sites have the best location to establish particular new facilities, or the best function in the case of a proposed reuse. As the MDCA are a good way of implementing a multidisciplinary engagement to ensure a more reliable inheritance for future generations, improvements to implement specifically MCDA methods for HBs/sites should be pursued.

7.3.2. Measures for protection and prevention of damage

The following lists measures that can be used to impact positively on some of the risks to which HBs/sites and their surroundings are exposed to.

- **Legislation**: creation of a clear structure of responsibilities where legislation and planning are integrated, known as integrated conservation - one typical tool is to define buffer zones; and compliance of UNESCO and ICOMOS guidelines to carry out appropriate conservation interventions. Further effort should be made at the EU level to homogenise legislation on interventions on old but not listed residential buildings located in the immediate vicinity of HBs/sites or energy efficiency policies, and to promote the independence of government agencies in relation to protection against urban pressures.
- **Urban development**: territorial management of areas of development to limit the movement of population to large urban centres and promotion of a European sense of culture in rural areas,

[2] A buffer zone is an area surrounding the property which has restrictions placed on its use to give an added layer of protection.

- **Major infrastructure works**: forecasting the consequences of major infrastructure works in order to avoid irreversible destruction or forced consolidation of HB/sites structures. Again, buffer zones should prevent such damages in both rural and urban areas. Another way to intervene would be to stop any property speculation within sensitive HBs/sites and their surroundings.
- **Demographical changes**: accurate strategy of integration of newcomers (migrants, tourists), monitoring demographical changes in European regions to understand how HBs/sites will be perceived in the future or managed under changes in the urban culture.
- **Natural hazards**: development of new integrated methodology such as the EU NIKER [6] application which formalises four different interrelated phases of earthquakes, namely the investigation, intervention, evaluation and management phases, to develop and validate innovative materials and technologies for systemic improvement of behaviour of cultural heritage (CH) construction. Similar approaches could be setup for other natural hazards such as flooding. A significant effort has been made worldwide to set up rules to shape common risk indicators. On 6th December 2017 in Bonn, the United Nation Office for Disaster Risk Reduction (UNISDR) organised the launch event of the Sendai Monitoring Process. During the event the need to have proper risk indicators for Cultural Heritage, in particular related to potential economic losses, was greatly supported [7].
- **Technological (man-made) hazards (e.g. vandalism, armed conflicts, gas explosion, bomb treats)**: introduction of new concepts such as CH of the greatest importance for humanity through international conventions: the 1954 Hague convention which second protocol entered into force in 2004 [8] and which clarifies states' duties before and during conflicts.
- **Bio-deterioration**: implementation of the results of EU-funded projects (such as BACPOLES program (EVK4-CT-2001-00043) [9] to prevent bacterial decay and fungal infestation of wooden structures.

7.3.3. Optimized management

Guided by measures for protection and prevention of damage discussed earlier, the following actions can be taken at different levels to optimize the management of HBs/sites within their surroundings. Some of them have been implemented in practice (see the I2MHB public report [1] for further details).

- **Responsibilities and inter-organisational coordination**: establishment of appropriate legal structures which would allow to apply for proper funding or benefit from tax reductions, proper training of public or private HBs/site managers, and assessment of the quality of activities proposed by HBs/sites by neutral entities.
- **Documentation and monitoring**: availability of relevant and appropriate documentation of HBs/sites using 3D measurement technologies (photogrammetry, laser scanning, etc.) [10] recommended by international organisations such as ICOMOS, CIPA (the International Committee for Heritage Documentation), the International Society of Photogrammetry and Remote Sensing, the World Heritage Center and UNESCO.
- **Maintenance plan and monitoring guidelines**: establishment of a UNESCO chair on Preventive Conservation, Monitoring and Maintenance of Monuments and Sites in 2009 and confirmed until 2020 [11]; set up of maintenance approaches based on prevention of damage through planning or screening (based on inspections and controls - the 'Monumentenwacht' approach [12] outlined in guidelines and recommendations [13].
- **Effective engagement of locals and stakeholders**: dedicated websites, social media, printed brochures and flyers, exhibitions and events, volunteering to care, education links to local schools, provision of premises, and setup of partnerships between HBs/sites, are commonly used engagement methods to promote HBs/sites and engage with locals and stakeholders [14].

The adoption of these methods can however vary according to circumstances and site characteristics, e.g. site size, ownership, location.

  - There is growing evidence that people are participating in heritage more, by visiting sites, donating money or volunteering time to support heritage organisations [15]. These engagement activities have further enabled people to recognise the social benefits that HBs/sites can provide, and has made them an important aspect of today's society through recognition of these benefits [16,17].

- **Tourism as a tool and resource**: organisation of regular meetings between HBs/sites managers, and tourism offices and agencies at local, regional and national levels, to develop common strategies and prevention of exposure of HBs/sites and their surroundings to mass tourism such as the development of web applications of control of crowds of tourists [18].
- **Funding and share resources**: supporting initiatives such as fund raising for private HBs/sites (e.g. Donation factory [19]) and offering visitors reduced entrance fees through tourist routes.

7.3.4. Optimized interventions

Technology is linked to material employed in interventions on HBs/sites. In the past years, innovative materials have been invented such as artificial stone and composite which can be used in different types of action on HBs/sites. Caution in using them, however, is needed since consistency with traditional materials and building techniques, reversibility, compatibility or durability has not yet been entirely assessed. The implication is that it is needed to entrust work to specialised companies.

Technology applied in conservation/rehabilitation/reconstruction should be the nearest to the original one even with differences in materials. Technology should take the following into account: (1) materials behaviour and their interaction (e.g. chemical and physical stability under temperature stress and prevailing wind); (2) the interaction with the original structure; and (3) the relation of HB/site and its surroundings (e.g. colour, design in case of reconstruction).

7.3.5. Optimized visualisation, preservation and dissemination

New technologies, ways of networking and promotion tools are also paramount.

- **Digital technologies**: digital technologies such as 3D reconstructions, augmented reality (AR) or virtual reality (VR) are powerful tool for transferring historical, cultural and other CH values to the public in complement to traditional interpretation methods [20,21]. They make HBs/sites accessible while reducing tourist impact on endangered sites. The presentation should though focus on highlighting the heritage value and the tools should be as discrete as possible to respect the authenticity of the HBs/sites.
- **Technical and scientific network**: because of the multidisciplinary character of the preservation and valorisation of HBs/sites and their surroundings, interoperability is essential. It has been developed particularly in the field of protection against natural hazards through the European Directive INSPIRE [22]. Databases and web platforms such as EUROPEANA [23] are clearly supporting this interoperability process.
- **Novelty tools of marketing**: beyond the traditional tools of communication, governmental institutions have to constantly innovate by creating new labels for the better recognition of the ethical way to transfer the values of Cultural Heritage through its HBs/sites and their integration within their surroundings. The French label 'Maison des Illustres' [24] is one of them.

7.4. Recommendations for an optimized integration

7.4.1. Key issues and their associated recommendations

Based on the key issues and optimized strategies developed in the previous sections, a number of recommendations can now be highlighted for a better integration of HBs/sites in their surroundings.

They are summarised in Table 7.2.

Table 7.2. Key issues and their associated recommendations for an optimised integration of HBs/sites within their surroundings.

Key issues		**Recommendations**
Legislation	• Lack of an integrated legislation and planning to clearly identify the structure of responsibilities • Lack of monitoring and assessing the impact of legislation on the protection of HBs/sites and their surroundings • Lack of a common legal framework in Europe	• To develop an integrated conservation o To setup a clear structure of responsibilities where legislation and planning are integrated o To revise and extend definitions and measures with regard to buffer zones in existing urban environments • To monitor the impact of legislation on the protection of HBs/sites and their surroundings • To homogenise legislation on HBs/sites at an EU level • To update and foster the diffusion of international database to integrate heritage building data with territorial data, risk analysis data, and data useful to support the implementation of disaster management structures (in particular Sendai Framework priorities [25]).
Management	• Lack of strategies or procedures for a better application of multi-criteria models to HBs/sites • Lack of citizen participation/local communities in the decision-making process (interventions)	• To promote and resource multi-criteria optimisation tools and procedures for implementing a multidisciplinary engagement • To implement maintenance plans • To develop and provide tools for the citizen' participation in management and maintenance of HBs/sites
Preservation	• Lack of understanding of the aims and principles of CH preservation among the general public • Lack of consideration of the impact of urban development and major infrastructure works, demographical changes, natural and technological hazards, and bio-degradation • Lack of proper risk indicators for the protection of HB/sites against natural hazards • Lack of balanced preservation and valorisation of HBs/sites policies • Lack of balanced sustainability policies	• To implement existing and efficient measures for protection and prevention of HBs/sites damage within their surroundings • To promote an integrated approach to predicting and tackling the problems originating from the urban development • To include demographic changes impact in territory and funding policies to achieve balanced CH preservation • To develop balanced and sustainable preservation and valorisation of HBs/sites policies • To homogenise preservation practices (including reuse) of HBs/sites at an EU level through a multidisciplinary approach

Documentation and valorisation	• Lack of documentation of all characteristics (general or unique) of HB/sites • Lack of use of digital technologies to support cultural and touristic dissemination	• To implement existing and efficient measures for documentation of HBs/sites within their surroundings • To promote the use of digital technologies in conjunction with traditional interpretation methods
Conservation	• Lack of appropriate maintenance and conservation/restoration policies • Lack of clear guidance on how an intervention (conservation or reuse) should be carried out	• To implement existing and efficient measures for maintenance of HBs/sites within their surroundings • To homogenise conservation practices (including rehabilitation/reconstruction) of HBs/sites at an EU level • To develop new integrated methodology to evaluate an intervention
Stakeholder engagement	• Lack of stakeholders' interoperability • Lack of engagement of the younger generation (aged 15-24) • Lack of focus of engagement activities on 'quality' versus 'quantity'	• To develop and resource appropriate training for staff who are involved in the preservation and valorisation of HBs/sites • To continue to promote the concept of a European web platform where good practice can be shared and lessons can be learnt • To increase the valorisation of open data coming from citizens and other open data platforms (such as Open Street Map)
Cultural heritage (CH) education	• Lack of balanced integration of newcomers (migrants, tourists) which results in lack of respect of European culture (local or global)	• To include integration of newcomers (migrants, tourists) in CH education • To develop a unified educational strategy for a wider education of non-conservation officials[3] and experts for preservation of CH • To promote CH education among local population, and bring it in line with the advanced methodologies and technologies in the modern heritage education
Funding and partnership network	• Lack of financial capital to support engagement activities • Lack of partnership network to support cultural and touristic promotion • Lack of novelty tools of marketing applied to HB/sites within their surroundings	• To raise awareness of the need for more funding into the heritage sector • To promote and share resources network o To develop network activities between similar HBs/sites and HBs/sites located in the same geographic area o To setup cultural events integrating the surroundings

7.4.2. European web platform based on the interoperability concept

The EU web platform based on the interoperability concept should promote the communication between European citizens and European institutions, regarding the debate around good practices and bad practices involving HBs/sites. In this way, a more unified common understanding and ope-

[3] Politicians, local and national administrations, municipalities, etc.

ration in the HBs/sites domain would be achieved within the EU member states, and in turn would lead to a more coherent and balanced European culture.

This task would complete existing European Commission initiatives such as EUROPEANA, JPI-Cultural Heritage [26], E-RIHS [27] and funded projects such as RESCULT [28], HERAKLES [29].

7.4.3. European funding criteria

The criteria used for European funding should show a balanced strategy with direct impact on the preservation and conservation of HBs/sites. It should not be directed mainly to virtual concepts of HBs/sites or supposed 'innovative materials' (as nowadays the nanomaterials which still present gaps of compatibility, production and use), which sometimes show problems of durability and compatibility with the existing materials. It is recommended that a more balanced distribution of resources addressed to all stages of work and use of HBs/sites, and the monitoring of the results of projects should be followed.

7.4.4. Smart heritage city

The 'smart city' concept is based on the use of technology to make the city more efficient: functional, economically and energetically sustainable. The city is monitored by sensors to record and collect big data. This concept has also reached the heritage field. Smart Heritage City (SHCITY) [30,31] is a European project which aims to create an open-source tool to manage and monitor historical centres through the installation of sensors all over the city and HBs/sites. Both concepts of smart city and smart heritage city focus on the institutions or companies which use the data to make the cities more efficient, but none of them have taken a consideration of the role of the citizen as an active player.

To address this gap, the 'sentient city' (or 'conscious city') concept has been developed. It is a smart city which has "the ability to sense and the intelligence to react appropriately based on the results of the sensing" [32]. The difference between a smart city and a sentient city is that, in the latter technology is used to serve people. This difference helps to configure a city which is user-centred. The user-centred focus is especially important for buildings and heritage environments because it makes the inhabitants become an active part of the solution, not the problem, helping to make the heritage more sustainable.

7.4.5. Cultural Heritage education

Education for multidisciplinary fields of preservation and conservation of CH should be seen as an important sub-domain of heritage education, with an emphasis on in-depth understanding of the reasons for preservation/conservation of CH, of its methods, principles and challenges. The recently developed advanced methods and tools, including educational methodologies (e-learning, VR/AR), should be fully used for supporting different heritage-oriented activities among stakeholders (including non-conservation officials and experts) who have a significant impact on the development and implementation of conservation policies, and by doing so to allow their contribution better-targeted and educated to heritage preservation at different levels and on a wider scale [33,34].

7.4.6. Future work

The perception of material and technological conservation intervention on HBs/sites plays an important role in the different stages of the conservation (restoration/reconstruction) process, from decision making, the evaluation of conservation results to maintenance. The theme of correlation between visual and technological characteristics of CH is of importance to both the professional conservation experts and the general public (the 'consumer' of the conservation product). This is due to a constantly extending scope of the diversity of the forces involved in conservation.

Along with conservation experts, many non-conservation experts (through collaborative research and conservation projects) and the general public (through heritage preservation educational and real projects) contribute to conservation of CH on a regular basis. In this reality, it is essential to make the values, challenges and principles of conservation of CH understandable to the diverse non-conservation communities. The issue of interdisciplinarity, which is especially relevant to the domain of conservation of CH, calls for the development of innovative methods and strategies. Initial experiments in the framework of COST Action TD1406 laid the first steps in this direction [35].

7.5. Validation of the public report "Integration of heritage buildings and sites within their surroundings"

To reiterate, this chapter highlights the key outcomes of a larger work presented in the I2MHB public report [1]. During this process, a majority of the key issues and recommendations presented in the previous sections were consistent with those findings raised by the young researchers who carried out short-term scientific missions (STSMs) on the HBs/sites selected within this Action.

Furthermore, upon the completion of the aforementioned report and thus this chapter, we further invited stakeholders external to our core group of experts to comment on our key findings. A debate on the public report was organised in a public session by a non-profit organization - APRUPP (Associação Portuguesa para a Reabilitação Urbana e Proteção /Portuguese association for Urban Rehabilitation and Heritage Protection - https://aprupp.org/) and the session was moderated by Dr Alice Tavares (president of APRUPP and WG3 member).

The APRUPP is a national Portuguese association whose members are mostly technicians and experts in the field of built heritage (such as architects, civil engineers, conservators, researchers, stakeholders, managers), from the practice to research. The APRUPP is often called upon to discuss with national or regional entities with respect to the strategies for urban rehabilitation and their compatibility with the protection and preservation of the built heritage. Their activities also involve technical workshops within the scope of conservation.

After the debate of the public report, the APRUPP members emphasized three main topics, considering those as needs of international and national debate and promotion of future actions:

- Monitoring of the implementation of legislation on the scope of construction and rehabilitation or urban regulations and their impact on HBs/sites over a period of time. This was not only considered a challenge and a need, but also a key issue in terms of future preservation and protection of HB, supported in timely knowledge of integrated approaches;
- Integration of the maintenance of HBs/sites and their surroundings in the urban planning and attribution of scheduled financial grants to cover the associated costs. This could be implemented through the combined reduction of taxes and the support of technical networks through the municipalities in close contact with the owners of HBs/sites. This should favour preventive conservation to costly remedial interventions or rehabilitations;
- Control of urban development integrating any action related to the protection and preservation of HBs/sites. In this sense, an enlarged area of control (buffer zone) around the HBs/sites should be implemented as it already happens in some European countries. Nowadays, a continuous control of the urban quality of arrival paths or routes, the introduction of new urban functions and the balance with existing ones, and finally the control of point of views from different areas in the surroundings of HBs are mandatory issues to be included in the future strategies of development.

7.6. Conclusions

Although the previous chapters have demonstrated that some good practices for the better management of HBs/sites are already in place, a number of key issues which put HBs/sites at risk of damage are still not well tackled. The aim of this Chapter was, therefore, to give the floor to a

multidisciplinary team of EU experts from different backgrounds who gave an overview of the current main issues, and the strategies adopted to optimize the better preservation and valorisation of HBs/sites within their surroundings. Not all strategies can be applied on all HBs/sites and in all EU countries. Therefore, recommendations are given to improve the current situation at an EU level. It is interesting to note that these recommendations are consistent with those highlighted by the young researchers who carried out STSMs on the HBs/sites selected with the COST Action TD1406. Similarly, findings drawn from a public debate with external stakeholders from a non-profit organisation also show a clear consensus between conservation experts and HBs/sites end-users (owners, visitors, etc.). These recommendations, hopefully, will be taken on board by government agencies at national, regional and local levels.

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8. The perception and social role of Heritage Buildings in modern society

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DOI 10.1484/M.DEM-EB.5.118099

Heritage Buildings are (more or less) integrated into their physical and social surroundings. The investigation of their social role aims to offer a range of possibilities for improvement of the social aspects of HB's integrations into their social environment and interconnection between a specific HB and its users, stakeholders and general public. In order to complete the investigation, within the COST Action TD1406, a sociological research using the technique of a survey on a convenience sample was organized to offer more knowledge about how HBs are perceived and treated in different countries and among different strata of population. Three questionnaires were developed – for the stakeholders, for the users/owners, and for the general public. The analysis of the responses gives enough material to consider a range of possibilities to improve an optimized management of historical buildings.

Keywords: *cultural heritage; survey of different heritage actors; perception of heritage buildings; interdisciplinary approach; identification of cultural heritage asset; expert evaluation; preservation process; integration into the society; memory of existence; function; methodology.*

8.1. Introduction

Heritage buildings are the subject of many discussions, treatments and uses as well as of their potential social roles. Nevertheless, the general perception of the role played by Cultural Heritage in modern society is often ambiguous, depending on the dominant point of view. In a pub, anyone can be a national football team coach, as anyone thinks he can be an expert in judging artistic achievements – we have all heard very "scientific" analyses of a recent movie, or a fashion show, or on design, on a museum item. On the contrary, we seldom hear an animated discussion on a technical problem, on a mathematical problem. It is in the very nature of human beings – some topics are only for experts, but in some topics everyone considers themselves an expert. But when this everyday pastime becomes a trend in a serious matter that needs scientific approach, we witness misunderstandings, and worse, misguiding practically in every step of the process. The result is, if the care for Cultural Heritage falls in the wrong hands, irreparable damage, interestingly, always done "with good intentions". And – nothing happens.

In an effort to improve the state of things, the European Commission, the European Council, other governmental bodies, as well as practically all organizations committed to the preservation of Cultural Heritage issued different documents with statements and guidelines in order to unify the procedures. Therefore, things should go better. But, on the contrary, we are witnessing a dramatic loss of Cultural Heritage everywhere. And here we need to comment on a current statement, heard

practically everywhere: that the number of heritage buildings is constantly increasing. This we consider a very dangerous statement, that stems from mere looking at the lists of world heritage, or national lists, which indeed are growing. But, those lists are only a tool for mapping outstanding examples of world cultural heritage, or significant examples of national cultural heritage, giving them the rightfully deserved place, to integrate it into society. Those assets being included in different lists were already, and regardless of the lists, cultural heritage. The reality, however, is totally different.

Cultural heritage is in danger, it is decreasing rapidly, it is in some places even disappearing. We are still not aware of the fact that the loss and deterioration of cultural heritage is such that it can be rightfully compared to the extinguishing of languages, or the disappearance of different species in the natural world. Inscribing monuments into national or international cultural heritage lists does not automatically imply the implementation of adequate measures either for systematic research and presentation or for the long-term and sustainable protection of cultural heritage. What is unfortunately evident is the fact that we do not deal systematically with the monuments, often without a detailed and sustainable plan. We are witnessing a series of recent examples that confirm this thought, one of them being Pompeii, certainly one of the most fascinating monuments of cultural heritage, often the subject of discussion when we talk about its sustainability [1].

Figure 8.1. Pompeii, Italy. Example of overtouristification, © I. Kranjec.

8.2. Interdisciplinarity in management of Cultural Heritage

The first step in the process of heritage management is to define, or decipher the exact position of the monument(s) in the complex network of social relations. Every monument, every building, every object that we now understand as cultural heritage has once been created as a result of an infinite set of social interactions of individuals or groups of individuals. At that moment, it even may have not been considered a cultural monument or a work of art. It means that the monuments that have been preserved up until today have performed different roles through history, either as an im-

portant place of religious cult or a mere residential object. Only through a certain period of time and usage in which they have interacted with the society (e.g. serving for religious ceremonies, offering a place to live, etc.) they have become what we today consider them to be: a materialized piece of a memory of society, or cultural heritage.

If we insist on studying our heritage buildings as isolated technical objects, while disregarding their social role and their interaction with the society, we are ignoring a crucial fact: the work of artists and artisans was a product of its time and social context, not the opposite. We are the ones who are constructing a story around a monument. Therefore, it is vital to enrich our studying of cultural heritage with social studies, while paying particular attention to the social contexts – the original, historical ones, and the contemporary ones, as well as the possible future ones.

The only way that guarantees a successful intelligent management of heritage must include interdisciplinary approach which involves both social and technical sciences. Unfortunately, although praising such an approach is quite common nowadays, it is rarely practiced in a full sense. In reality, every scientific discipline analyses the object only by using its own methodology, which results in a mosaic of fragmented perspectives, hard to understand. Hidden under the relatively recent trend of interdisciplinarity, there are still experts neglecting the real need for multiple complementary approaches. For example, marvellous technical features of the Roman Pantheon or the exquisite artistic expression of Byzantine mosaics of Hagia Sophia cannot be comprehended completely without the social and historical context from which they have emerged. The real phenomenon then is not only a single outstanding feature of some monument (technical marvel of an architectural element, artistic accomplishment or spatial organization of a religious space), but the fact that the society from its time has reached such a civilizational milestone that it could perform such an act. Yet, without a universal systematic approach with clear guidelines, the analysis of the interaction between the monuments and the society is almost regularly left to one's individual judgment.

Figure 8.2. Amphitheatre in Pula, Croatia. Example of integration of historical building in dense urban structure. COST Action TD1406 Training School, © I. Kranjec.

The integration of cultural heritage into society (be it global or local) is the end of a long process comprising the identification of the cultural heritage asset, the expert evaluation, assessment of it, including the identification of the main threats to that particular asset, the decision on how to preserve it, the preservation process (with either rehabilitation or, possibly, reconstructions), the decision of its use/reuse or finding a new use, including sustainability, and then and only then can the cultural heritage asset be delivered to society which then can manage it and benefit in different ways.

At the beginning of the process stands the cultural heritage asset itself, and at the end of the process its integration into the society. This is why we have chosen here to approach the matter of the role of Cultural Heritage in society from two different angles – starting with the Cultural Heritage asset itself because it cannot be well managed without maximum knowledge of it, and from the point of view of sociology, the science with adequate methods for understanding the role of heritage in society, all with the purpose of better understanding Cultural Heritage, better preserving it, better using it. [2, 3]

The COST Action TD1406 is striving towards the investigation of different meanings, perceptions and social roles of the HBs in different countries. In this chapter we will present and discuss the potentials of the HBs and possible function they might perform as well as the major points in intelligent management of the heritage in general. We will explain major elements and the research findings of the sociological analysis that was carried out for this Action project as well as the methods that should be applied, and show whether different groups in society have different perception of the role of the HBs. Major questions to be asked are the following – what position does the HBs occupy within wider surroundings, where the HBs are places in the open landscape, intact or transformed, well maintained or in a state of a ruin, what might be a new function of a certain HB and what new technologies might be used to preserve the HBs.

The two poles that will be discussed here are the monuments themselves and their integration into the society.

8.3. Cultural Heritage – State of the Art

Cultural Heritage is by definition everything man made in a historical sense, but that statement is far from being the only one. We frequently forget the evaluation (artistic) of man-made things. Anyway, it seems that to decipher all the problems we need first to decipher the human impact on cultural heritage – the impact of those to whom that heritage has been left as a memory of existence.

And what do we do with that heritage? We mostly destroy it, and mostly due to ignorance. That is why we need first to deal with the cultural heritage itself, in this case heritage buildings, so as to understand the processes, and to deliver a few major recommendations that might help its preservation and integration into society.

For more than a century now we have been witnessing rapid degradation of our cultural heritage. Major problems and negative impacts facing HBs today are the high level of touristification, too many visitors threatening the potential carrying capacity of the HBs environment; then different influences – natural and man–made risks and hazards. Even if the top organizations dealing with it make fervent efforts to stop the process, their endeavour seems to be insufficient. There are many reasons for that, beginning with the overall administration of those entities, which are, more than ever, inventing protocols that seem to be done more for the purpose of strengthening those organizations, less for the benefit of Cultural Heritage. The inert and huge global administration is such, among other reasons, because it cannot set rules in the global worldwide sense. The traditions of dealing with heritage are different in different societies, thus, methods of preservation cannot be the same everywhere. Beliefs are different, thus religious buildings cannot be treated the same way, and so on, and so on. The overall inefficiency of such organizations, despite the good will and all the efforts

invested, is clear when it comes to issues linked with the different societies. Thus, it seems that we first need to understand different societies to be able to understand the processes of preservation.

Furthermore, we must state that if legislation in different countries might be a problem, it is not a crucial one. Legislation is relatively comparable in European countries, not everywhere the same, somewhere better, but always accurate. In our point of view, unification of legislation would be a nice goal in the future, but it is not an essential issue.

8.4. HBs categorization - Different position of different HBs in different surroundings. Their old and new functions.

In dealing with Cultural Heritage, here only Heritage buildings, meaning that we are going to deal only with tangible heritage, but not exempting all movable heritage that belonged or belongs to that heritage building, the basic problem is always the autopsy of the monument itself, the understanding of its values, in order to choose the best way of preservation and only then to deliver it to society, including guidance for a sustainable use.

Heritage buildings, as human creations, also depend on human interventions. The crucial question is the following: are the interventions done with the full understanding of the heritage building or not. Practically, the fate of each and every heritage building depends on that. So, to arrive to the point of thorough analysis of the impact that Cultural Heritage has on society we need to understand firstly the overall complex structure of the cultural heritage asset itself. And here it is pointless to differentiate the immovable from movable heritage, tangible from intangible.

Heritage Buildings are (more or less) integrated to their physical and social surroundings. The understanding of their social role is crucial in order to be able to offer a range of possibilities for improvement of the social aspects of HB's integrations to their social environment and interconnection between a specific HB and its users, stakeholders and general public.

Firstly, an analysis and the autopsy of the problem should be taken into account, which means that state of the facts, in general, but mostly directly connected to one specific HB and its immediate surroundings must be analysed.

In general, there are a few, among them very different, kinds of HBs which influence the types of intelligent management:

1. urban structures
2. urban structures in state of ruins
3. monument in urban surrounding
4. monument in landscape
5. ruin in urban surrounding
6. ruin in landscape
7. historical landscape

They all need different approaches from the point of view of preservation and of integration into society. Examples that were selected as case studies of this Action could serve for the observation and study of their roles and statuses in relation to their surroundings, both physical and social: Château de Germolles (France) representing the monument in landscape, Temple cathedral of Pozzuoli (Naples, Italy) and the whole historical centre of Rione Terra in Pozzuoli being both ruin in urban surrounding and urban structures in state of ruins (Figure 8.5), Baroničina hiša (Maribor, Slovenia) as a monument in urban surroundings, Monastery of Santa Maria la Real (Palencia, Spain) – once a ruin, today restored monument in landscape, Lamot brewery (Malines, Belgium), a monument in urban surroundings, Tvrđa (Osijek, Croatia), both monument in urban surroundings and urban structure, and Malta – representing urban structure. Nevertheless, beside these basic examples, the

Figure 8.3. Scotland, UK. Tantallon Castle, Conference Grant (April 2018). Example of a ruin in landscape, © J. Behaim.

Figure 8.4. Born Market in Barcelona, Spain. Example of ruin in urban structure. STSM (April 2018), © I. Kranjec.

research was briefly expanded to other monuments in order to better understand the problematics and to complete different proposed categories. Therefore, the urban structures (being at the same time historical landscapes) such as Dubrovnik Old town and Venice, were considered as important and interesting examples of somewhat arguable (intelligent) management of HBs (Figures 8.9 and 8.10). An example of intelligent management of a ruin in urban structure, conserved and presented, is Born Market in Barcelona, Spain, where the former marketplace, together with other projects for the area, was removed in order to make way for the ruin that now forms part of one of the most vibrant city quarters (Figure 8.4) [4].

In the process of preservation of any single cultural heritage asset, here historical building, one of the main steps connected to their social role is the decision of restoring the HB to its original function, or giving it a totally new one, bearing always in mind the sustainability. If the decision is wrong it will lead to further degradation of the historical building, if it is a good one, it will generate benefits for the society.

There are no general rules for deciding the future of a cultural heritage asset; it needs to be a decision that fits the monument itself. And here we often see that different, sometimes hidden requirements of an interested person or enterprise, rule over the decision makers, making profit overruling preservation needs.

Figure 8.5. Rione Terra, Pozzuolli, Italy. Example of reconstruction of urban structure. STSM (February 2018), © I. Kranjec.

An example of an extremely demanding and extensive process of reconstruction of the monument and its immediate surroundings is the reconstruction of the cathedral complex and the historical centre of Rione Terra in Pozzuoli near Naples, used as case study within the COST Action TD1406 (Figure 8.5). Historical events and natural threats (tectonic activity) have resulted in total abandonment of the historical nucleus in which the local population has created and maintained social ties over two thousand years. In the final cycle of the complete reconstruction of the settlement, with

the central project of restoration of a burnt modern cathedral which in its structures concealed valuable remains of the ancient temple, the physical space was drastically changed. A significant part of the baroque mantle of the cathedral, the one known to several generations of the inhabitants of Pozzuoli, even those that are still living today, was removed in order to present the layer of an ancient temple, among other things, using the elements of contemporary architecture. Furthermore, the entire abandoned historical centre is experiencing complete restoration, not to regain its original residential use, but to import new commercial and catering activities in restored buildings. This ambitious project will change not only the physical urban space, but also the social context of the monument. It remains to be seen whether the local community will adopt this new "artificial" environment, and whether the scenario of long-term sustainable development in this case is even possible. In any case, the example of an extreme renewal of the Pozzuoli historical centre shows the long-term importance of decision-making in the management of the monumental heritage for the wider local community.

8.5. How to define the social role of HBs? Major elements of sociological analysis of the importance of Heritage Buildings and the need to establish intelligent management

Within the COST Action TD1406, the survey of all groups of respondents was organized on the basis "person to person" using Internet (e-mail addresses, but hidden personality data). The questionnaires for the survey were created using Google questionnaire forms which have proven to be easy to adjust to the specific needs of various groups of respondents and easy to distribute. The original forms where created in English, whilst in some cases it was necessary to translate them in order to gather a wider sample of local population. The monuments chosen for the research were the case studies adopted for this Action. All the answers are stored in an online database which only the administrators have access to. The structure of the sample was the following:

(1). Stakeholders or respondents who make the decisions and are usually professionals with knowledge about the HBs (for this group a special questionnaire No. 1 was developed).
(2). Owners or users of the HBs who live in them (HB houses) and who are facing many daily and long term problems how to preserve their HB (for this group a special questionnaire No. 2 was developed).
(3). Finally, the third group of respondents was assembled from the "general public" (for this group a special questionnaire No. 3 was developed) or the respondents who came to visit and see certain HB but who are in many cases also actors with interests – these respondents were contacted directly, on site.

Furthermore, the three developed questionnaires can be upgraded in other studies but in this edition they can be used as a "blueprint" for this kind of fieldwork researches in different settings. The results of the investigated case studies will enable the researchers to produce valuable recommendations for future dealing with integration of the HB's in the society.

For the intelligent management of heritage including the historical buildings and their surroundings a sociological analysis of their "performance", impact and roles within the wider area is necessary at least once in a while. In other words, "social assessment" of their roles, impacts etc. must be evaluated – from time to time – using standard social (sociological) methods of field research. The results of these analyses could be a part of the Management Plan of the heritage (buildings) in a certain environment (city, state, county) where the data of social research could be incorporated including the management within the existing social and political context.

8.5.1. Methodology and major methods and techniques of social research that should be applied in the research of HBs

Usually the following techniques might be applied*: observation, interview, focus groups analysis, and survey on a sample basis. Observation* should include the following: systematic observation of major

variables like the number of visitors (of the monument, building), their structures, the structure of visitors according to the time of the day (working days – weekends), holidays, months, individual visitors – collective visiting (tourist groups, schools), etc. as well as the targets of their attention in visiting a historical building and/or the city or its parts as a "unity". Observation must be done in a systematic way with full control of all variables, data registering, etc. The findings of the observation could be used to build up and structure the interviews and survey topics. *Interviews* – usually individual, but with the idea about the structure/quota of the respondents. For example, equal representation of females and males, younger, medium aged, older population (visitors, tourists or passer-by), "local people" who live close or further by the monument, specifically targeted population – stakeholders, different clusters – representatives of city government, the office for the preservation of cultural heritage, etc. and others, depending on the context. *Focus groups* – could be taken into account as well, *survey on a sample basis* is usually used for mass investigations of larger groups of respondents. In our investigation, three groups of respondents had been taken into account (stakeholders, people who own HBs and who live in and take care of them, and general public - visitors with the written questionnaire or via Internet or phone. All rules that apply to the selection of the respondents (building up a sample) must be obeyed also in the investigation of the HBs.

8.5.2. Questionnaires of different kinds for different purposes

8.5.2.1. Operationalization of the methods

In the very condensed operationalization of the methods used in this research we will concentrate only on the most important issues and then present major and most important results.

Observation – detailed-register the following items:

- How many people visit HBs in a unit of time (one hour, for example)?
- How many visits in an organized way (groups) or individually?
- What are the usual places within the environment of the HB where people spend most of the time?
- In which part of the day the number of visitors is the lowest or the highest? In which day of the week (weekend days or working days)?
- Is the HB accessible all the time or not? Tickets – yes or no?

Interview structure – major topics to be addressed

Interviews should follow the logic of the investigation, starting from the general and continuing to the specific dimensions. Interviewing could be more or less "closed" and/or open, structured, flexible or more structured and in principle individual – with one person selected on the spot or prearranged (for example with the representative of the city restauration office). Interviews might be used as a research strategy for general public, stakeholders and other strata of the population. The usual questions – topics that should be asked (general public, visitors) are:

- Why do you visit this HB?
- What do you think is important in this HB?
- What is a detail you most appreciate, like?
- Do you think it is well preserved?
- What other HB places do you plan to visit?
- How did you know/learn about this HB?
- Would you recommend to your friends to visit this important HBs?
- What should be improved?

For the city officials, for example:

- What are major problems of HBs in this city?
- What particular actions a city council must engage in to preserve the heritage including the most important HBs?

- Do you think that local population should contribute in money donations for the maintenance of heritage in this city?
- What is (are) the most important symbols of the heritage in this town?
- What are the most common problems when dealing with the preservation and rehabilitation of the heritage in general in this city?

Focus groups

- The usual topics that should be discussed include:
- What is the importance of the HBs and heritage in general in this city, region?
- What should be improved?
- How?
- Who makes the most profit of the heritage today?
- What is the carrying capacity of most attractive HB points?
- How to „regulate" the number of visitors?
- How to emphasize symbolic values of the most important heritage places including the HBs?

Survey on a sample base

Each survey is constructed for each specific project purposes, case, and problem to be studied. As mentioned earlier, a questionnaire as a main tool of the survey should be developed in accordance with the issues to be studied, the size of the population, selection of the quotas, stratification and spatialization of the sample, etc.

So, for the purpose of the COST Action TD1406 project as we mentioned earlier several methods and target groups had been chosen and taken into account in the investigation:

1. Stakeholders or people who have real interests in the preservation of the HBs, who are usually experts and work in different offices of the regions, municipalities, cities or even in the countries; the method used was a written questionnaire (see appendices, questionnaire No. 1) that was distributed to stakeholders
2. People who own and live in the HBs (questionnaire No. 2)
3. General public – visitors of the HBs (questionnaire No. 3)

In this report, we present the results distributed among the participating countries, HBs places and variables that had been used in the investigation.

8.5.2.2. Interpretation of the field-work research results concerning COST Action TD1406

The sociological research using the technique of a survey on a convenience sample was organized within the COST Action TD1406 project to offer more knowledge on how HBs are perceived and treated in different countries and among different strata of population.

The research and field work were organized during 2017/18 and the results of the investigation are indicative and could be used to expand the future researches of this sort – both in the scope and in techniques. But even in the very reduced form the results might provide better understanding and more information about the usual perception of social (and other) functions of the HBs and how to improve their functions and roles as well as on how to apply more intelligent measures in the management of the heritage in general. Also, the authors believe that this technique of sociological research should be used in many other researches into HBs within the EU. Furthermore, the three developed questionnaires could be upgraded through time in other studies but in this edition they can be used as a "blueprint" and the starting point for this type of field research in different settings.

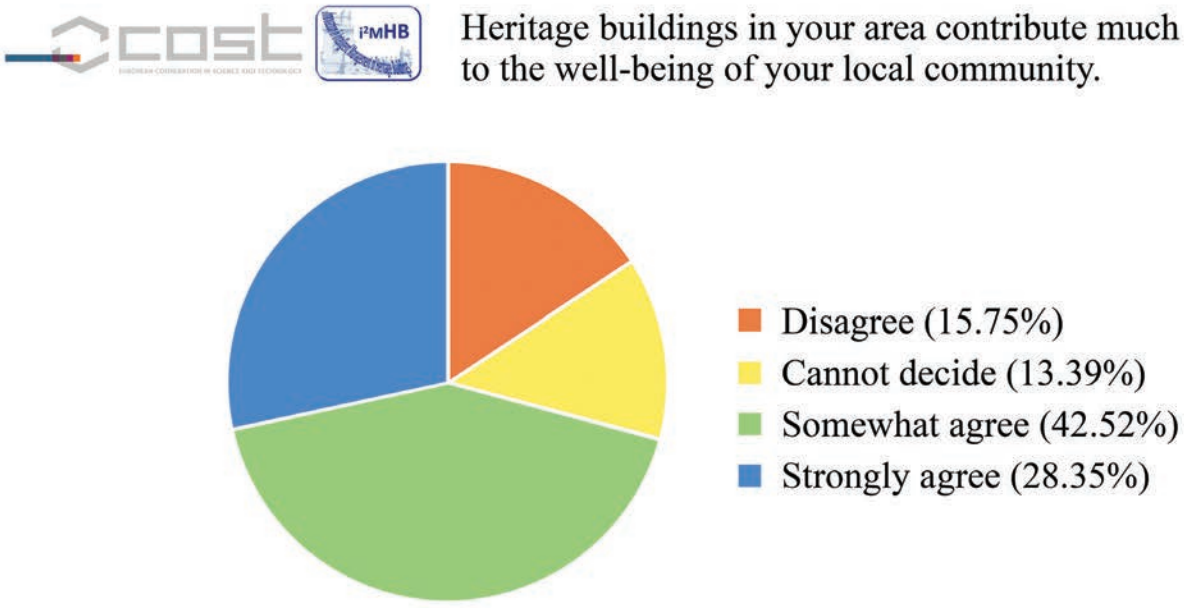

Figure 8.6. Questionnaires responses regarding HBs and community well-being.

Stakeholders and their perception and statements

As it was mentioned earlier, this group of respondents represented "actors with knowledge" and with agency to deal with the HBs. Respondents from 6 countries – Italy, Spain, France, Slovenia, Portugal and Belgium – were included in the investigation. The respondents were contacted via e-mail using the questionnaire No. 1. Major findings of this segment of the research are summarized below.

The stakeholders are employed in different institutions – in state and in private institutions, in the field of education, and in research institutions. All respondents emphasize the importance of the HBs with major accents on their cultural and historic functions, their educational function but also on their importance as a local attraction. Also, several respondents emphasize their architectural importance, their importance as specific item for the country, their originality, and their rarity. The perception of the stakeholders concerning the future functions and uses of the HBs are as follows - educational purposes, as place to be visited as an attraction, as a means of "social cohesion" within the community and as a means of fostering identity. As we can see from the presented major results, the answers of the stakeholders are more or less similar. It is, however, very important that many stakeholders are employed in different functions in different roles and within different institutions where they can influence decision-making concerning the "the fate" of the HBs.

As the second targeted group of respondents (owners and residents) is very heterogeneous a pertinent analysis of their answers should wait for a substantial increase of available data.

"General public" as a third group of respondents (questionnaire No. 3.)

This group of respondents is the largest: participants from 11 countries filled out the questionnaire (France, Croatia, Malta, Germany, Spain, Portugal, Poland, Greece, Spain and Israel).

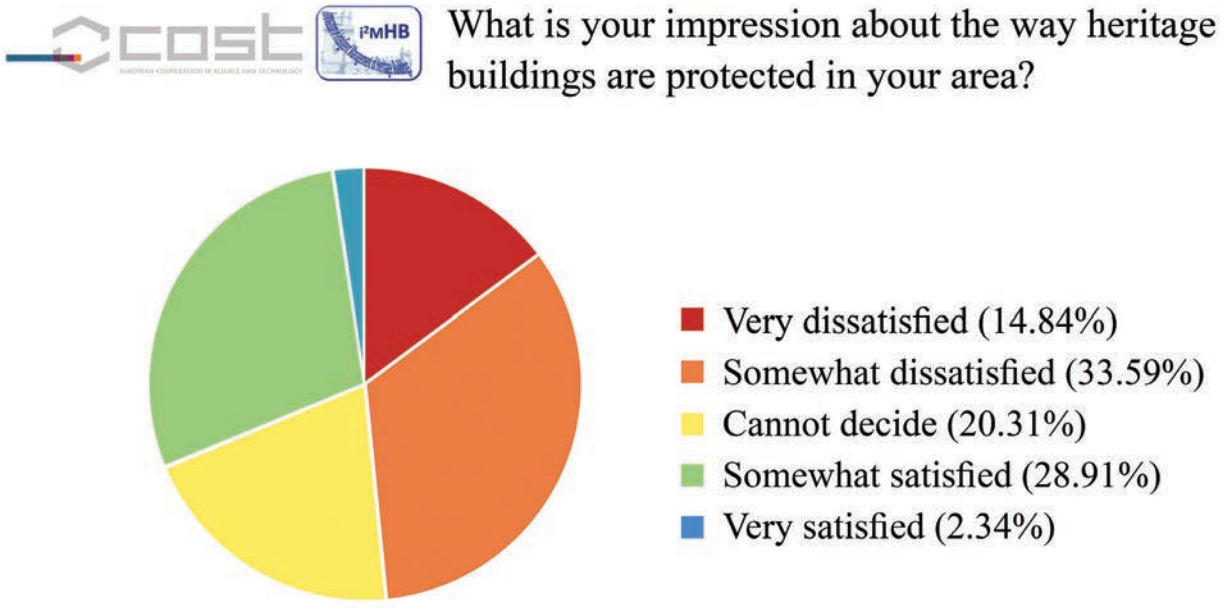

Figure 8.7. Questionnaires responses regarding HBs and personal impressions.

For most of the respondents-visitors HBs are very important because they provide national identity, promote cultural values, bring economic development and provide continuity between past, present and future and provide the sources for community identification. It is clear from these answers that HBs are seen as cultural and economic source for promotion of cultural values of the country and that the attitudes of the respondents are positive towards HBs in general. The most important value of the HBs in their country are their historical value, promotion of tourist interests, cultural and educational values, architectural value and social and archaeological values. The statements concerning the values of the HBs are not presented here in their hierarchical positions, but they show the structure of valorisation of the values. Major roles of the HBs were to promote tourism in the area, to promote history, local traditional and cultural manifestations and local culture. Also, the HBs contribute very much to the well-being of the local community. Many respondents visited the HBs during the last year – cultural buildings, historical sites, religious buildings, archaeological sites and memorials and monuments. Most of the respondents are not satisfied with the current state of the monuments in their countries. Ministry of culture and local government institution as well as owners of the HBs, professional associations, NGOs and International organizations should be engaged in better care of the HBs. Major reasons for the present situation of the HBs lies in the lack of economic resources, lack of knowledge and skilled professionals, lack of legal framework for protection, gaps in the implementation of the management plan for protection, low public awareness of heritage buildings, real estate pressures and mass tourism. The care for the HBs could be improved through better care provided by local government, local administration, civic actions and public policies oriented towards preservation. Specific actions in this sense could be educational activities, promotion in different media, lectures, discussions and informal events, exhibitions and lectures on the HBs, festivals and civic actions.

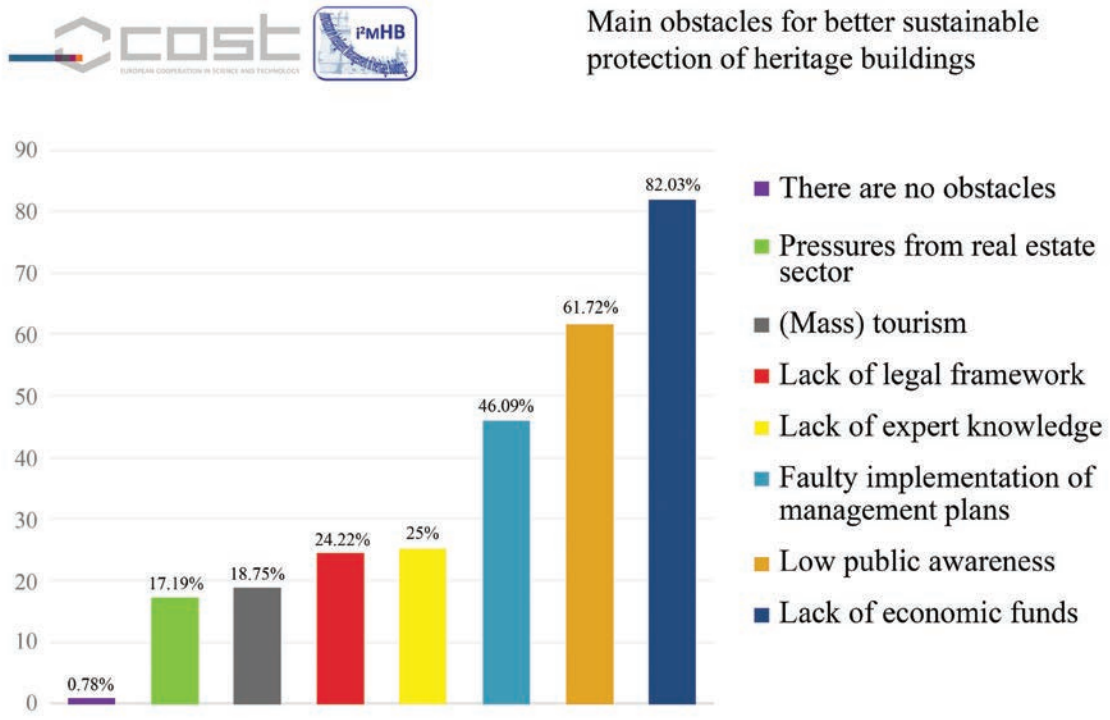

Figure 8.8. Questionnaires responses regarding HBs and their sustainable protection.

8.5.3. Proposals for intelligent management of the HBs

We will conclude this short interpretation of the fieldwork concerning the perception and usage and public functions of the HBs as a basis for the establishment of intelligent management with several major findings:

- All respondents in the three groups think that HBs are an important asset for any country
- The evaluation of the HBs should be done mostly at the institutional level, by the organization specialized in heritage management
- Local environment of the HB site is not specifically evaluated as an economic resource asset
- The differences among various professionals concerning the management of the HBs are small
- In the future, the HBs might be one of the most important economic assets for gaining and disseminating knowledge about the heritage and for the education of local population regarding its values
- More research is needed in the future to shed more light on different uses of the HBs as well as to improve management of the heritage in general
- This research is only a first step toward better understanding of the complex meanings of the past where heritage represents a very important set of signs, traces and human practices through centuries. More standardized researches are needed to harmonize the comprehensive approach to the HBs across Europe. This action research is a small contribution to the common goal – how to better manage, preserve and upgrade the HBs?

8.5.4. Already identified (not necessarily listed) Cultural Heritage assets

For better management of cultural heritage, here only the so called historical buildings, it is important to differentiate between two main categories – a cultural heritage asset that is already considered cultural heritage (listed or not listed), and unknown or not recognized (identified) cultural heritage asset.

Optimized management of a cultural heritage asset from the point of view of its integration into society could be made more efficient with implementing flexible rules that cannot be "legislated", because of their dependence on the good will of the interested parties. Education of the users / stakeholders is the first step, but is not enough. Let us illustrate it with the example of the World heritage listed town of Dubrovnik (Figure 8.9) [3]. For years now, the citizens of Dubrovnik, well educated on the meaning and importance of the town for the world heritage, are fighting against different interest groups. The problems are multilayered: a) a foreign interest group is trying to build a golf course on the hill overlooking the town, where citizens usually go on weekends by a funicular and enjoy the beautiful view; b) cruisers deliver thousands of tourists on a daily basis to a town that can manage approximately a third of them, thus creating chaos in the town; c) the citizens are leaving town because of two facts – foreigners are buying their apartments to stay there only in the season, and because of the fact that in the town you cannot find a shop to buy everyday necessities, or a doctor, or any of the normal facilities a town has to offer. The town of Dubrovnik is becoming a town of shadows. And nothing can help, the exodus is irreversible. The citizens have lost the battle they fought with interest lobbies that for the sake of economic benefit have already destroyed the town. The only thing is that we, as society, are still not aware of that fact that the carrying capacity of the old core is overloaded.

Figure 8.9. Dubrovnik, Croatia. Example of urban structure and historical landscape, © T. Gazdek.

In the case of Dubrovnik, everyone has lost already, the users (citizens), the stakeholders – except the interest lobby, and the general public that cannot enjoy the beauty of the world heritage listed city.

And, what can be done? How are we going to preserve the social purpose of the cultural heritage asset, in this case the town of Dubrovnik? Someone will say, there is no damage to the town itself, it is still a world heritage listed monument, nothing is wrong. But, in reality, everything is wrong – the town is losing its original function, and it is happening now, we are witnessing it [3].

The answer to those questions from our point of view has to come from a strong social engagement of end users, those who can, by pressure, reach the decision makers, policy makers, the only ones who have the power (financial and legislative), to force them to protect the cultural heritage asset. Strict rules, i.e. strong legislative are the last possibilities.

All that we are facing today could be eventually overcome if the general public interest overcomes the financial one. An example of the consciousness of the end users together with local policy makers is another world heritage listed town – Venice (Figure 8.10). Venice has begun with charging the entrance to the city centre for casual visitors. Time will show if the endangered town will benefit from this decision, but at least they have tried to do something.

But, the two cases, Dubrovnik and Venice open new questions. Indeed, whatever sense there is to have a monument, a cultural heritage asset for itself? The monument, the cultural heritage asset has to keep its original function. If it cannot for whatever reason, it has to get a new one, but not a devastating one; it has to be a new function that benefits it, that supplements it.

Figure 8.10. Venice, Italy. Example of urban structure and historical landscape, © I. Kranjec.

8.5.5. The threats for not yet identified Cultural Heritage assets

That is the main problem for the social engagement. In most cases, the individual interest of the owner/user or the interest of a lobby, or a political decision overrules the scientific approach. In worse cases, yet unidentified heritage buildings are being destroyed in the name of "progress" (read it as interest) without any knowledge of the fact on the part of the institutions in charge of protection. It is happening nowadays with the historical landscape that has not even been identified as such. In these cases, only strict implementation of legislations and penalties might be of some use. But, without permanent education of the interested parties, stakeholders, owners, users, the case is lost forever. Here, most of the work has still to be done.

8.6. Conclusion

Intelligent management of Cultural Heritage, or in the case discussed here, only the Historical buildings, in other words, immovable heritage, is an issue far from being resolved at the beginning of the 21st century, in spite of massive efforts that have been made in the last decades, especially by organizations committed to cultural heritage preservation. Many documents issued by those entities (among which, for example: On Heritage as a driver of development, Icomos 2011; ICOMOS Paris Declaration, 2011; Towards an integrated approach to cultural heritage for Europe, EU Commission, 2014; Namur Declaration, EU Commission 2015; European Cultural Heritage Strategy for the 21st century, CM/Rec, 2017- see the bibliography at the end of this chapter) give an optimistic vision and guidelines for a better management of Cultural Heritage. Legislation in different EU countries poses no problem: even though not unified, it provides reasonable ground for efficient protection of cultural heritage.

On the other hand, cultural heritage is threatened more than ever. The risks to which that cultural heritage has been exposed, the main threats have been identified. And those threats are being dealt with on an everyday basis. But things are getting worse. To understand the problem, we need to stress again the main threats: urban development, abandonment of whole areas, mainly rural, infrastructure works especially in the landscape, natural and technological hazards including biodeterioration, climate change, demographical changes, and lack of education.

Among those hazards some are unpredictable, such as war destructions, and unfortunately cannot be dealt with in a systematic way. For bio-hazards and various natural risks, as earthquakes, protocols have been made, improving with technological progress. All other hazards are within the social component, fostered by men.

The aggravating circumstance for the implementation of the results of sociological researches in heritage management is that the positive outcomes will not be immediately visible. Only through a certain period of interaction of the heritage with local, regional, national and/or international public will we be able to recognize the impact of our work. It is an often overlooked issue which can lead to a common belief that social and humanistic sciences do not contribute to a successful care of the heritage. The reality is quite the opposite though, since they can act as a valuable mediator between the needs of an individual, the heritage itself and the society.

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9. Final remarks and recommendations

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DOI 10.1484/M.DEM-EB.5.118100

COST Action 1406 managed to bring together a wide and diverse group of experts and early stage researchers. These multidisciplinary collaborations had the merit of letting participants understand the different views on heritage buildings and, furthermore, incorporate them in each one's field of knowledge.

One of the most important conditions which guarantees a long term and sustainable future of heritage buildings is their successful incorporation into the society. Without a proper role, such buildings, regardless of their state of physical preservation and historical value, present nothing but isolated material objects prone to social neglect and/or improper use. For instance, the process of restoration of a heritage building, which regularly requires significant economic and technical resources, can result in a perfectly restored physical structures (wall structures, plaster, installations, furnishings etc.). Yet if the stakeholders disregard the social aspect and public interests during the planning phase, it is also likely that the investment could turn into a failure where the building, although restored, cannot find a proper role in the surrounding society, cannot realize its full potential (cultural, educational, economic), even turn out to be unsustainable in the long term.

In order to incorporate social context into the intelligent management of the buildings, it is necessary to establish their current role(s) in the society: determine delicate social connections which the buildings could be a part of, specify all the groups of social actors, which could be related with the building, and which are directly or indirectly responsible for its well-being, and to define their perceptions of the buildings. Such study, possible only through the implementation of the methods of humanities and social sciences, would offer us a comprehensive insight into the social context of the heritage buildings, i.e. a firm basis which our planning process for the future of successful monument's social inclusion could rely upon.

Although human being should be the key driver in every initiative related with heritage buildings, other key issues must also be considered such as legislation, management or preservation/conservation and digital technologies. Legislation issues often differ from country to country lacking a unified European vision and often prevent an effective Pan-European collaboration. Lack of management strategies promoting multi-criteria optimisation tools and procedures for implementing a multidisciplinary engagement, will prevent proper implementation of maintenance/preservation/conservation plans. Proper maintenance/preservation/conservation strategies require a good and useful documentation, where the use of digital knowledge-based technologies, together with traditional interpretation methods, will be essential to support cultural and touristic dissemination. Digital technologies propose a variety of IT tools that can manage interoperability of complex data about heritage buildings. Innovative application and use of knowledge-based systems may support heritage building experts to aggregate data into meaningful information that help them to reason about any heritage building lifecycle activity.

In order to preserve the heritage building's values for future generations, suitable education and stakeholders' engagement approaches should not be discarded. Promoting heritage building's education amongst local communities (particularly younger generation), giving them a sense of pride related with their culture heritage, is fundamental for preserving, advertising and making good usage of those heritage buildings.

The final and most delicate problem is the collaboration of technical sciences with humanities and social sciences. The only proper intelligent management of heritage buildings must engage methods and tools of all of them and needs to recognize and acknowledge the advantages of each approach. In practice, this means that every expert must rely on the tools offered by his/her field of science in order to reach a certain solution of a problem. But in the case of the management of heritage buildings, where there is a myriad of universal problems which concern a wide spectrum of experts and public (for example, if a heritage building is a part of an urban structure where it interacts with infinite number of individuals on a daily basis), the only solution is a mutual cooperation of experts where all the actions are results of mutual agreements. Only then it is possible to consider all the aspects of the problems of intelligent heritage management and to provide most effective solutions.

Notes on Contributors

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Ognjen Čaldarović, sociologist (PhD University of Zagreb, 1981), is *professor emeritus* at University of Zagreb, Faculty of Humanities and Social Sciences. He has been the head of the department of sociology in two terms and the co-director of the international course on social stratification in comparative perspectives (Topic: The Quest for Social Justice) for more than 15 years at the Interuniversity Centre for Postgraduate Studies in Dubrovnik. He has been a Fulbright fellow two times (New School for Social Research, 1982-83 and Indiana University, Bloomington, 1993-94. He published 15 books (single author or co-authored) and more than 60 articles in professional journals, and 50 chapters in different books. Also, he presented more than 80 professional papers at domestic and international conferences in different countries. He has been invited to present a lecture as a visiting professor on many occasions and at different universities and schools – University of Ljubljana, University of Belgrade, University of Lock Haven, City University of New York, New School for Social Research, Florida Atlantic University, Indiana University, etc.). He taught on a regular basis different sociology subjects at several universities – University of Split, University of Rijeka-Cultural Studies, ACMT – American College of Management and Technology in Dubrovnik). He has been editor and chief of sociological professional journal of the Croatian Sociological Association more than 10 years (Sociological Review), and the member (and a president in two terms) of the Croatian Sociological Association. Also, he is a member of the ESA – European Sociological Association and of the ISA – International Sociological Association. He was engaged as a researcher in many applied social projects covering different fields of modern society. His professional interests are oriented towards urban sociology, contemporary sociological theories, risk sociology, social assessment, the value of nature in urban environment, social methodology for urban studies. He was awarded with the medal from his faculty for his professional achievements.

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He received his PhD in production engineering in 1991. He has strong experience in information systems modelling, semantics modelling and discovery, and database development. His research field is based on information systems modelling for enterprise applications and processes interoperability, with applications in enterprise modelling, manufacturing processes modelling, furniture data modelling. He is working in ERP and MES integration from a Business to manufacturing perspective. He is expert at AFNOR (French National standardisation body), CEN TC310 and ISO TC184/SC4 and SC5. He participated in many European projects including IMS FP5-IST Smart-fm project (awarded by IMS) and the FP6 INTEROP NoE (Interoperability Research for Networked Enterprises Applications and Software) where he was leader of the work package dealing with scientific dissemination and standardisation. He is serving as expert-evaluator for the European Commission, FNR, AERES and ANR in the domain of ICT. He is visiting Professor in 2013-2015 in the frame of a Science Without Borders PVE project with PUC Parana, Brazil and full visiting Professor in 2016 at the UTFPR, Curitiba, Brazil. He is editor or guest editor of books and special issues of international journals. He is author or co-author of more than 150 papers in the field of Automation Engineering, Enterprise Modelling and Enterprise systems integration and interoperability. After being Chair of the IFAC Technical Committee 5.3 "Enterprise Integration and Networking" from 2008 to 2014. He is Chair of the IFAC Coordinating Committee 5 on "Manufacturing and Logistics Systems" since 2014. He received the IFAC France Award 2013, the INCOSE 2015 Outstanding Service Award and the IFAC 2017 Outstanding Service Award. He is co-organiser of the yearly EI2N workshop on "Enterprise Integration, Interoperability and Networking". He is General Co-chair of the OTM Federated conferences. He is member of the Editorial Board of the Annual Reviews in Control, Computers In Industry, the International Journal of Computer Integrated Manufacturing, the International Journal on Universal Computer Science, the scientific journal Facta Universitatis, series Mechanical Engineering, and an Associate Editor of the international Journal of Intelligent Manufacturing (JIM), Springer, the Enterprise Information Systems (EIS) journal, Taylor & Francis and the Journal of Industrial Information Integration (JIII), Elsevier.

Dalik Sorjef got his PhD from the Mendelejev Institute for Chemical Technology / Karpov Institute for physical chemistry, Moscow. He is Director and Founder of WTTC company (1993), with expertise in material science, physical chemistry, energy storage devices/systems, development and implementation of new technologies and management of international co-operation projects. WTTC build significant competence in the strategic areas of Technology Development and Transfer as well as Business Consulting, managing a long list of reference projects, including projects with the German Federal Ministries, German and international entities and with the World Bank.

Stella Sylaiou is an Adjunct lecturer at the Department of Visual and Applied Arts. 1997: degree in History, Archaeology and History of Art, AUTH, Greece, 2001: MSc in Archaeological Computing, University of Southampton, UK, 2010: MA in Museology AUTH, Greece, 2008: PhD, Inter-departmental Postgraduate Programme *Protection, Conservation and Restoration of Cultural Monuments*, AUTH, Greece, partially funded by Marie Curie Scholarship for the Transfer of Knowledge and conducted at University of Sussex, UK. She has a long experience in archaeological projects, museums and cultural NGOs. Since 2003, she has served as an Adjunct Lecturer at various universities in Greece and Cyprus, such as the Aristotle University of Thessaloniki, Hellenic Open University, University of Ioannina, Open University of Cyprus. Her field of expertise lies in digital culture, virtual museums, digital museology. Member of the CAA-GR Steering Committee (Computer Applications and Quantitative Methods in Archaeology-GR). Scientific reviewer to 10 journals, guest editor for the Journal Museum

and Society (2015, special issue: on Museum Education: Creative Synergies in Multicultural Contexts), the Interartive journal (2018, special issue on Walking Art), the Journal of Computational Methods in Heritage Science (2019, special issue on ICT for Culture and Tourism), the Personal and Ubiquitous Computing (2019, Virtual and Mixed Reality in Culture and Heritage) and Vice-Chair, principal researcher, or member of research groups in 20 Greek and European research projects. Her published work includes 12 chapters in international books and 53 papers in journals and conference proceedings.

Alice Tavares graduated in architecture (FAUP - University of Porto, Portugal) and holds a PhD in Civil Engineer (2015) from the University of Aveiro (PT). She is researcher financed by FCT (Portugal – grant SFRH/BPD/113053/2015) at RISCO – University of Aveiro (UA, PT) and she is assistant professor at the Civil Engineering Department – UA in the Course of Built Heritage Conservation. She is chairing the NGO association APRUPP - Associação Portuguesa para a Reabilitação Urbana e Protecção do Património (Portuguese Association for Urban Rehabilitation and Heritage Protection - https://aprupp.org/), she is member of the national board of the Portuguese Architects Association (OA - Ordem dos Arquitetos) and coordinator of the Seismic Group and Sustainability, Energy and Comfort Group at OA. She is the coordinator of the project: International Forum of Built Heritage Portugal/Brazil (FIPA). She is supervisor of PhD studies about Lebanese Built Heritage (Ottoman and French mandate) of Beirut and co-supervisor of Master theses in Architecture and Civil Engineering. She develops her research mostly about construction systems from the 18th to 20th centuries of Portugal and Brazil, Earthen Architecture and Strategies of Conservation, with more than 40 papers published in conferences, journals and books. Presently, she is researcher at "CemRestore – Mortars for early 20th century building conservation – Compatibility and Sustainability" and "SafEarth: Seismic protection of earthen construction heritage" projects, financed by FEDER – COMPETE – FCT.

Piero Tiano is a Biologist (University of Florence, Italy). From October 2012 He is associate researcher at the Institute for the Conservation and Valorization of the Cultural Heritage in Florence (CNR - ICVBC). He has been interim Director of the ICVBC from July 2007 to June 2008 and from July 2011 to November 2012.

The main activities are focused in two lines: Biodeterioration and bioremediation processes, and the study of monumental stone decay mechanisms and on intervention methodologies for their conservation. The natural development of such researches were the development of new diagnostic methods for the determination of the state of conservation and for the evaluation of the performance of conservation treatments applied to cultural assets.

Piero Tiano has more than 150 journal publications, and more than 70 papers in conference proceedings with referees. He has collaborated in several national and international projects (as scientific responsible or coordinator)

He is the scientist responsible for ICVBC in the Horizon 2020 Project *InnovaConcrete* "Innovative Materials and Techniques for the Conservation of 20th Century Concrete-based Cultural Heritage" (2018-2021, grant agreement No 760858).

Ecocement Project (New microbial carbonate precipitation technology for the production of high strength, Economic and Ecological Cement, (ENV.2011.3.1.9-1 grant n. 282922, 2012-2015). Coordinator of EC funded projects: Hardrock (Contract: SMT4-CT96-2065). Bioreinforce (Contract EVK4-CT2000-00037). Momorex - (Agreement 2003 - 1394/001-001 CLT CA12). McDUR (Contract G6RD-CT2000-00266).

He has been named by the Minister of Culture and Communication of the Republic of France, member of the « Conseil Scientifique de la Grotte de Lascaux » for the period March 2013- February 2017.

Referee for the following publications: Journal of Cultural Heritage; International Biodegradation and Biodeterioration; Biofouling. Member of editorial board of The Journal of Cultural Heritage, Elsevier Masson sas Ed., France.

He was Convenor and Invited Speaker at: 1st European Conference on Biodeterioration of Stone Monuments ECBSM 2014, November 7, 2014 Cergy-Pontoise, Cergy, France.

"36th International Symposium on the Conservation and Restoration of Cultural Property, hold on December 5 to 7, 2012, in Tokyo (Japan). International seminar for the World Cultural Heritage site "The Dazu Rock Carvings" in Chongqing (28/10/2009).

Andrej Tibaut is an Assistant Professor at the University of Maribor (http://www.um.si) Faculty of Civil Engineering, Transportation Engineering and Architecture (http://fgpa.um.si) and Head of the Chair of Construction and Transportation Informatics. He received his Ph.D. (2002) degree in computer science from the University of Maribor and has since then been active in construction and transportation informatics with research focus on building information modelling, knowledge engineering, digital interoperability and the use of e-learning in engineering. He also obtained professional experience as Head of the research group in an engineering and design consultancy company (Lineal d.o.o.). He is an active member of CEN/TC 278/WG3 standardization groups (Transmodel - http://transmodel-cen.eu, NeTEx - http://netex-cen.eu, OpRa). He is also the founding member and Chairman of siBIM (BIM Association Slovenia, http://sibim.si). He is co-author of the BIM Manual for Construction Projects developed for Slovenian Chamber of Engineers and co-author of the Action Plan for Digitalisation of the built environment sector in Slovenia.

Goran Zaharija is a postdoctoral researcher at the Department of Informatics at the Faculty of Science, University of Split. He received his PhD degree in computer science at the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture in Split (FESB). He participated as a collaborator on several European and national projects. He teaches several undergraduate and graduate courses in programming and computer architecture. He is currently working on his research in the field of Artificial Intelligence as a member of a research group focused on intelligent behaviour in biological and artificial systems during problem-solving and learning. His other scientific interests include machine learning, artificial neural networks and multi-agent systems. He is also involved in the local community as an active participant in various scientific manifestations ("European Researchers' Night"; "Festival Znanosti"), educational projects (EDIT Code School) and professional meetups (ML/AI Split).

Annex A – Selected Use Cases' Description

This annex presents briefly the selected nine use cases used all through this final report. They were compiled by Christian Degrigny from data collected by: Christian Degrigny (Case 1 Germolles), Luisa Migliorati, Dipartimento di Scienze dell'Antichità, Rome Sapienza University, Roma, Italy (Case 2 Temple-cathedral), Margareta Turkalj Podmanicki, University J.J. Strossmayer, Academy of Arts and Culture, Osijek, Croatia (Case 3 Tvrđa), Andrej Tibaut and Daniela Dvornik Perhavec, University of Maribor, Maribor, Slovenia (Case 4 Baroness House), Gumersindo Bueno Benito (Case 5 Santa Maria la Real), Maria Leus, Department Heritage Studies, Faculty of Design Sciences, University of Antwerp, Antwerp and Faculty of Architecture & Arts, University of Hasselt, Diepenbeek, Belgium (Case 6 Lamot), Marko Marinković, Faculty of Civil Engineering, University of Belgrade, Belgrade, Serbia (Case 7 Kalemegdan), Alice Tavares (Case 8 Romanesque Route) and Shirley Cefai, Department of Conservation and Built Heritage, Faculty for the Built Environment, University of Malta, Malta (Case 9 Valletta waterfront) who we acknowledge for their important contribution.

Case 1 – Germolles, FR

Château de Germolles

Princely palace of the Dukes of Burgundy

Mellecey (FR)

www.chateaudegermolles.fr

Brief description: In 1380, Philip the Bold (Philippe le Hardi), Duke of Burgundy and brother of Charles V, king of France, bought the stronghold of Germolles for his wife Margaret of Flanders (Marguerite de Flandre). The Duchess transformed it into a luxurious home with the help of the finest artists of the Burgundian School (Claus Sluter, Jean de Beaumetz). After the collapse of the Burgundian dynasty at the end of the 15th century, Germolles became a royal property till the French Revolution. It was then owned by 8 different families. The current owners (9th family) have owned Germolles since the end of the 19th century.

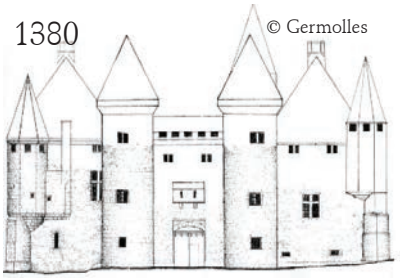
Key facts

- **Best preserved** residence of Dukes of Burgundy;
- **Unique evidence** of a pre-Renaissance château inspired by courtly love spirit;
- **Partly destroyed** after the French Revolution and a fire in 1873.
- Today: **listed** (1989) and labelled as "Maisons des Illustres"
- **Private** but **open to the public**: 10 000 visitors / year

Margaret of Flanders
© Lille, Hospice Comtesse Museum, 16th century

Philip the Bold
© Vienne, Hofburg, 16th century

Evolution with time: the example of the entrance gate



As it might have looked like originally (top part based on historic records)

Time of neglect after the French Revolution

The stabilised and restored entrance gate as it looks today

High level of authenticity and integrity

Hamlet before the château, only accessible on foot

Preserved shape, materials and surroundings

The main 3-floor building designed by the architect Drouet de Dammartin. The dukes lived on the first floor

Conservation strategy: stabilisation when possible, restoration and reconstruction when needed

1873, after the fire

Reconstruction of the vault / roof of the nave of the ducal chapel with modern materials: the external copper sheets have tarnished with time

Reconstruction of the roof of the oratory of the ducal chapel with materials close to the original

Management: some key issues

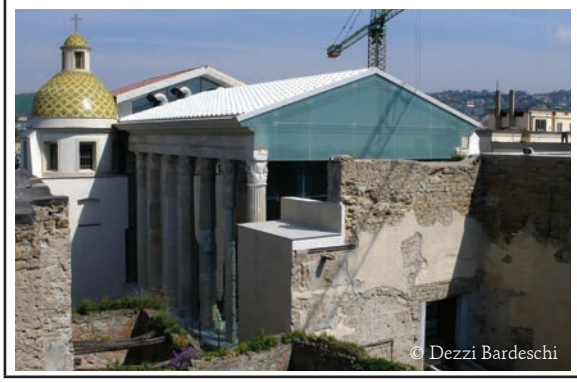
- Experiencing **cultural tourism** in an authentic HB well integrated in its surroundings;
- Emphasis on the **transfer of knowledge**, **values** and **respect** through guided tours operated by the owners;
- Setup of a cultural season and events integrating the **spirit** of the place;
- Raising **awareness on the fragility of HBs**: fire (1873), floods or drought, insects infestation due to climatic change

'Un air de Moyen Âge'

'Asteria' group

2015 flood: destruction of the external wall

2017: after reconstruction



Case 2 – Temple-cathedral, IT

Temple-cathedral
Merging a Roman temple and a Baroque cathedral
Pozzuoli (IT)

Brief description: the current HB represents the Augustan reconstruction of the principal temple (Capitolium) of the Roman colony, *Puteoli*, founded in 194 B.C. The temple was incorporated in St. Prokulus Cathedral as early as the 6th century. In mid-17th century, Bishop Martino de León y Cárdenas enlarged the Cathedral destroying or hiding the traces of the Roman temple under Baroque features. In 1964 the Cathedral suffered a fire and the restoration works brought to light the ancient temple.

Key facts

- **An impressive integration** of different ages under joint management of Pozzuoli Municipality and Roman Curia
- **Listed** and waiting to obtain UNESCO label
- Property of the **Roman Curia** and the **municipality**

Evolution with time

Reconstructed view of the Augustan temple in Pozzuoli, 1766

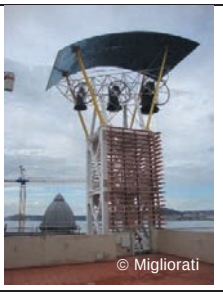
The cathedral incorporating the temple in mid-17th

Cathedral nave after 1964 fire

Rione Terra after bradyseism crisis and 1980 earthquake

Rione Terra in 2007

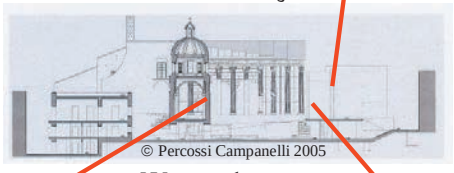
Integration into the urban surroundings: good caring



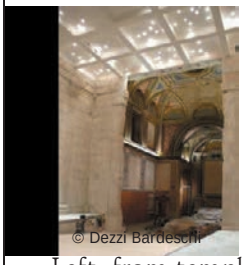
Left: the new bell tower and Rione Terra unchanged urban structure: a sharp contrast. Right: the three 17th bronze bells of the bell tower

Restoration and reconstruction strategy: different techniques and details to suggest temple and cathedral structure and volume

Cathedral façade



West side view



Left: from temple to cathedral and right: temple façade

Reinforced concrete and on floor shape integrating columns

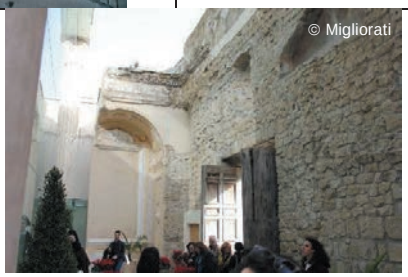
Light mortar and concrete to integrate wall, columns and entablature

Plate glass suggesting cathedral interior, serigraphied to indicate missing pronaos columns

Management: some key issues

- Incorporation into **Rione Terra archaeological park** which is accessible on reservation (weekend, holidays) and hosts frequent exhibitions;
- The archaeological park is more appealing and drives visitors to the HB, whose message is **subtle** and **more cultural**;
- Entrance to Cathedral (and to the temple) is open on worship days and celebrations;
- The buildings surrounding the HB will be turned into hotels and facilities: **replacement of the local population by tourists.**

Rione Terra archaeological park



Students visiting the HB

Case 3 – Tvrđa, HR

Osijek old city nucleus and baroque fortress

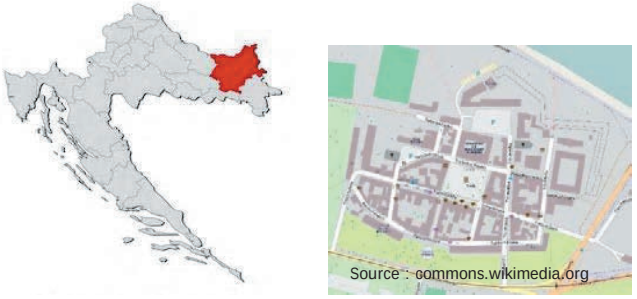
Osijek (HR)
http://www.aoot.hr

Brief description: The urban structure of the baroque city-fortress Tvrđa was planned and built after the liberation of the city from Ottoman domination and the union of the territory with the Habsburg monarchy. It was an ideal urban fortress with a central square, blocks within the grid and a system of military barracks along the city boundary. The fortification plan is a synthesis of the precepts of the famous French military architect Vauban and the Dutch fortification school. Despite its essentially military character, the Baroque historical centre of Osijek includes buildings with a military, secular and sacred vocation. By 1722, the fortress was largely completed, but minor construction work continued until the seventh decade of the 18th century. In the 19th century, we recorded the construction of only a smaller number of buildings inside the fortress. Although most of the fortification walls were demolished in 1920, the structure of a baroque city projected inside a citadel remains intact to this day.

Key facts

- **Typologically characteristic urban form of an 18th century** Baroque fortified city - it is a first example of a Baroque city - a fortress that combines military and civil functions;
- **One of the best preserved baroque urban nuclei in Croatia**;
- **Part of a large system of baroque fortified cities** that has extended to the territories of the current states of Hungary, Croatia, Serbia and Romania.
- As one of the first fortified cities in the large fortification complex, **its plan represents a model for the future fortified cities of this system**;
- **Listed**;
- **62% is public** (city and state) and the rest is in private hands.
- **Quite fully authentic**.

Map of Tvrđa, 1861



Left : Osijek-Baranja county today in Croatia and right : map of Tvrđa today

Conservation and reconstruction strategy: based on historical sources

The Water gates before restoration

View of the so-called lunette in front of the Water gates, during restoration[2]

Project of reconstruction. Visualization: Damjan Uzelac[1]

Water gates after restoration[3]

The same view after restoration[4]

Management: some key issues

Tvrđa should have an important place in the tourist offer but this place remains limited due to:

- Restoration operations on HBs, often limited to façades;
- Insufficient financing and strategic planning;
- Inadequate maintenance of the historical site;
- Unsolved property ownership;
- Unsatisfactory access;
- Unsatisfactory cultural and touristic presentation of Tvrđa.

[1] http://www.aoot.hr/studije/Vodena_vrata_-_press_materijal.pdf [Accessed 03.02.2019]

[2] http://www.glas-slavonije.hr/Slike/2015/04/175495.jpg [Accessed 03.02.2019]

[3] https://www.tzosijek.hr/znamenitosti-57 [Accessed 03.02.2019]

[4] http://radio.hrt.hr/radio-osijek/clanak/otvorena-obnovljena-vodena-vrata/104446/ [Accessed 03.02.2019]

Case 4 – Baroness' house, SI

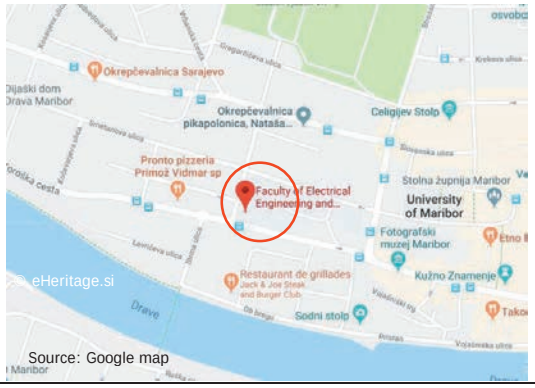
Baroničina hiša

Best preserved Secession buildings in Maribor (SI)

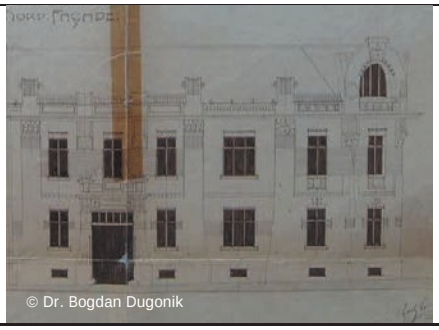
Brief description: Baroness' house is one out of seventy buildings in Maribor built by Architect Fritz Friedriger. Trained in Vienna, he settled in Maribor around 1894 to move back to Austria in 1920, where he soon died. His clients were middle class citizens. Baroness' house, perhaps the most interesting jugendstylish house in Maribor, was designed in 1903 for Baroness Mixich Rast. Two private owners followed until World War II. After the war, the building became a municipal property and was poorly maintained until 2006. Since 2007, it is one of the buildings belonging to the technical faculties at University of Maribor and in 2015, it became part of the Faculty of Electrical Engineering and Computer Science.

Key facts

- **One of the best preserved Secession** (Jugendstylish) buildings in Maribor;
- **Perfect example of integration** of modern and old architecture;
- **Listed** (Register of Slovenian Cultural Heritage);
- **Public** building;
- Most of the current construction is from 1902-1903, except the roof and courtyard which are new.



Evolution with time: the main façade



Modification of the openings. Left: original drawing and right: in 2013

Integration in its surroundings

An excellent example of integration of old (Baroness' house, right) and modern architectures (Faculty of electrical engineering and computer science, left) separated by a covered corridor

Conservation and reconstruction strategy: recovering the original visual appearance of the building while modernizing it according to modern standards

	Removal of a supporting wall to open the basement spaces to the interior of the existing atrium		Steel roof construction
	Sub-contraction of elevator and glazing of elevator shaft		Interior design

Management: some key issues

- **Flooding risk** exist but **seismic safety** taken into account
- **Long-term** and **costly** project
- **Tourist highlight** with information pillars outside the building
- Architectural highlight for the area with **night illumination**

Case 5 – Santa Maria la Real, SP

Monastery of Santa Maria la Real

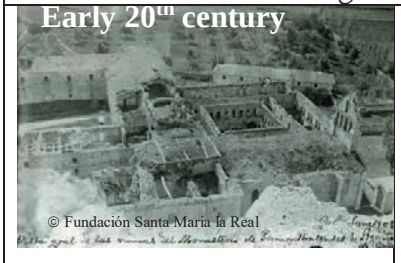
Aguilar de Campoo, Palencia (SP)
www.santamarialareal.org/

Brief description: The monastery was founded in the 9th century, but the current building was built between the 11th and 13th centuries. The confiscation of Mendizábal in 1836 led to the abandonment and ruin of the building. The looting followed. Due to the situation of powerlessness, in 1871 it was decided to remove the most precious capitals from the cloister, the chapter house and the church, which were deposited in the National Archaeological Museum. In the mid-1930s, improvements were made to the roof of the church. Restoration started between 1955 and 1968 and was pursued in the 1980s. Owned by the regional government and the Fundación Santa María la Real, it is today a high school, a museum and a hotel.

Key facts

- Representative of the transition from **Romanesque** to **Gothic**;
- Declared in 1914 as **National Monument** and considered today as **a Cultural Interest site**;
- Not fully authentic
- **Public** and **fully accessible** to visitors (15000 per year)

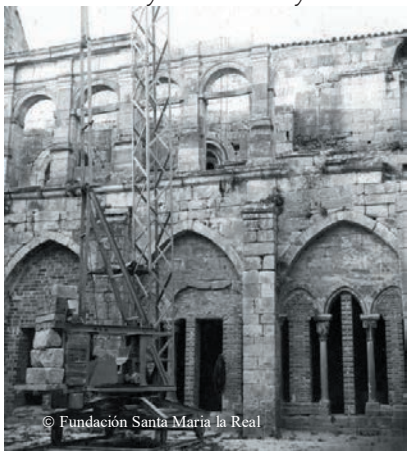
Evolution with time: general state of conservation



Current state

Conservation strategy: after a period reconstruction (1955 to 1968: returning back to the primitive medieval aspect; 1978-1984: rebuilding and reusing the space for new secular uses), preventive conservation through the monitoring of the building based on MHS (Monitoring Heritage System)

Early 20th century



Work in progress in 1960

Work in progress in 1978 using original and contemporary materials

Management: some key issues

- **Good balance** between culture and tourism;
- **Workplace of 80 persons**: contribution to local economic development;
- **Exhibition centre of the Romanesque art**: window on the surrounding territory;
- **School**: need to build classrooms and a gymnasium;
- **Hotel**: risks inherent to such an activity.

Case 6 – Lamot, BE

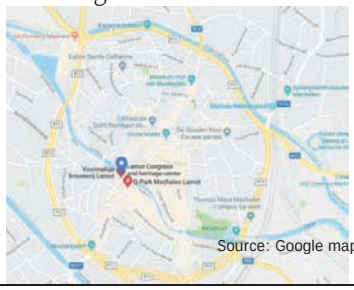
Lamot brewery
Malines (BE)
http://lamot-mechelen.be

Brief description: The site, located near the river Dijle, was one of the largest industrial areas in the old city centre of Malines. The brewery extended from 1922 to 1981 to lead to a conglomeration of several buildings. New extensions were built because of functional reasons. After the activities stopped, the buildings were restored between 2000-2005 to become a conference and heritage centre. Only one eighth of the former complex was preserved.

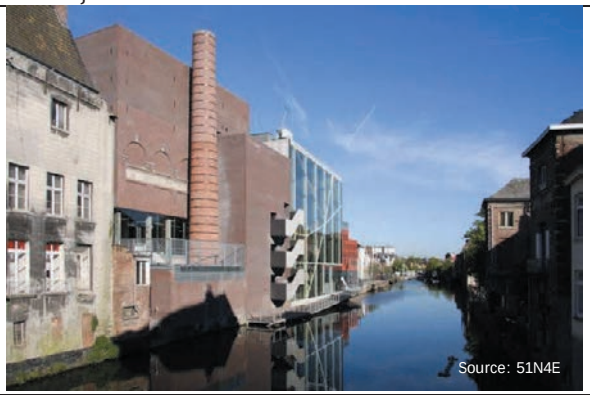
Key facts

- **One of the most daring feats of contemporary architecture** right in the heart of Malines;
- Partially authentic and in fragmentary condition;
- **Listed** (architectural inventory);
- **Public**: property of city of Malines (since 1996)
- Fully accessible to visitors

Flanders in Belgium and Malines in Flanders



Evolution with time: the façade on river Dijle



Besides the oldest part with the brewing kettles, the chimney was preserved as well. It is an important landmark for the city of Malines

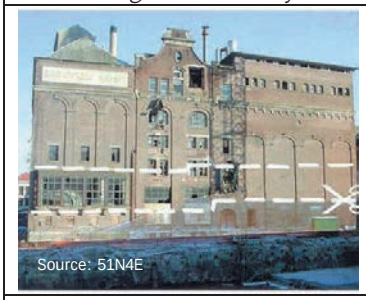
Conservation strategy: based on the value determination

Before

Parts not considered as structurally important or aesthetically interesting were destroyed.

After

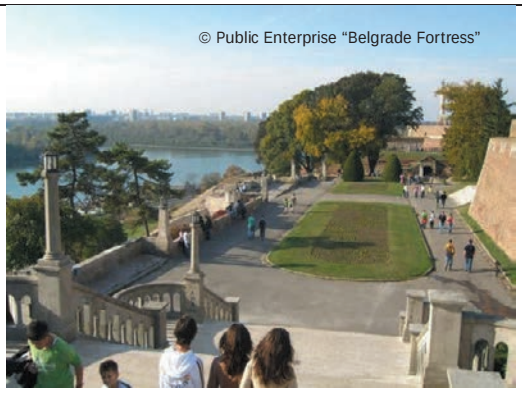
https://inventaris.onroerenderfgoed.be/erfgoedobjecten/113770



A whole level was cut away and replaced by a wall of glass with the aim to create an open space with a splendid view on the historical city centre of Malines

Management: some key issues

- Good balance between culture and tourism;
- Local urban, cultural and economic developments;
- Excellent integration of a lost city district: 2003 award 'At home in the city'.



Case 7 – Kalemegdan, RS

Belgrade fortress

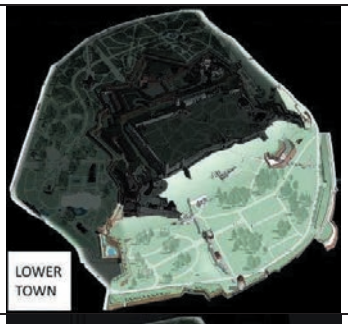
Belgrade (RS)

www.beogradskatvrdjava.co.rs

Brief description: Inhabited since prehistoric times, occupied by the Celts, conquered by the Romans, the city-fortress is located at the confluence of the Danube and the Sava rivers. Later destroyed by the Goths and the Huns, it was rebuilt by Byzantine Emperor Justinian I in 535 and remained a Byzantine stronghold until the 12th century when it fell in the hands of the newly emerging Serbian state. From then it moved from Hungarian to Serbian domination until 1521 when it was conquered by the Turks. It remained under the rule of the Ottaman Empire until 1867 with a short period of Austrian rule (1718-1738) during which the fortress was largely rebuilt and modernized. Today the fortress consists of the old citadel (Upper and Lower town) and Kalemegdan Park (Large and Little Kalemegdan).

Key facts

- **Representative** of the history of Belgrade and its periods of destruction and reconstruction
- **Medieval architecture** intertwined with **dominant Baroque elements**
- **Cultural monument of exceptional importance**
- Rather **authentic** (most constructions date from the end of the 15th century and the 18-19th periods;
- **Public** and managed by Public Entreprise 'Belgrade Fortress'
- Yearly number of visitors: estimated to 2 millions



Belgrade fortress, © Institute for the Protection of Cultural Monuments of the City of Belgrade

Evolution with time



Belgrade fortress through history: during the 15th and 16th centuries on the left, the 17th century in the middle and as it looks today on the right), © Public Enterprise 'Belgrade Fortress'

Conservation strategy: many of the current buildings were reconstructed using, when possible, materials similar to the original

During reconstruction

After

Before

After

Left: Nebojša Tower (1460) built by the Hungarians and right: Sava gate (18th century), © Public Enterprise 'Belgrade Fortress'

Management: some key issues

- A site which benefited of **reuse**;
- **Most popular** park for visitors (including locals) and **organisation** on the site of **activities of public interest** (music and cultural events);
- Important **risk** of damage due to **mass tourism**;
- Protection against flooding risks apparently covered by historic riverside ramparts (17th century).

Case 8 – Romanesque route, PT

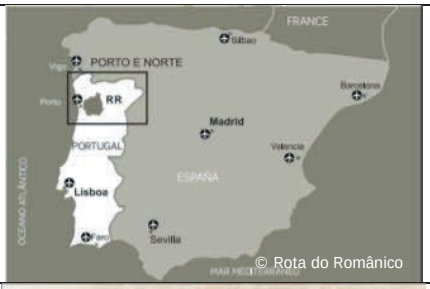
Rota do Românico

NUT III - Tâmega and Sousa / Porto Metropolitan Area (12 municipalities)
http://www.rotadoromanico.com/vEN/

Brief description: Architectural heritage of Romanesque origin initiated at the time of King D. Afonso Henriques (11th century) and pursed in the 12th and 13th centuries. The land of the valleys of Sousa, Tâmega and Douro, in the heart of the North of Portugal, played a major role in the expansion of the Romanesque style while developing its peculiar characteristics. The monuments have common traits that carry legends and stories born with the foundation of Portugal and are witnesses of the significant role that this territory formerly played in the history of the nobility and religious orders in Portugal. This heritage, structured in the Route of the Romanesque, germinated in 1998. After 10 years, it comprises three tourist circuits ("Vale do Sousa", "Vale do Douro" and "Vale do Tâmega"), distributed across the territory (1988 km^2) belonging to 12 municipalities, with a combined population of more than 520 000 inhabitants.

Key facts

- **58 public and private monuments** (churches, monasteries, bridges, towers, memorials and castle): some are urban but most are **rural and located in remote areas**;
- **Engagement of the local population** (intangible heritage);
- Managed by the **association Valsousa** which intends to take on a role of excellence in the scope of cultural and landscape touring;
- Distinguished with the **Turismo de Portugal Award 2009** and the **Medal of Touristic Merit** by the Portuguese Government in **2010**.



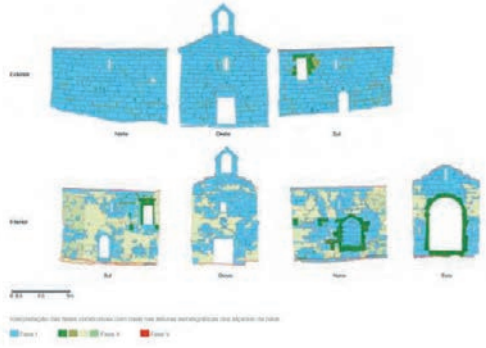
Evolution with time

Church of São Mamede of Vila Verde in 2003 (left) and after reconstruction of the church and creation of a buffer zone around the site (right)

High level of authenticity and integrity

Rural area within 'The Route of the Romanesque' (Tabuado and Mancelos Churches), © Rota do Românico

Conservation strategy: implementing maintenance plans and restoration projects to recover as much as possible the original aspect using materials and conservation techniques complying with International Heritage Charters



Documentation of the periods of construction of the church of São Mamede of Vila Verde

Ancient paintings discovered on the walls of the church, © Rota do Românico

Management: some key issues

- Strong engine of promotion of the region;
- Contribute to the sustainable development of the region (regional planning through the enhancement of the heritage, ensuring qualified employability);
- Important dissemination of knowledge, mainly through the Centre for Romanesque and Territorial Studies and the route's website;
- Still the risks of urban pressure, industrial development, new infrastructures, changes of ownership have to be tackled.


Source: https://www.vallettawaterfront.com/Overview.aspx?id=96874

Case 9 – Valletta Waterfront MT

Valletta Waterfront

Pinto stores
Floriana (MT)

Brief description: Valletta was one of the first European cities in the 16th century to be built on an entirely new site. Between 1634 – 1659, the military architect, Floriani, designed and built the extension of the fortifications of Valletta to create Floriana. Valletta was inscribed as a World Heritage Site in 1980 though Floriana and the Grand Harbour were not. Pinto stores, which are found along the waterfront of Floriana overlooking the Grand Harbour, were built under the patronage of Portuguese Grand Master Emanuel Pinto de Fonseca in 1752. The construction consisted of 19 stores stretching along the waterfront. The Knights of St John and European merchants used to unload their wares in these stores. The stores were used up to the beginning of the 20th century. During the Second World War, the central area of Pinto Stores was bombed and was left in a derelict state for a number of years until the restoration project in the early 21st century was undertaken. The restoration project consisted of the conversion of the stores into retail outlets, mainly entertainment outlets like bars and restaurants, as well as the creation of a marina that would function also as a cruise liner terminal.

Key facts

- **Preserved** and **reuse** into a public use; regeneration of the area of Valletta Grand Harbour;
- **Unique evidence** of stores built under the Knights of St John;
- Today: **listed** (2008) as a Grade 1 national monument.
- Government owned but leased to Valletta Cruise Port plc for 65 years as from November 2001.

Source: World atlas

Source: Lonelyplanet


Source: Google map

Evolution with time: neglect, war damage and present day


Source : National Archives, Rabat

Late 19th century

Post second world war, period of neglect and lack of use (source: National archives, Rabat)


Source: Cruisemapper.com

2019

Creation of Cruise Linear Terminal in front of Pinto Stores and access road behind Pinto Stores

High level of authenticity and integrity

Authenticity: The façade of the Valletta Waterfront is mainly authentic and has been restored. Part of the façade was reconstructed, copying the previous original design and hence is authentic not in so far as materiality is concerned, but in so far as the form and detail is concerned

Integrity: The integrity of the site as a whole though has suffered dramatically due to two main issues.

- The creation of the marina which is used as a cruise liner terminal has severed Pinto Stores from its context – that being the Grand Harbour.
- The creation of the road behind Pinto Stores which implied the loss of the back yards of the said structures - an integral part of the typology of the stores

Conservation strategy: restoration and reconstruction when needed

Reconstruction of the wall demolished due to war damage. The building behind the wall was not reconstructed

Management: some key issues

- Site under the responsibility of the Valletta Cruise Port which manages the Valletta Waterfront and the Valletta passenger terminals: direct link with the use of the Valletta Waterfront and the passenger terminals.
- **Balancing culture versus tourism**: the balance between culture and tourism tends to always be difficult. In this particular scenario the management is responsible for both the passenger terminals, which includes cruise liners, as well as the management of the Valletta Waterfront which is a cultural heritage site.

Annex B – Questionnaire for Good Practices in Heritage Buildings' Management

This annex presents the Questionnaire for Good Practices in Heritage Buildings' Management…

Section 1	Section 2	Section 3	Section 4
Id of Heritage Building	Research data	Management of HB	Use and social impact of HB

ID of Heritage Building

Name of heritage building:

Enter name...

Type of heritage building:

Archaeological Site

Subtype of heritage building:

Please select one of subtypes below or enter your own.

Select subtype

Enter subtype...

Spatial context:

- ○ **Urban**
- ○ **Rural**

Condition of heritage building:

- ○ **In function**
- ○ **Not in function**

Conservation condition of HB:

- ○ **In good condition**
- ○ **Requires minor renovations**
- ○ **Requires significant restoration**
- ○ **In ruins**

Level of protection:

(UNESCO World Heritage list, National Heritage List etc.)

- ○ **Yes**

Enter category:

From date:

- ○ **No**

Unique Reference Number of HB:

- ○ **Yes**

Enter number...

- ○ **Don't know / doesn't exist**

Ownership:

- ○ **Public**
- ○ **Private**
- ○ **Other**

Please explain...

Location:

Country:

Afghanistan

Municipality:

Postal code:

Enter code...

Address:

GPS coordinates - WGS84:

Longitude:

Latitude:

Altitude:

Additional details:

Photo:

If you want to upload multiple photos, please compress them in a zip file before uploading.

Pretraži... Datoteka nije odabrana.

Save file

Short Description of HB:

Here you should briefly explain form, function and from which period is HB.
For example: XY (today in ruins) is fortified, oval shaped settlement from 8th century.

Website:

Enter site...

Scientific knowledge of Heritage Building

Should be edited by experts in field - art historians/archaeologists

1. Available research data

☐ **Structural analysis**

Where and when was published and/or where is stored?

☐ **Spatial context analysis**

☐ **Historical sources**

☐ **Preliminary sources**

(data collection, aerial survey, ground-penetrating radar (GPR) analysis etc.)

Please explain...

☐ **Archaeological excavation**

When and who?

☐ **Laboratory analysis**

(mortar analysis, radiocarbon dating, chemical analysis, petrographic analysis etc.)

Please explain...

2. Detailed description of HB

(In this part the experts from disciplines such as art history, archaeology, ethnology etc. will evaluate the HB and will provide the information about the HB´s main characteristics/features, its function, current condition, placement and the level of its integration and relation with the surroundings. Furthermore, a historical analysis and context of the HB will be provided together with hypothesis about the date of construction and its chronology, and about its importance and need for historical preservation/protection.)

3. Research documentation

☐ **Archival documentation**

Enter details and/or link to document...

☐ **Architectural plans**

(Floor plans, Sketches, drawings, plans for architectural projects etc.)

Enter details and/or link to document...

☐ **Digital archiving**

(3D building models, reconstruction, ortho-imagery…)

Enter details and/or link to document...

4. Preventive conservation of HB

Previous intervention(s):

○ **Yes**

Enter details and/or link to document...

○ **No**

Previous risk analysis:

(Here you should share the information about analysis and risk assessment of deterioration as well as an evaluation of structural safety and seismic vulnerability of HB).

☐ **Internal**

Enter details and/or link to document...

☐ **External**

Enter details and/or link to document...

Maintenance plan:

(weekly, monthly, annual; example: https://www.perth.wa.gov.au/sites/default/files/documents/Maintenance%20%20Agreement%20and%20Schedule.pdf).

○ **Yes**

Enter details and/or link to document...

○ **No**

Preventive conservation plan:

○ **Yes**

○ **No**

○ **In Progess**

Monitoring the parameters of deterioration processes:

(Several experts from different disciplines need to be included (biologists, geologists, environmental engineers, chemists, architects, experts for the illumination and drainage system, etc.) next to the experts from the fields of art history and archaeology.)

○ **Yes**

Who, in what way, explain...

○ **No**

5. Restoration/reconstruction of parts of HB

Level of intervention:

- **Minimum**
- **Intermediate**
- **Extensive**

Preservation of elements from original structure:

- **Yes**
- **No**

Renewed structure solutions compatibility with original ones:

- **Yes**

Describe...

- **No**

Materials compatibility (visual appearance and physical properties):

- **Yes**

Describe...

- **No**

Visible substitution of materials:

- **Yes**

Describe...

- **No**

6. Restoration

Scale is from 1 (low) to 5 (high)

Level of risk and threat assessment: 3

Expected durability of renewed structure/s: 3

Depending on the environment/external factors

7. Re-use of HB

Restoring the old function:

- ○ **Yes**

Describe which function...

- ○ **No**

New uses of HB:

- ○ **Yes**

Describe...

- ○ **No**

Social role:

- ○ **Yes**

Explain...

- ○ **No**

Management of HB

1. Financial resources

(example: http://www.europanostra.org/wp-content/uploads/2017/04/7ME-2013-EIBI-HeritageFundingOverview.pdf)

☐ **Loans**

Please enter details...

☐ **Public funding from national/regional/local sources**

Please enter details...

☐ **Private funding sources**

Please enter details...

☐ **Public-private partnership**

Please enter details...

☐ **European Grant Funding sources**

- ○ **Within the EU**
- ○ **Outside the EU:IPA**

☐ **Other Grant Funding sources**

(The EEA and Norway Grants, Swiss Financial Mechanism…)

Which?...

☐ **Sponsoring/donations**

☐ **Fundraising (crowdfunding)**

2. Economic benefits of exploiting HB

Self-sustainable

- ○ **Yes**
- ○ **No**

Economically profitable:

- ○ **Yes**
- ○ **No**

3. Presentation of HB

☐ **Website**

☐ **Social media**

☐ **Audio guide**

☐ **Tour guide**

☐ **Guidebook**

Other:

Describe...

4. Promotion of HB

Scale is from 1 (negative) to 5 (positive)

Use of social networks: 3

Educational/promotional materials: 3

Mass media presence: 3

Agreements with third parties: 3

(co-operation with other cultural entities, participation in different cultural/HB networks)

Promotion of HB together with its spatial (urban/rural) context: 3

5. Technical support

Scale is from 1 (negative) to 5 (positive)

Network monitoring: 3

Use of new techonlogies: 3

Use and social impact of HB

1. Visiting Heritage Building

Please evaluate your experience on scale from 1 (negative) to 5 (positive)

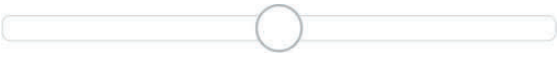
Opening hours: 3

Facilities: 3

Interactive approach: 3

Emergency planning and operations: 3

Overall experience: 3



2. Evaluation of indoor comfort

Please evaluate your experience on scale from 1 (negative) to 5 (positive)

Level of user/visitor comfort: 3

Comfort compromise: 3

Compromise and co-relation between comfort, energy use and preventive conservation

Smart building efficiency:

Illumination: 3

Thermal comfort: 3

Air quality: 3

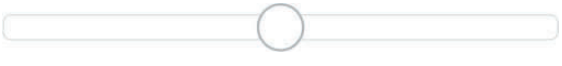
Physical security: 3

Sanitation: 3

3. Outdoor experience

Please evaluate your experience on scale from 1 (negative) to 5 (positive)

Immediate surroundings: 3



Parking: 3

4. Access for disabled visitors

Please evaluate your experience on scale from 1 (negative) to 5 (positive)

☐ **Entrances**

☐ **Lifts**

☐ **Parking for disabled people**

☐ **Accessible toilets**

5. Social participation

Please evaluate your experience on scale from 1 (negative) to 5 (positive)

Engagement of local community: 3

Program of activities: 3

Relation with stakeholders: 3

Co-operation with other HB representatives: 3

6. Social benefits of exploiting HB

Please evaluate your experience on scale from 1 (negative) to 5 (positive)

Employment growth: 3

Level of HB impact on community:

○ **Good**

○ **Bad**

○ **Neutral**

Explain...

7. Author details

Name

Enter your name...

Proffesion

Enter your proffesion...

Institution

Enter your institution...

Country

Enter your country...

Annex C – Questionnaires for The perception and social role of Heritage Buildings in modern society

This annex presents the Questionnaires for The perception and social role of Heritage Buildings in modern society …

COST TD1406 QUESTIONNAIRE #1 STAKEHOLDERS

The intention of the questionnaire is to learn about the perception of various stakeholders of the heritage buildings regarding the living and working conditions, level of protection, potential benefits, economic issues (lack of funds needed for maintenance) etc.
The results will be used only for scientific and research purposes and will help the COST TD1406 i2MHB project to develop further research strategies related to the research and protection of heritage buildings.
The questionnaire was composed by Ognjen Čaldarović, Roko Žarnić, Paulo Amaral, Jelena Behaim, Ivor Kranjec, Miljenko Jurković, tested by Ognjen Čaldarović and Paulo Amaral and approved by chair João Martins.

Thank you for your cooperation!

1. Your name

2. E-mail address

3. Name of organisation

4. Organisation headquarters (street, place, country)

5. Organisation contact (e-mail address and web page)

6. Type of organisation

Check all that apply.

- [ ] Private
- [ ] State
- [ ] NGO
- [ ] Municipal
- [ ] Administrative body
- [ ] Educational
- [ ] Industry
- [ ] Industry SME (Small and medium sized enterprise)
- [ ] Research
- [ ] Research SME
- [ ] Services
- [ ] Other:

7. Your position regarding the usage of heritage building (HB)

Check all that apply.

- [ ] Owner of HB
- [ ] Manager of HB
- [ ] Investor (corporate)
- [ ] Administrator of HB
- [ ] Mayor
- [ ] Administrative Authority (local/regional/national)
- [ ] Cultural consultant on Cultural heritage
- [ ] Technical consultant on Cultural heritage
- [ ] User of HB as an employee
- [ ] Educator
- [ ] Apprentice
- [ ] Decision maker
- [ ] Expert in heritage assessment. Education:
- [ ] Other:

7.1. If you are an expert in heritage assessment, please specify how many years of professional experience you have in this area?

- ◯ < 5
- ◯ 5 - 10
- ◯ 11 - 15
- ◯ 16 - 20
- ◯ > 20

8. How would you describe the general state of preservation of heritage buildings in your country, city, area?

Please, fill the form according to the current condition of following categories (1 – Poor, 2 – Fair, 3 – Good, 4 – Very good, 5 – Excellent)

Material

1	2	3	4	5
◯	◯	◯	◯	◯

Structure

1	2	3	4	5
◯	◯	◯	◯	◯

Usage

1	2	3	4	5
◯	◯	◯	◯	◯

Risk and hazard management

1	2	3	4	5
◯	◯	◯	◯	◯

Self-sustainability

1	2	3	4	5
◯	◯	◯	◯	◯

9. According to your opinion, what are the most important risks in the management of HBs? Please, mention three of the most important!

10. According to your opinion and/or experience, please scale the probability of following risks concerning heritage buildings!

1 (Not probable) - 5 (Very likely to happen)

Bad maintenance

1	2	3	4	5
○	○	○	○	○

Neglect

1	2	3	4	5
○	○	○	○	○

Inadequate usage

1	2	3	4	5
○	○	○	○	○

Natural hazards

1	2	3	4	5
○	○	○	○	○

Destruction caused by man

1	2	3	4	5
○	○	○	○	○

11. Please, mark the level of importance of the heritage buildings in your country, city, area!

1 (not at all important) - 5 (very important)

Cultural

1	2	3	4	5
◯	◯	◯	◯	◯

Historical

1	2	3	4	5
◯	◯	◯	◯	◯

Educational

1	2	3	4	5
◯	◯	◯	◯	◯

Local

1	2	3	4	5
◯	◯	◯	◯	◯

Archaeological

1	2	3	4	5
◯	◯	◯	◯	◯

Specific for the country

1	2	3	4	5
◯	◯	◯	◯	◯

Generating employment growth

1	2	3	4	5
◯	◯	◯	◯	◯

Generating economical activities/potential (business, tourism, conservation activities etc.)

1	2	3	4	5
◯	◯	◯	◯	◯

Creating incomes/economical resource

1	2	3	4	5
◯	◯	◯	◯	◯

Architectural significance

1	2	3	4	5
◯	◯	◯	◯	◯

Authenticity/originality

1	2	3	4	5
◯	◯	◯	◯	◯

Novelty

1	2	3	4	5
◯	◯	◯	◯	◯

Rarity

1	2	3	4	5
◯	◯	◯	◯	◯

12. What could be the most important functions of the HBs generally?

1 (not at all important) - 5 (very important)

Educational activities

1	2	3	4	5
⬭	⬭	⬭	⬭	⬭

Increasing visits and enhancing local income

1	2	3	4	5
⬭	⬭	⬭	⬭	⬭

Fostering social cohesion

1	2	3	4	5
⬭	⬭	⬭	⬭	⬭

Fostering intercultural dialogue, cultural and social inclusion and creating an atmosphere of tolerance through heritage projects or heritage institutions

1	2	3	4	5
⬭	⬭	⬭	⬭	⬭

Using heritage buildings as an instrument of social development

1	2	3	4	5
⬭	⬭	⬭	⬭	⬭

Increasing identity of local community

1	2	3	4	5
⬭	⬭	⬭	⬭	⬭

Fostering the level of interaction between heritage buildings and its surroundings

1	2	3	4	5
⬭	⬭	⬭	⬭	⬭

13. **According to your opinion, what are the three most important characteristics of this specific heritage building, regarding quality, regardless of the present state of conservation?**
For example: “One of the most important Romanesque churches, but in ruins.”

14. **According to your opinion, what could be done to improve certain aspects of this particular heritage building?**
(e.g. maintenance, financial management, public presentation of the monument...)

15. **What is your opinion on national heritage preservation policy in your country?**

Date

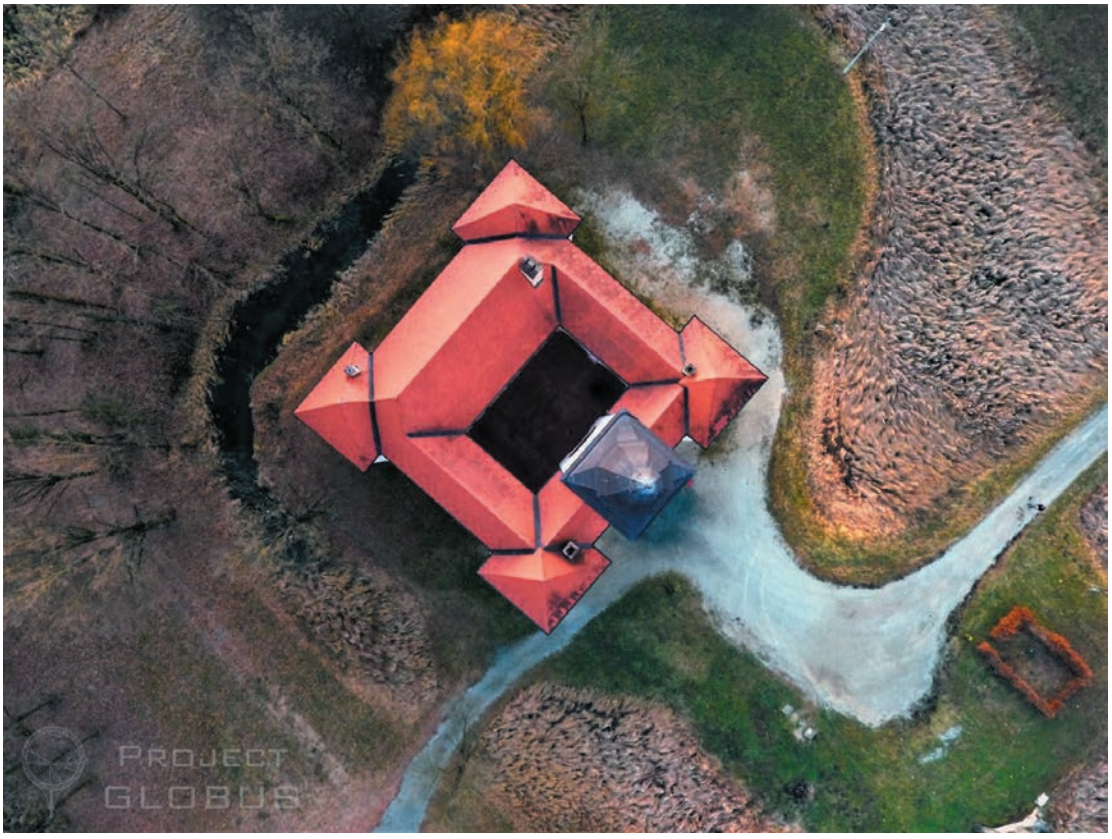
Example: 15 December 2012

Thank you for your cooperation!

COST TD1406 QUESTIONNAIRE #2 HERITAGE BUILDING OWNERS AND RESIDENTS

The intention of the questionnaire is to learn about the perception of the owners and/or residents of the heritage buildings regarding the living conditions, level of protection, benefits, economic issues
(lack of funds needed for maintenance) etc.
The results will be used only for scientific and research purposes and will help the COST TD1406 i2MHB project to develop further research strategies related to the research and protection of heritage buildings.
The questionnaire was composed by Ognjen Čaldarović, Roko Žarnić, Paulo Amaral, Jelena Behaim, Ivor Kranjec, Miljenko Jurković, tested by Ognjen Čaldarović and Paulo Amaral and approved by chair João Martins.

Thank you for your cooperation!



1. Name and surname

2. E-mail address

3. Gender

- Female
- Male
- I prefer not to answer

4. Age (optional)

- 20 - 25
- 26 - 35
- 36 - 45
- 46 - 55
- 56 - 65
- over 65
- I prefer not to answer

5. Education level

- Primary
- Secondary
- University

6. Heritage building name

7. Heritage building location (street and number, town, country)

8. Type of heritage building

- Complex of buildings
- Freestanding building
- Part in heritage building

9. Approximate size of heritage building (in square meters)

10. Formal protection

- ◯ Not listed, but with historical importance
- ◯ Listed building (UNESCO, National list, etc.)

If your HB is listed, please specify!
(UNESCO, National list, etc.)

_____

11. Brief description of heritage building

_____

_____

12. Your relation to heritage building
Check all choices that apply.

- ☐ Owner of HB
- ☐ Manager of HB
- ☐ User of HB as an employee
- ☐ User of HB as a resident
- ☐ Other: _____

13. How many years have you been responsible for, or have lived in heritage building?

_____

14. According to your opinion, what are the three most important characteristics of this specific heritage building, regarding quality, regardless of the present state of conservation?
For example: “One of the most important Romanesque churches, but in ruins.”

_____

_____

15. Current stage of usability of this HB?

- ◯ Well maintained
- ◯ Limited damages that do not affect the stability of structure, but decrease its level of comfort
- ◯ Serious damages that affect the stability of the structure and limit the usage of HB

16. Does your economic situation allow you adequate HB maintenance?

- ◯ Yes
- ◯ No
- ◯ Depending on the current stage of preservation of the HB and the necessary cost for maintenance

17. If yes, to which extent?

Check all that apply.

- [ ] Regular maintenance
- [ ] Extended maintenance
- [ ] Fundamental investment maintenance

18. Are you interested to continue to live in this heritage building?

- ◯ Yes
- ◯ No
- ◯ Maybe if I acquire help from the municipality/responsible institution to repair it

19. What is your opinion about the national heritage preservation policy in your country/city?

- ◯ Kind and supportive to owners and users of heritage buildings
- ◯ Neutral and not interested for the needs of the owners and users of heritage buildings
- ◯ Non-supportive to owners and users of the heritage buildings

20. Regarding the level of protection of your HB (national/local-regional) please answer one of the following questions:

	Technical	Tax reduction	Safety and security free-of-charge services	Offering various financial support mechanisms needed for the maintenance	Investment in heritage buildings
Which kind of support from the NATIONAL authorities responsible for heritage preservation would you need and expect?	☐	☐	☐	☐	☐
Which kind of support from the LOCAL/REGIONAL authorities responsible for heritage preservation would you need and expect?	☐	☐	☐	☐	☐

21. Can you write down the list of three major problems associated with living in the heritage building?

_____

_____

_____

_____

22. Do you mind the tourists visiting the building you live in?

- [ ] Yes
- [ ] No

23. I think the visits of tourists should be reduced.

- [ ] Yes
- [ ] No
- [ ] I do not mind

24. Do you feel that you have some privileges living and/or using this heritage building? If yes, please state the three most important!

_____

_____

_____

_____

_____

25. Do you want to be interviewed by an authorized member of the COST TD1406 Action?

- [ ] Yes
- [ ] No

Date of completed questionnaire

_____

Example: 15 December 2012

Thank you for your cooperation!

COST TD1406 QUESTIONNAIRE #3 GENERAL PUBLIC

The COST i2MHB (Innovation in Intelligent Management of Heritage Buildings) WG4 pilot survey research is oriented to collect opinions and perceptions of the visitors of the heritage buildings. We hope that we'll get new inputs concerning the rehabilitation, maintenance and intelligent management of the heritage buildings. Please fill this questionnaire and help us to come closer to the right decisions! The collected data will be used only for the purpose of this professional and scientific research!

All respondents are treated as anonymous subjects. Increased knowledge of participants in this research will help the professionals and local leaders to develop more meaningful ways of intelligent management of heritage buildings. Please, read carefully the questions and answer to them sincerely and completely.

The questionnaire was composed by Ognjen Čaldarović, Isidora Karan, Olga Kvasova, Paulo Amaral, Jelena Behaim, Ivor Kranjec, Miljenko Jurković, tested by Ognjen Čaldarović and Paulo Amaral and approved by chair João Martins.

Thank you for your cooperation!

1. In your opinion, heritage buildings (HBs) are generally to be considered of:

- [ ] Universal value
- [ ] National value
- [ ] Regional value
- [ ] Local value
- [ ] All of them (Universal, national, regional, local)

2. In your opinion, how important are HB in your country?

- ◯ Very
- ◯ Of medium importance
- ◯ Not important

3. Why do you think the heritage buildings are important in your country?

Please, choose up to 3 answers!

- [ ] They provide national identity
- [ ] They provide the sources for community identification
- [ ] They provide continuity between past, present and future
- [ ] They bring economic development
- [ ] They promote cultural values

4. Do you think that heritage buildings in your country/region are primarily of:

Please, choose up to 3 answers!

- [ ] Architectural value
- [ ] Historical value
- [ ] Cultural and educational value
- [ ] Social value
- [ ] Archaeological value
- [ ] Tourist interest

5. Please rate your knowledge about heritage buildings in your country!

- ◯ I have little knowledge
- ◯ I have reasonable knowledge
- ◯ I am an expert in HBs

6. The most common heritage buildings in your region are:

- [ ] Heritage buildings/ruins in urban areas
- [ ] Heritage buildings/ruins in landscape

7. In your opinion, what is the main role of heritage buildings in your area?

- ◯ To promote local architectural and urban values
- ◯ To promote history
- ◯ To promote local traditional and cultural manifestation
- ◯ To promote tourism in the area
- ◯ To promote local culture
- ◯ Other: _____

8. Heritage buildings in your area contribute very much to the well-being of your local community.

- ◯ I do not agree at all
- ◯ Not agree
- ◯ Not sure, cannot decide
- ◯ Agree
- ◯ Agree completely

9. Have you visited any heritage building in the last six months in your country or abroad?

- ◯ Yes
- ◯ No

9.1. For those who answered "Yes" what type(s) of heritage building have you visited?

Please, check all that applies!

- ☐ Cultural buildings (museums, theaters, concert halls, etc.)
- ☐ Historical sites
- ☐ Religious buildings
- ☐ Archaeological sites
- ☐ Memorials and monuments
- ☐ Other: _____

9.2. What was the reason for of your visit?

- ☐ Important cultural event
- ☐ Personal experience (educational purposes, etc.)
- ☐ I came as a tourist
- ☐ I live nearby

10. What is your impression about the way heritage buildings are protected in your area?

- ◯ Not satisfied at all
- ◯ Not satisfied
- ◯ So-so
- ◯ Satisfied
- ◯ Completely satisfied

11. According to your opinion, who are the important actors involved in the protection of heritage buildings in your area?

Please, choose up to 3 answers!

- ☐ International organizations (e.g. UNESCO)
- ☐ National governmental institutions (e.g. Ministry of Culture)
- ☐ Local governmental institutions (e.g. City Department for Culture)
- ☐ Non-Governmental Organizations (e.g. civic organizations)
- ☐ Owners of heritage buildings (e.g. families living in heritage buildings)
- ☐ Professional associations (e.g. Heritage Conservation Society)
- ☐ I don't know
- ☐ Other: _____

12. According to your opinion, what are the main obstacles for better sustainable protection of heritage buildings in your area?

Please, choose up to 3 answers!

- ☐ There are no obstacles
- ☐ Lack of legal framework for protection
- ☐ Low public awareness of the values of heritage buildings
- ☐ Lack of knowledge and skilled professionals
- ☐ Lack of economic funds
- ☐ Gaps in the implementation of the management plan for protection
- ☐ Real estate pressures
- ☐ Mass tourism

13. What do you think could primarily contribute to better care and sustainable protection of heritage in your area?

Please, choose up to 2 answers!

- ☐ Local government / local administration
- ☐ Civic actions
- ☐ Public policies oriented towards preservation
- ☐ I do not know
- ☐ Other: _____

14. What type of activities could contribute to better care and sustainable protection of heritage buildings in your area?

Please, choose up to 3 answers!

- [ ] Educational activities (guided tours, school activities - inside/outside, etc.)
- [ ] Exhibitions and lectures on heritage buildings
- [ ] Promotion by printed resources (e.g. newsletters)
- [ ] Promotion on different kinds of media
- [ ] Talks, discussion and informal events
- [ ] Festivals
- [ ] Civic actions

15. Are you personally involved in any kind of activities related to heritage buildings protection?

- ◯ Yes
- ◯ No

16. Is your community active in organizing events which are involving heritage buildings?

For example, folk arts and crafts fairs, concerts, festivals etc.

- ◯ Yes
- ◯ No

16.1. If your answer is "Yes", please explain what kind of activity?

17. Do you have any suggestion on how to contribute to better care of heritage buildings?

18. Gender

- ◯ Male
- ◯ Female
- ◯ I prefer not to answer

19. How old are you?

- ◯ 15 - 17
- ◯ 18 - 30
- ◯ 31 - 45
- ◯ 46 - 60
- ◯ 60+
- ◯ I prefer not to answer

20. What is your country of permanent residence?

_____

21. What is your educational level?

- ◯ Primary education
- ◯ Secondary education
- ◯ Bachelor or equivalent level
- ◯ Master or equivalent level
- ◯ Doctoral or equivalent level

22. Are you employed?

- ◯ Yes
- ◯ No

23. What is your primary relation to heritage buildings in your daily life?

Please, choose up to 3 answers!

- ☐ I own a heritage building and I live in it
- ☐ I own a heritage building, but I do not live in it
- ☐ I live in a heritage building, but I do not own it
- ☐ I live in the close proximity of the heritage building(s)
- ☐ I work in a heritage building
- ☐ I am a specialist in heritage buildings
- ☐ I enjoy visiting heritage buildings/sites
- ☐ I have no relations to heritage buildings

Date of completed questionnaire

_____

Example: 15 December 2012

28. **Thank you for your cooperation! Please, feel free and add your opinions concerning the topic!**

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ISBN 978-953-8250-04-0