Deliverable number	D6.2
Title	**Regional studies[1]** **(Spain/Catalonia, Greece/Thessaloniki, Cyprus)**

Due date	25 January, 2019
Actual date of delivery to EC	6/2/2019

Included (indicate as appropriate)	Executive Summary	☒	Abstract	☐	Table of Contents	☒

Beneficiary Responsible:

Universidad Pompeu Fabra (UPF),
Dept of Humanities / Dept of ICT ,
Roc Boronat, 138 / 08018 Barcelona
Spain

Georgios Giannoulis Giannoulopoulos
georgios.giannoulis@upf.edu
(0034) 638950714

---

[1] *A partner from Croatia was envisaged in the early stages of proposal writing but was not involved in the final consortium. Therefore funding was not been allocated for a study in this region. However, the word "Croatia" remained by mistake in the technical annex. In fact, the studies cover the only 3 Mediterranean regions of the project as specified in DoA.*

Partner responsible for deliverable	UPF
Deliverable author(s)	Georgios Giannoulis Giannoulopoulos, Laia Pujol, , Ricardo Collins, Marinos Ioannides, George Papagiannakis
Deliverable version number	Resubmitted following rejection at Year 2 review

Dissemination Level	
Public	☒
Restricted to other programme participants (including the Commission Services)	☐
Restricted to a group specified by the consortium (including the Commission Services)	☐
Confidential, only for members of the consortium (including the Commission Services)	☐

History:

Change log			
Version	**Date**	**Author**	**Reason for change**
0.1	15.1.2018	Georgios Giannoulis Giannoulopoulos, Laia Pujol, , Ricardo Collins, Marinos Ioannides, George Papagiannakis	First draft
0.2	20.09.18	As above	Following review
0,3	22.09.18	Rob Davies	Internal review/edit
0,4	5.10.18	Afroditi Kamara	External review
Draft Final	10.10.18	Georgios Giannoulis Giannoulopoulos	
Resubmission draft 0.1	05.02.19	Georgios Giannoulis Giannoulopoulos	
Resubmission draft 0.2	05.02.19	Rob Davies	Internal review/edit
Draft final	07.02.19	Georgios Giannoulis Giannoulopoulos	

Statement of originality:
This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

Table of Contents

1. EXECUTIVE SUMMARY

Deliverable 6.2 is the second step of an extended study, covering 3 regions in three EU countries - Greece, Spain and Cyprus – which have passed through a deep economic and social crisis during recent years. The study aims to analyse the relationship between the objectives of institutional policies through the development, support, and implementation of digital cultural projects, and their economic and social impact in various sectors.

The 3 (three) Mediterranean regions have been defined and outlined in the D6.1 where a first approach concerning the institutional and economic regional framework in the macro level was also presented, together with an initial exploration of possible sources and examples, from which a selection is made for deeper analysis and study within D6.2 according to their exemplarity, the availability of data and personnel and the potential to derive further conclusions about the general effectiveness of policies and to and propose improvement actions.

More concretely in D6.2. the Micro Macro analysis approach originally developed in D6.1 has been used a a method and adapted in order to meet the objectives of the current deliverable as presented in detail in the section 2.2 STRUCTURE AND APPROACH OF THE DOCUMENT.

In the current document, D.6.2 the focus at the macro level has moved from sectors and overall economic indicators of the regions (D6.1.) to the institutional and economic framework within which Digital Cultural Heritage (DCH) projects are conceived, designed, implemented and operated and to the socio-economic impact issues.

For that purpose, the study has identified the laws and regulation as well as the public policies that actively or passively influence, improve, motivate or create obstacles in the penetration of digital cultural actions of various types in institutions, economies and societies.

A part of this framework covers a wide range of fields (research, donation, tax system, education, tourism, urban and territorial policies, general cultural policies) where digital projects fit, take advantage of provisions, or find obstacles.

Another part focuses on specific policies and actions of the institutional players in the 3 regions, targeting the DCH opportunities and support, under cultural, tourism, or technology policies.

The document presents the relevant legal and policies framework along with an institutional analysis of the public agencies responsible for each one. With that purpose in mind, a map has been created for each region of the institutions involved with responsibilities affecting DCH penetration support and operation, including the National, regional and Local Authorities and public agencies as well some important NGO not for-profit agencies, their responsibilities and overall objectives.

The institutional and legal framework (or in some cases absence on some issues) is critically presented, based upon results of DCH, taking into account also the main economic and social characteristics of the regions, the effects of the recent economic crisis and subsequent recovery, the strong touristic orientation of their economies, and the trends of over-concentration of tourism flows and visitors in some areas/cultural assets, while others remain less valorised.

The macro level analysis for the 3 regions is presented in similar format, adapted to the actual differences of the regions, in the section on the MACRO APPROACH: INSTITUTIONAL AND LEGAL FRAMEWORK AND POLICIES.

In each of the regions, opportunities and problems or lacks emerging form the macro analysis have been identified in each law or policy and the overall conclusions are presented at the end of the respective chapter for each region.

At the Micro level, the focus has been moved in this deliverable from the mapping of examples demonstrating the diversification of the digital applications in the territory and their variety in the interlinking with various economic sectors, to a new approach: in-depth analysis of some representative cases, selected for their

diverse technological, operational, regional, data availability features and their particular economic and social interest. These cases are examined as far as it is possible from the point of view of information available in the 4 phases of their creation: idea/concept generation, design, implementation operation. The study identifies and critically presents the stakeholders, the decision makers, the institutional and funding framework, the operational and impact environment for each case, linking and illustrating the opportunities, the incentives for effectiveness and the achievement of impact objectives set by policy makers at the macro level. It also provides clues about the sustainability issues and raises important questions concerning business planning, and the necessary social investment in DCH, along with wider public and private sector participation (ideas, support, volunteering, donations, income generation opportunities for DCH owners) in the design, implementation and operation of DCH projects - and the respective limitations.

All Micro level cases are presented in the section MICRO LEVEL APROACH REPRESENTATIVE CASES IN THE 3 REGIONS of the study , separately for each region, using appropriate tables and conclusion schemes. In each one of the micro cases, the study identifies important issues linked with the DCH owner, the other stakeholders and the socioeconomic environment and technologies. Each partner has drawn up conclusions and raised questions based upon these micro cases concerning its own region concerning policy priorities, achievements, impact, obstacles opportunities and lacks.

Finally in the section OVERALL INTERREGIONAL CONCLUSIONS AND PROPOSED POLICY MAKING AND ROADMAP ACTIONS, the study summarises some of the issues which emerged in the 3 regions in the macro and micro analysis, and which appear to be of outstanding importance and/or present significant opportunities for new policy making decisions at the organizational level, for impact measurement or for sustainable and cost effective DCH projects. It also identifies the most challenging areas where technology could provide new solutions, particularly in tourist flow distribution and content, informative and emotional immersion of visitors, in-house impact and satisfaction measurement and evaluation, social and economic impact measurement and increase of private / citizenship participation, among other issues.

The study provides also a base of extensive resources information and references, as well opening a number of new questions that could be of significant use for other approaches, and for future research on economic development and cultural heritage in periods of crisis, affecting economies with high dependence on tourism, multiplier effects and return issues, new methods of impact and return calculation in cultural investment and the digital coefficient, tourist and cultural management efficiency and methods etc..

2. INTRODUCTION

2.1 ROLE OF THIS REPORT IN THE PROJECT

As foreseen in the Description of Activities (DoA), WP6 will extend the outcomes of ViMM as far as possible to influence thinking and policies for economic growth, by creating realistic exemplifications in areas of Europe, in particular example regions of Greece, Spain, and Cyprus, in order to illustrate in practical terms, the benefits to be gained in specific target sectors of demand such as smart cities, creative industries, tourism, education and research and management.

The overall objective is to map the institutional policies and the landscape of the various sectors involved in digital culture in the three (3) regions within a comparative study, together with their objectives and impact on growth, social and economic development.

The study of the DCH role in 3 regions aims at providing transferable conclusions in Europe concerning policy making and priorities based on real regional cases and analysis, particularly studying the relationship between policies, cost effectiveness of the investment of DCH, and impact in the society and the regional intersectoral economy.

D6.2 is based upon the sectoral analysis in D6.1 and DCH mapping in the 3 regions, where the sectors and the possible sources of information have been identified and the general methodology of a macro and micro approach has been developed.

Within D6.2 the micro-macro approach has been further developed and adapted in order move the focus from the sectors to the to study the institutional / legal framework and policies in the 3 regions concerning DCH and on the other hand to analyse and extract conclusions from exemplary cases concerning the effectiveness of these policies.

The work of D6.2 takes advantage also of the work effectuated within WP6 task 2, the four (4) stage Decision Making Process (DMP), using this method in order to question the sources (professionals and documents) addressing the issues at each stage separately. Because of its experimental nature at this point, this approach is confined to the study in Spain and to where this kind of information was available.

Finally, the D6.2 conclusions have provided input and documentation concerning the ViMM Roadmap propositions and priorities, based on the study of real regional cases of Digital Cultural heritage, policies, difficulties, achievements, obstacles, achievements and impact.

The input to the process of creating the ViMM Manifesto and Roadmap has been continuous throughout the various stages of the work and finally is resumed in the conclusions of the current document.

2.2 STRUCTURE AND APPROACH OF THE DOCUMENT

This deliverable is structured according to studies and approaches in the 3 different Mediterranean regions. All of them are following a macro- and micro- analysis concept. However, each one has used its own methodology, because of actual differences in

The size, of each area studied, and its particularities: Catalonia/Spain is a large region, with various levels of central, regional and local administration, and various institutions and policies involved in culture, tourism and digital culture. Thessaloniki/Greece is an exemplary urban centre, under a process of touristic, urban and development and valorization of its own cultural assets. Cyprus is a touristic island, with important cultural assets, a simpler institutional structure, undergoing a development process in the field of digital cultural heritage during the last few years. All areas are Mediterranean, with important cultural assets, and significant development and tourism potential, emerging from a long period of economic crisis, the different levels of penetration of Digital heritage technologies in each case region, and finally the availability of accessible primary data produced by quantitative and qualitative surveys studies in each region
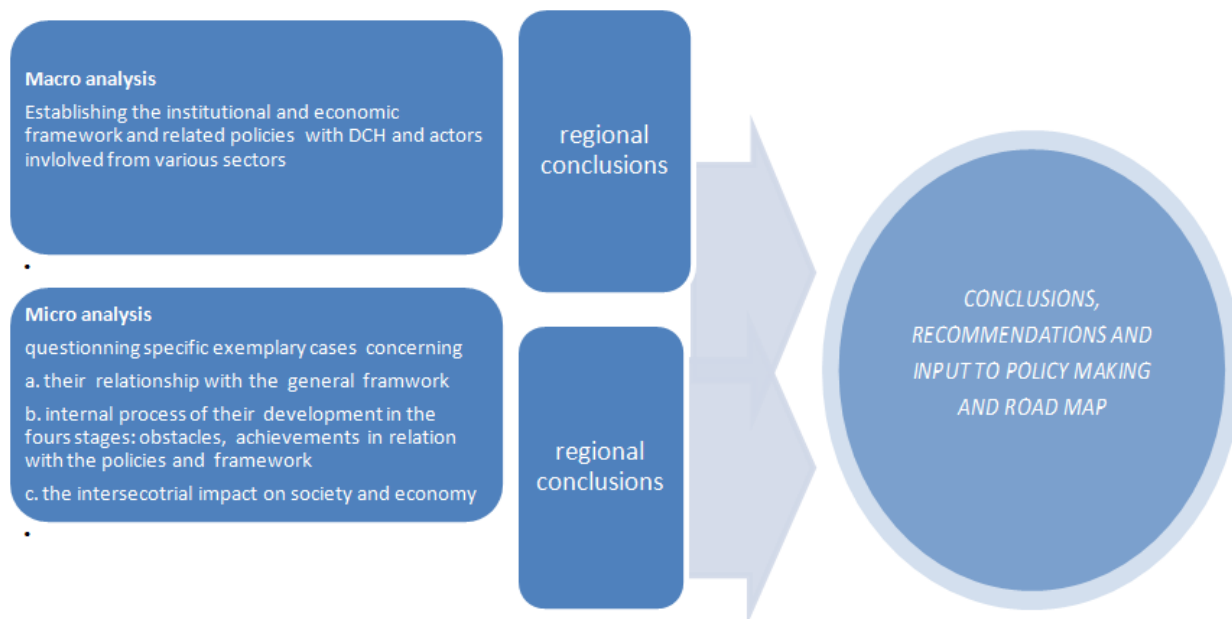
The Micro-Macro approach

The objectives were established, taking also into account the conclusions of the report "Cultural Heritage Counts for Europe study" (CHCfE project/2015). The more general holistic approach of CHCfE, has been adapted in at a more practical and concrete regional level, within the micro-macro concept in order to archive the following objectives in order to support evidence-based policy making [2].

The objectives are common to all three studies:

- to extract valid conclusions on the effectiveness of policies through DCH projects, in terms of regional and local development, the impact and/ or interlinking with various other sectors (tourism, technological and humanities research, education sector, intelligent urban development, community development) and to identify positive effects and difficulties or areas for improvement.

- to identify critical issues related with risks/obstacles or achievements within the implementation of digital projects, in the (four) 4 phases of the project cycle as identified in the Decision-Making Process already elaborated by ViMM: a. Idea creation, b. Design and planning, c. Implementation, d. Operation / evaluation

- to propose policy actions and recommendations for stakeholders in order to improve effectiveness of the resources allocated in order to achieve sustainable operation, increase resource availability and improve the multiplier impact and engagement in the local economy and society.

3. MACRO APPROACH: INSTITUTIONAL AND LEGAL FRAMEWORK AND POLICIES

3.1 REGIONAL CASE 1 – MACRO APPROACH : SPAIN / CATALONIA

General objectives

To analyze the relationship between public policies on the development of digital technologies applied to cultural heritage and their impacts on society and economy.

Specific aims

To identify the key actors involved in the management of cultural heritage in Catalonia, with a particular focus on technology and cultural heritage.

To analyze the management processes and challenges faced by museums and interpretation centers when developing digital tools for heritage management, preservation, accessibility, promotion and valorization in order to "conciliate diverging objectives of the involved organizational and social actors in each stage"[3] .

To explore the current state of studies and analysis of the social impacts generated by the use of digital technologies in the cultural heritage.

Key study questions

Q1. Which are the main public policies that (directly or indirectly) affect the development of digital technologies in the cultural heritage in Catalonia?

Q2. How does the incorporation of new technologies affect the overall museum objectives and operation?

Q3. What are the main axes of the socioeconomic impact at a local level of the usage of innovative technology in cultural heritage?

Purpose

To contribute to decision making in cultural and economic policies, through the analysis of real cases, in order to illustrate in practical terms, the benefits that will be obtained in specific demand sectors, such as smart cities, creative industries, tourism, education and research.

Methodology

The approach is based upon quantitative and qualitative data analysis, based on existing information and studies, the institutional framework and the body of relevant laws and regulations; as well as on interviews with stakeholder professionals in order to understand and analyze the impacts of public policies in the introduction of digital technology in cultural heritage institutions and its interaction with users, the local community and the tourism sector.

The primary goal of the qualitative method is to interpret the interaction among these elements, which creates a complex structure in a specific social environment (Denzin and Lincoln 1998:3) as quoted by Vershuren (2003).

Study Method

A review is conducted of active public policies and strategies at national (Spain) and (Catalonia) level which have an impact on the management of museums, culture, tourism and regional development and growth.

Scientific articles related to the use of technologies in museums and the interpretation of cultural heritage are consulted, analyzing new paradigms in traditional museography and their repercussion in today's society.

---

[3] GEORGIOS GIANNOULIS GIANNOULOPOULOS, *(2012)* Organizational aspects of ICT applications in cultural heritage "Virtual Museum" context: the permanent challenge of reconciliation of diverging scientific, technical, operational and financial objectives., Virtual Archeology Review, Vol 3, No 7

The documentation focused on laws and strategies that represent the main public policies in each of the sectors that integrate this research (culture, tourism and technology); and that are considered to have an impact on museums and technology applied in cultural heritage interpretation.
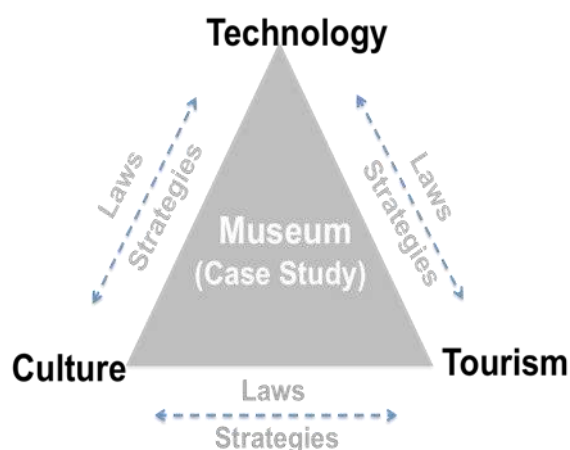
Culture tourism and technology synergy

The following are the laws and regulations analyzed in this research and that suggest the basis of public policies in Spain and Catalonia on matters of culture, tourism and technologies.

SPAIN	
Sector	**Policy**
Technology	-Law of Science, Technology and Innovation. -Spain's Strategy for Science, Technology and Innovation.
Tourism	-Spain's National and Integral Tourism Plan.
Other	-Law of Fiscal Regime of Entities without lucrative purposes and of fiscal incentives to patronage. -Law of Foundations.
CATALONIA	
Sector	**Policy**
Technology	-Strategy of Research and Innovation for the Intelligence Specialization of Catalonia (RIS3CAT).
Culture	-Law of Museums. -Plan of Museums 2030 -Law of Catalan Cultural Heritage. -National Agreement for Museums of Catalonia.
Tourism	-Law of Tourism of Catalonia. -Strategic Plan of Tourism of Catalonia 2020.

Spain and Catalonia public policies and strategic plans analysis.

Theoretical framework

The work performed took into account the definition of Digital Heritage projects generated by ViMM, resulting from the work of experts:

"A museum is defined by the International Council of Museums (ICOM) as a 'non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment'.

A virtual museum (VM) is a digital entity that draws on the characteristics of a museum, in order to complement, enhance, or augment the museum through personalization, interactivity, user experience and richness of content.

Both the 'physical' museum (PhM) and the VM share a common commitment to the institutional validation of content and quality of experience through curatorial process, inherent in the ICOM definition.

VMs perform as the digital footprint of a PhM or act independently and are committed to the public access to knowledge systems, the long-term preservation of collections and the delivery of exceptional experiences. In addition, the VM provides new opportunities for the public in ways not previously viable through the modification, experimentation and combination of collections based on the digital iteration of the analog original. Users actively participate in novel ways such as through enhanced 'presence', immersive experiences, multidirectional communication, and interactive storytelling.

A variety of actors are now welcome into the VM ecosystem where end-users interact with the museum; sharing and remixing primary and secondary resources for their own consumption and production. As user generated contributions, and new methods of co-curation evolve, appropriate sets of practices develop, managed under the umbrella of the museum as endorsed by ICOM. Traditional guidelines of validation, professional integrity and recognition of copyright are extended to sustain new kinds of creativity, while procedures are adopted to preserve both originals, and reproductions in novel curatorial scenarios.

Enabled by technical innovation, this kind of direct engagement with content changes the paradigm of the way we experience a museum. Collections are opened up for creative appropriation, shared and sharable content flows in and beyond the museum walls, and new opportunities for creative production extend the museum mandate from the pre-visit, during the on-site experience, as well as over post-visit narratives. The VM opens up compelling opportunities for inclusion and accessibility and extends the museum encounter through personal advocacy in new scenarios for life-long learning, inspiration and creativity.

Furthermore, a VM:

- *can retrieve and deliver collections to end-users in limitless, simultaneous and remote locations*

- *provide access to content that is otherwise inaccessible (in storage, lost, in private collections)*

- *combine objects across geographical distances from sister institutions or sites: in situ in remote locations, archaeological excavations, public sites and monuments.*

- *showcase objects that have no physical presence and are born digital."*
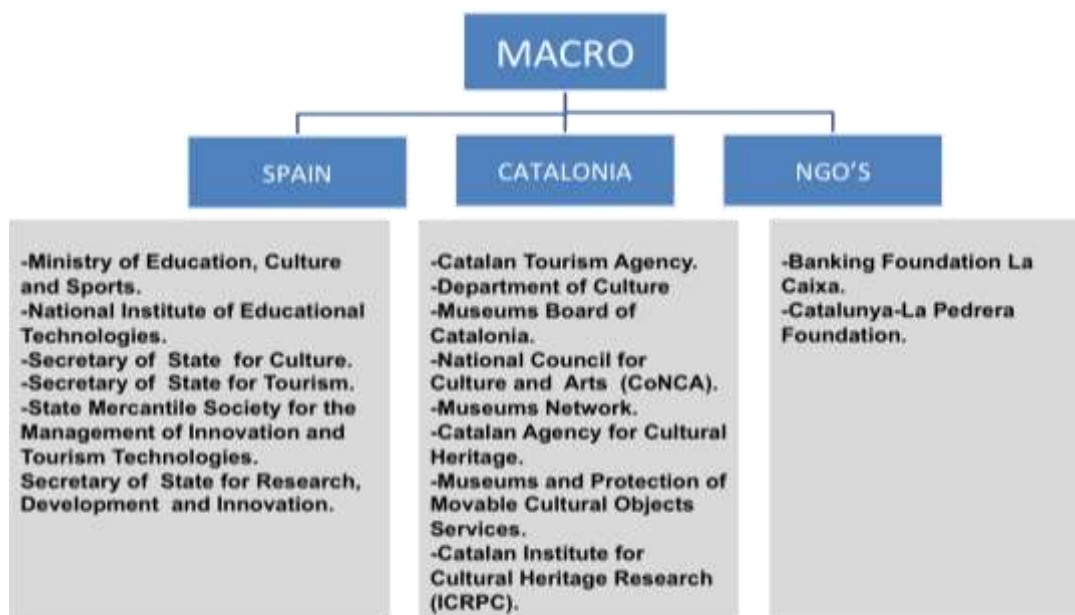
Identifying Macro and Micro level stakeholders

Stakeholders / National Level , Spain

Ministry of Education, Culture and (Ministerio de Educación, Cultura y Deporte)[4]

Its main objective is to propose and execute the government's policy on education. Among its actions are the promotion, protection and dissemination of the Spanish historical heritage, arts and state museums ...of audiovisual activities... and the promotion and dissemination of culture in Spanish.

National Institute of Educational Technologies and Teacher Training (Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado)[5]**.**It is the unit of the Ministry of Education, Culture and Sports responsible for the integration of ICT in non-university educational stages. Its objective is the development and dissemination of digital and audiovisual materials in all areas of knowledge; thereby, information and communication technologies become an ordinary instrument of work in the classroom.

Secretary of State for Culture (**Secretaría de Estado de Cultura**)[6]**.** It exercises its functions in the field of culture according to the competences of the State, as well as maintaining positive relations with the Autonomous Communities with respect to their competences in culture.

Secretary of State for Tourism (Secretaría de Estado de Turismo)[7]**.**Under jurisdiction of the Ministry of Industry, Trade and Tourism; it will carry out actions for the definition, development, coordination and implementation of tourism policies of the State.

State Mercantile Society for the Management of Innovation and Tourism Technologies.(**Sociedad Mercantil Estatal Para la Gestión de la Innovación y las Tecnologías Turísticas**)[8]**.**Reporting to the Ministry of Industry, Trade and Tourism, and attached to the State Secretariat of Tourism, it is responsible for promoting innovation

---

[4]Data from official website https://www.mecd.gob.es/portada-mecd/

[5] Data from official website http://www.ite.educacion.es/en/descripcion

[6]Data from official website http://www.mecd.gob.es/portada-mecd/

[7]Data from official website www.mincotur.gob.es/turismo/es-ES/SecretariaDeEstado/Paginas/SecretariaEstado.aspx

[8]Data from official website www.segittur.es

in Spain's tourism sector, both in the public and private sectors. It generates and manages technology, knowledge and innovation necessary to improve competitiveness, quality and sustainability in the environmental, economic and social areas of tourism.

Ministry of Science, Innovation and Universities (Ministerio de Ciencia, Innovación y Universidades)[9]. Department of the General State Administration in charge of the proposal and execution of the Government's policy regarding scientific and technological research, development and innovation in all sectors, including the direction of international relations in the matter.

Stakeholders Regional Level – Catalonia

Catalan Tourism Agency (Agencia Catalana de Turismo)[10]. An agency of the Government of the Generalitat de Catalunya in charge of developing tourism promotion projects. Its main purpose is to promote the image of Catalonia as a tourist destination.

Department of Culture(Departamento de Cultura)[11]. Responsible for the governance of cultural policies: language, heritage, libraries, cinema, popular culture, cultural industries, music and intellectual property.

Museums Board of Catalonia (Junta de Museos de Catalunya)[12]. It establishes criteria for museum policy coordination and fosters relations between Catalan museums and the rest of the state.

National Council for Culture and Arts (CoNCA) (Consejo Nacional de la Cultura y las Artes)[13]. Public organization whose mission is to ensure the development of cultural and artistic activity in Catalonia.

Museums Network (Red de Museos)[14]. The Museums Network are thematic and territorial support structures within the Museums System of Catalonia. They are created in order to encourage cooperation between the different museum centers, to achieve greater efficiency of resources and organize services of economies of scale for the set of Catalan museums.

Catalan Agency for Cultural Heritage. (Agencia Catalana para el Patrimonio Cultural)[15]. Its mission is to manage the cultural heritage of the Generalitat, with criteria of integrity, sustainability and efficiency. It seeks to promote training, research and knowledge transfer in all areas of cultural heritage, and the incorporation of information and communication technologies in the management and information on cultural heritage.

Museums and Protection of Movable Cultural Objects Services (Servicios de Museos y Protección de Bienes Muebles). It is responsible for the implementation and control of the museum policy, the coordination of the Museums System of Catalonia and the promotion, monitoring and evaluation of the Museums of Catalonia Plan. Among its functions is to design and promote plans and programs relating to the General Directorate of Cultural Heritage in terms of documentation, conservation, restoration and dissemination of personal property.

The Catalan Institute for Cultural Heritage Research -ICRPC (Institut Català de Recerca en Patrimoni Cultural)[16]. Created by the Generalitat of Catalonia and the University of Girona, aims to undertake cultural heritage research that contributes to society, and Catalan society in particular, by providing analyses of its historical and cultural heritage, and its current and future social relations.

Stakeholders – NGOs (indicative)

Banking Foundation La Caixa (Fundación Bancaria La Caixa)[17]. The Banking Foundation Caja de Ahorros y Pensiones de Barcelona, "La Caixa", is the result of the transformation of the Caixad'Estalvisi Pensions in

---

9 Data from official website www.ciencia.gob.es
10Data from official website act.gencat.cat/
11Data from official website http://cultura.gencat.cat/
12Data from official website http://web.gencat.cat/ca/generalitat/cercador_organismes/index.html?codInf=2767
13Data from official website http://conca.gencat.cat/
14Data from official website
http://cultura.gencat.cat/ca/departament/estructura_i_adreces/organismes/dgpc/temes/museus/museus-de-catalunya/xarxes-de-museus/
15 Data from official website http://patrimoni.gencat.cat/
16Data from website http://icrpc.cat/
17 Data from website
https://www.fundacionbancarialacaixa.org/informacioncorporativa/informacioncorporativa_es.html

Barcelona, "La Caixa", in Banca Foundation "La Caixa"; in compliance with the Law on Savings Banks and Banking Foundations, of December 27, 2013.From its origins, "La Caixa" was characterized by a strong social commitment and vocation to work in favor of the general interest, both through its financial activity and its social work; which finances and maintains social, educational, cultural and scientific activities. During 2017 it had a budget of 510 million euros for social impact projects, being the most important banking foundation in Spain and one of the most important worldwide.

Foundation Catalunya - La Pedrera[18]**.** Born on January 1, 2013 to respond to a new social reality, undertaking projects that impact different sectors such as cultural, gastronomy and tourism. Its most outstanding activity, which gives its name to the entity, is the management and tourist and cultural exploitation of Casa Milà, a modernist building designed by Antonio Gaudí and popularly known as La Pedrera; they were also the managers and current administrators of the tourist project of Mon Sant Benet, a complex integrated by a monastery, hotel, restaurant and meeting center. Additionally, it houses an outstanding culinary project of the Alicia Foundation.

Public body's classification and status

Body of regulations

State agencies

According to the legal nature of government institutions, their rights and obligations are agreed in the Law of the Public Sector and it is the responsibility of the Ministry of Finance and Public Administration to monitor the correct application of the requirements set forth in this Law.

The Public Sector Legal Regime Law establishes the principles of action and operation of the Spanish public sector, regulating ministries, secretariats and other administrative figures.

Article 1. Object. The present Law establishes and regulates the bases of the legal regime of the Public Administrations, the principles of the system of responsibility of the Public Administrations and of the sanctioning power, as well as the organization and operation of the General Administration of the State and of its institutional public sector for the development of its activities.

Article 2. Subjective scope. 1. This Law applies to the public sector, which includes:

- The General State Administration.
- The Administrations of the Autonomous Communities.
- The Entities that make up the Local Administration.
- The institutional public sector.

There are laws that also establish the obligations and actions of public subjects and which have an impact on cultural heritage promotion activities and the application of technologies such as the Museums Law and the Science, Technology and Innovation Law.

Regional agencies: Catalonia

Regarding agencies in Catalonia, among which the Catalan Tourism Agency, the Department of Culture, the Catalan Agency for Cultural Heritage and the Board of Museums of Catalonia stand out; we found that they sustain and govern their actions mainly on the basis of the Tourism Law of Catalonia and the Catalan Heritage Law where its scope is prescribed within the protection and promotion of the cultural heritage of Catalonia.

NGO Sector

Regarding the private sector agencies identified for this work, is basically composed of the La Caixa Banking Foundation and the Catalunya La Pedrera Foundation; we found very specific laws such as the Law on the Fiscal Regime of Non-Profit Entities and the Law of Foundations. These indicate the characteristics that must

---

[18] Data from website http://www.fundaciocatalunya-lapedrera.com/

be fulfilled to be considered foundations, as well as the types of incentives to which they are subject when carrying out activities with social impact.

Institutional Framework laws, regulations, plans, policies

In this section are critically presented the intuitional framework, the policies affecting directly or indirectly the digital cultural heritage initiatives.

Spain - National Level

Law of Science, Technology and Innovation.[19]

This Spanish law created in 2011 establishes an action framework in which scientific and technical development contributes to solve some problems that society faces, through the development of research and innovation tools applied to projects that generate economic and social development. While it refers to technology and innovation, it is not always directly linked to culture. This Law is aimed to promote cooperation at different levels and sectors of scientific research, technological development and innovation. It clearly establishes in its article number 2, as well as in its objectives, that it seeks to manage scientific and technical research in all areas of society. Hence, to stimulate productivity, improve competitiveness and contribute to sustainable development.

This last section, clarifies that the management of innovation and technological development increasingly encompass a larger field of action surpassing the industrial-business sector, influencing other areas that contribute to benefit the community. Culture and education are strong pillars of social development, and the recognition and inclusion of these facts within this law is fundamental.

Article 3 of the Spanish Science, Technology and Innovation System, indicates that the system is composed of all public and private agents related to financing, execution, coordination, and administration functions; and carries out different actions focused on the promotion, development and support for research, development and innovation policies in all economic and social sectors.

It should be emphasized that this system is integrated by all those public policies developed by the administrative State, as well as by other regulations and laws generated by the Autonomous Communities.

Article 38, focused on scientific and technological culture, indicates that the public administration should promote activities that lead to the strengthening of scientific and technological knowledge in society; through education, training and publishing of information. This article is directly related to our study cases in virtue of the interaction between the different academic institutions, interpretation centers and museums, as well as the exposure of local and foreign visitors to the technologies used in them. People being exposed to these, considered innovative, technological elements, increase their knowledge; not only about history and culture, but also about the functionality of high-tech developments.

Within this article 38, paragraph 2., subparagraph c), it is mentioned that the institutions involved in the development of scientific and technological knowledge must be favored; this could be achieved, by means of reinforcing the activity of museums, planetariums and centers of Scientific information.

Nevertheless, no direct link with museums or cultural centres has been identified, in spite of these important regulations that govern technological and cultural development; possibly this is where SEGITTUR, as a representative of the technological development within the tourism activity, could strengthen their presence as an intermediary.

Continuing with Article 38, subparagraph e), it is stated, that the scientific and technological historical heritage should be protected. The next subparagraph f), indicates that scientific and technological innovation culture

---

[19] Analysis based on Law of Science, Technology and Innovation (Law 14/2011)
http://www.boe.es/diario_boe/txt.php?id=BOE-A-2011-9617

should be included as a transversal axis in the education system. This is linked to our case studies, since these applications constitute means of protection and dissemination of cultural heritage, besides the agreements they have with different schools and research institutions, that help to disseminate and strengthen scientific culture.

Article 47 refers to the research organizations under the jurisdiction of the General State Administration and mention several institutes and research centers dedicated to the areas of health, space technology, energy, agriculture, among others.

It must be emphasized, that SEGITTUR is not even mentioned. By representing tourism, one of the most dynamic and productive sectors of economy, it should be considered and recognized as an entity with great potential to contribute to social welfare through the development of technological and innovative projects regarding this activity.

This article, in its paragraph 1, announces that public research organizations are those created to develop scientific and technological activities, activities that can help scientific and technological development and activities that contribute to the progress of society. These are actions that the tourism sector and SEGITTUR might conduct to fulfill a key role; therefore, their inclusion within the section is crucial.

SPAIN		
LAW	**ARTICLE**	**Opportunities / incentives for Digital culture Applications**
Law of Science, Technology and Innovation Law 14/2011, of June 1	**Object.** This law establishes the framework for the promotion of scientific and technical research and its general coordination instruments, in order to contribute to the generation, dissemination and transfer of knowledge to solve the essential problems of society. The fundamental objective is the promotion of research, experimental development and innovation as elements on which sustainable economic development and social welfare must be based	The law establishes the norms and regulation of research in various fields (including culture and technologies), the status of researchers, and the financing public agents. It establishes the obligation of a national plan of priorities for research and innovation and the implementation bodies, including private entities, and public bodies, of any sector, including cultural sector.
	2. General objectives. The general objectives of this law are the following: • Encourage scientific and technical research in all areas of knowledge, as an essential factor to develop competitiveness and knowledge-based society, through the creation of an economic, social, cultural and institutional environment favorable to knowledge and innovation. • Promote the transfer by favoring the interrelation of the agents and fostering an efficient cooperation between the different areas of knowledge and the formation of multidisciplinary teams. • Foster innovation in all sectors and in society… • Coordinate the policies of scientific and technical research in the General State Administration and among the different Public Administrations, through the planning instruments that guarantee the establishment of objectives and indicators and of priorities in the allocation of resources. • Contribute to the continuous training, qualification and empowerment of research personnel. • Encourage development cooperation in the field of scientific research, technological development and innovation, aimed at social and	

	productive progress, under the principle of social responsibility of research and innovation institutions. • Promote scientific, technological and innovative culture through education, training and dissemination in all sectors and in society as a whole.	
	3. Spanish System of Science, Technology and Innovation. For the purposes of this law, the Spanish System of Science, Technology and Innovation is understood as the set of agents, public and private, that develop functions of financing, execution, or coordination in it, as well as the set of relationships, structures, measures and actions that are implemented to promote, develop and support the policy of research, development and innovation in all fields of the economy and society. Said System is integrated, as far as the public sphere is concerned, by the public policies developed by the General State Administration and by the developed ones, in its own area, by the Autonomous Communities.	
	35. Appreciation and transfer of knowledge. Promote relations between public research centers, technology centers and companies, especially small and medium-sized companies, with the aim of facilitating the incorporation of technological, design or management innovations that promote increased productivity and competitiveness.	
	38. Scientific and technological culture. The Public Administrations shall promote activities conducive to the improvement of the scientific and technological culture of society through education, training and dissemination, and shall adequately recognize the activities of the agents of the Spanish System of Science, Technology and Innovation in this ambit. The State Plans for Scientific and Technical Research and Innovation will include measures to achieve the following objectives: • Support the institutions involved in the development of scientific and technological culture, through the promotion and encouragement of the activity of museums, planetariums and informative centers of science. • Protect the historical scientific and technological heritage. • Include scientific, technological and innovation culture as a transversal axis throughout the education system.	

Law of Fiscal Regime of Entities for non-for-profit entities and fiscal incentives to patronage.[20]

This law was created with the intention of regulating the tax regime of non-profit entities such as foundations, associations and non-governmental organizations. Article 3 indicates that one of the main requirements to be considered to be a non-profit organization is to carry out actions with a social impact such as educational, cultural, scientific activities, environmental protection, promotion of the tolerance, among others.

Another requirement to meet to be considered within this Law and that is exempted from some taxes, is that 70% of all income generated must be allocated to activities with social impact

SPAIN		
LAW	**ARTICLE**	**OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS**
Law of fiscal regime of entities without lucrative purposes and of fiscal incentives to patronage. Law 49/2002, of December 23.	1. This Law is intended to regulate the tax regime of the non-profit entities defined herein, in consideration of their social function, activities and characteristics. Similarly, it aims to regulate fiscal incentives to patronage. For the purposes of this Law, patronage means private participation in the performance of activities of general interest.	The law offers significant tax exemptions (among others their income is are exempted for the companies' income tax and the real estate property local taxes) other administrative advantages for the non-profit entities of cultural purposes. The Law benefits also private profit companies that 70% of their income is allocated in social purposes. Additionally, it incentivizes donations in cultural entities that are covered by the law by providing fiscal exemption to the donors for the amounts donated.
	3. Requirements of non-profit entities. The entities referred to in the previous article, which meet the following requirements, will be considered, for the purposes of this Law, as non-profit entities: That pursue general interest purposes, such as, among others, those of defense of human rights ... social inclusion, educational, cultural, scientific, cooperation for development, promotion of volunteering,	

---

[20] Analysis based on the Law of fiscal regime of entities without lucrative purposes and of fiscal incentives to patronage (Law 49/2002): https://www.boe.es/buscar/act.php?id=BOE-A-2002-25039

	promotion of social action, of defense of the environment ... of promotion of the tolerance, of promotion of the social economy, of development of the information society, or of scientific research and technological development.	
	7. Exempt economic operations. Non-profit entities' income is exempt of Corporate income tax if obtained from the following economic operations, provided they are developed in compliance with its specific purpose or object: Economic exploitations for the provision of services for the promotion and management of social action, as well as social assistance and social inclusion, which are indicated below, including auxiliary or complementary activities of those, such as accessory food services, accommodation or transportation.	

Law of Fiscal Regime of Entities without Lucrative Purposes and of Fiscal Incentives to Patronage summary.

Law for the Foundations[21]

The Law of Foundations recognizes all those entities that are dedicated to developing projects in favor of human rights, combat terrorism, prostitution, environmental protection, cultural activities, etc. In section 4 it is commented that all those foundations whose objectives are linked to the protection and rescue of Spanish Historical Heritage will be referred to the Law of Spanish Historical Heritage which focuses on those activities that have to do with the exhibition and access to Historic and Cultural heritage goods.

SPAIN		
LAW	**ARTICLE**	**OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS**
Law of Foundations Law 50/2002, of December 26.	**2. Concept.** Foundations are non-profit organizations that, due to the will of their creators, have a lasting impact on their assets to the achievement of general interest purposes.	Many of the cultural organizations are under the legal form of Foundations. The ley establishes as a minimum 30K euros the initial donation in order to have access to the legal status of "Foundation". The law establishes a simplified accounting model for the Foundations and their governance and responsibilities. The fiscal advantages applied by the law 49/2002, of December 23, applies also in the Foundations with cultural purposes.
	3. Purposes and beneficiaries. The foundations must pursue general interest purposes, such as, among others, those of defense of human rights, victims of terrorism and violent acts, social assistance and social inclusion, civic, educational, cultural, scientific, sports , health, labor, institutional strengthening, cooperation for development, promotion of volunteering, promotion of social action, defense of the environment, and promotion of social economy, promotion and care for people at exclusion risk for physical, social or cultural reasons, promotion of constitutional values and defense of democratic principles, promotion of tolerance, development of the information society, or scientific research and technological development.	

.Law of Foundations summary.

---

[21]Analysis based on the Law of Foundations (Law 50/2002): https://www.boe.es/buscar/act.php?id=BOE-A-2002-25180

Catalonia – Regional level

Analysis of public policies - Catalonia

Strategy of Research and Innovation for the Intelligence Specialization of Catalonia (RIS3CAT)[22].

Europe 2020 is a welfare and progress strategy of the European Union which establishes that research, development and innovation must be the main tools to achieve economic transformation, fostering employment generation and social cohesion through collaboration from different sectors to jointly solve social challenges. This strategy is the starting point for other plans in Europe, such as the Research and Innovation Strategy for the Smart Specialization of Catalonia.

The Research and Innovation Strategy for Intelligent Specialization of Catalonia establishes the framework from which the government develops the RDI actions and programs for the period 2014/2020 and assumes a structure that will facilitate the means to generate well-being through the development of innovative projects, taking as a trigger the use of information and communication technologies.

For the elaboration of the Ris3cat, a broad analysis was developed. The different characteristics of the Catalan economy were analyzed and, through a SWOT analysis, opportunities and problems faced by different economic sectors could be identified. From the analysis emerged three vectors that encompass the actions proposed in the Ris3cat 2014-2020, and which are aligned with the Europe 2020 plan. It is proposed to develop synergies among the different agents of the 'quadruple helix': R & D system, companies, public administrations and innovation users.

The three identified vectors that compose the action framework are: 1) the inheritance of the Catalan industrial tradition; 2) the welfare of the people; and 3) climate change and the use of natural resources.

Four strategic objectives and four lines of action were identified, among which the axis of action 1, sectorial area "Leaders", refers to the main activities in the Catalan economy. The strategic objective of Axis 1 is to strengthen the competitiveness of the business sector through the improvement of the efficiency of
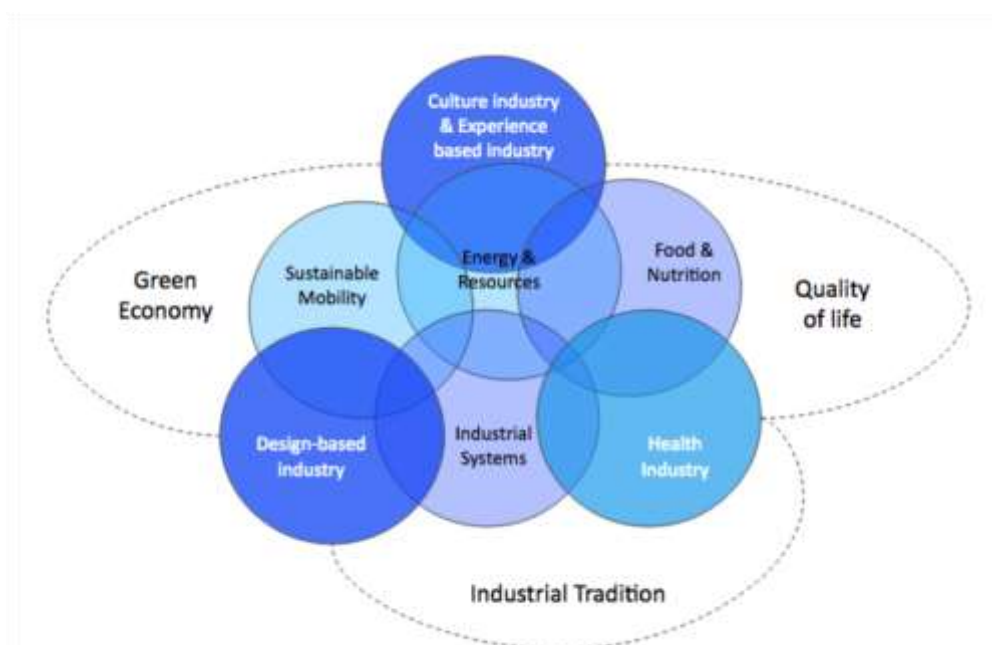
Strategy of Research and Innovation for the Intelligence Specialization of Catalonia

---

[22] Analysis based on The Strategy of Research and Innovation for the Intelligence of Specialization of Catalonia (RIS3CAT): http://catalunya2020.gencat.cat/web/.content/85_catalunya_2020/documents/castella/arxius/10_pa_ris3cat_201511 _es.pdf

production processes, internationalization and the reorientation of the consolidated sectors and activities of greater added value.

It is in the Axis 1 where the cultural industries and activities based on experiences are identified, which also accommodates the tourist activity and represents an important added value for the smart specialization strategy.

The financing of Europe 2020 is carried out through different funds, one of them is the ERDF and the other is the ESF, the latter fund is intended to cover actions related to employment, education and poverty reduction. Within the list of actions to be considered for financing a point related to our research is number 10, which indicates how to invest in projects focused on education, capacity development and lifelong learning. The Ris3cat seeks to promote specialization projects and territorial competitiveness, promoting economic development through RDI. One project to highlight is P.1.2. Impulse of Digital Innovation, in which the development of digital content in areas such as tourism, culture, education and games is proposed.

CATALONIA		
OBJECTIVE	**STRATEGIES**	**OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS**
1.Strengthen the competitiveness of the business sector by improving the efficiency of production processes, internationalization and the reorientation of the consolidated sectors towards activities with greater added value.	Axis 1. Sectoral areas of leadership, composed, among others, by cultural and based on experience industries. …Creative and cultural industries (such as publishing, graphic arts, multimedia, sound and audiovisual production, crafts and performing arts) and key services in Catalonia such as tourism and sports.	This plan, based on the Horizon 2020 Strategy, establishes a framework for the government of Catalonia to take action on R+D+I development, focusing on ICT as a detonator for economic and social wellness, noticing tourism and culture as part of the sectors to be impacted. It establishes access to funding opportunities from Fondo Social Europeo (FSE), Generalitat and private sector.

RIS3CAT summary

Law of Museums[23]

CATALONIA		
LAW	**ARTICLE**	**OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS**
Law of Museums Law 17/1990, November 2	**Concept of museum.** l. For the purposes of this Law, museums are permanent, non-profit institutions at the service of society and their development, open to the public, which bring together a set of movable and immovable cultural property, conserve it, document it and study, exhibit and disseminate their knowledge for research, teaching and intellectual and aesthetic enjoyment and constitute a space.	The law establishes the Generalitat and Public Administration shall provide the resources to improve the museums performance. Funding opportunities and advising are pointed out. Training of museum staff is mentioned among the resources provided by the Generalitat. The law also sets an annually program established by the Department of Culture of Catalonia providing technical assistance and funding for museums. The Board of Museums of Catalonia represents a platform for collaboration and discussion on museum related topics.
	Powers of the Generalitat. **6. Supervision and advocacy role** 3. The Generalitat and the Public Administrations of Catalonia shall endeavor to improve facilities and means of all kinds in order to ensure the highest service to society and increase museum funds. To this effect they may grant subsidies and give technical support…	
	8. Dissemination of funds. All museums will guarantee the dissemination of their collections to the general public. The cultural assets that make up a museum should be able to be the object of research, teaching, dissemination and enjoyment.	

---

[23] Analysis based on the Law of Museums (Law 17/1990): https://www.boe.es/buscar/pdf/1990/BOE-A-1990-28240-consolidado.pdf

	29. Regional museums and local museums. The regional museums and local museums are those that, promoted or maintained by the local entities of Catalonia, offer, by their approach and content, a global vision of the history, the human and natural characteristics or the patrimonial wealth of a region, a population or a specially defined part of the territory, or of some sectorial or thematically specialized aspect that is related to it.	
	32. Support from the Department of Culture. l. The Department of Culture will establish an annually program of economic aid to the county, local and monographic museums. According to the budget of said program, the Generalitat, after the favorable report of the Museum's Board, will be able to provide the technical assistance that the museums request. 2. The mentioned program will be elaborated with criteria that lead to the qualitative and quantitative improvement of the museum collections of Catalonia.	
	35. The Administration of the Generalitat will exercise, among others, the following functions: Dictate the technical standards of documentation, exhibition, diffusion and protection of the museum heritage. Promote the training and recycling of museum staff.	
	Board of Museums of Catalonia. Function and nature. The Board of Museums of Catalonia, continuation of the Board of Museums of Barcelona, represents the desire for collaboration and institutional participation in the management of the museums of Catalonia.	

Law of Museums summary.

Plan of Museums 2030[24]

The Catalonia Museums 2030 Plan (CMP) is a strategic plan focused on 10-year actions. It defines the global policy framework for all museums in Catalonia, based on a vision in which the museum is a cultural institution committed to cultural heritage and society. In this perspective, the CMP identifies some of the challenges that the museums of Catalonia are currently facing; several of which are part of the micro analysis of our study case studies (see micro level results analysis page). For purposes of our research, the main challenges identified in the plan are as follows:

- The public museums have lost autonomy, being subject to administrative and regulatory processes that tend to complicate the internal decision-making.

- During the economic crisis of 2011 and 2015, museums faced a budget reduction of 5.9%. Generally, Catalonian museums have a small organization structure composed of 1 to 3 staff members. This situation is identified in our case study as a critical struggle in museum management. Most museums are at a very basic level of digitization; 72% of the museums have a website, 76% have Facebook, only 36% have Wi-Fi and 16% use apps.

A SWOT analysis was conducted on museums and on the Generalitat, of which the following findings stand out:
- Museums' operational weaknesses due to lack of human resources.
- Insufficient coordination between administrations.
- Social dimension is not yet a central axis.
- Poor incorporation of new technologies.
- Museums' lack of public visibility.
- Growth in the offer of leisure and digital culture that increases the competition among museums.

The National Plan has 7 strategic goals and many specific objectives. Nevertheless, the focus here is only on those that have an impact on our study cases. These strategic objectives constitute the base for the strategies 2018-2020.
- Objective 1 aims to create and develop the museums system.
- Specific objective 1.2, means to strengthen the territorial network resulting in a positive impact on museums.
- Specific objective 1.4, intends to develop inter-institutional collaboration among the stakeholders that integrate the Museums System. Collaboration emerges again as a key factor to strengthen the sector.
- Objective 2 aims to reinforce the autonomy of museums.
- Specific objective 2.3, proposes to promote the autonomy of public museums.
- Specific objective 2.4, strives to provide technical and economic support to museums to rethink and innovate their mission, and to renew their infrastructures and museography.
- Objective 3 aims to strengthen national museums and improving their infrastructure.
- Objective 4 focus on improving the conservation and management of collections.
- Specific objective 4.4, promotes digitalization and online access to collections.
- Objective 5, points to strengthen the links in society through participation, access and education.

Specific objective 5.2, pursues to promote knowledge and proper identification of the museums' public. Focusing on gathering further accurate information about them, in order to develop better communication strategies.
- Specific objective 5.3 aims to strengthen and foster social commitment through citizen participation.
- Specific objective 5.4, seeks to reinforce the centrality and innovation of educational action.
- Objective 6 aims to increase the communication capacity and visibility.

---

[24] Analysis based on the Plan of Museums 2030: http://premsa.gencat.cat/pres_fsvp/docs/2017/09/22/12/59/7ae8204c-341e-4f4a-8727-aab5a8c997aa.pdf

- Specific objective 6.1 is about improving the experience of visiting museums. Thereby, and in relation to our study cases, it is fundamental that museums have a system that enables them to learn the level of satisfaction and other relevant visitors' data, in order to develop targeted strategies with a greater impact. In this section, the Visit Museum application is mentioned and recognized as an outstanding action.

CATALONIA		
OBJECTIVE	**KEY STRATEGIES**	**OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS**
1. Create and develop the Museum System.	1.2. Consolidate territorial networks as supporting structures for museums.	Through the elaboration of a SWOT analysis, the Plan of Museums identified the need of museums to incorporate new technologies.

It defines and systematizes a global policy for the museums of Catalonia providing specific objectives and actions. One of the specific objectives is provide technical and economic support to museums in order to encourage them to renew their museography.

A budget has been established to carry out actions for the benefit of museums in the period 2018 to 2021. The budget also includes a considerable monetary amount for the updating and improvement of museums museography which represents an important opportunity for the development and incorporation of digital projects

The Visitmuseum app has been given a particular budget for its development in the coming years. |
| | 1.4. Create an interinstitutional frame of stable collaboration and reorganize the instruments for the conciliation and monitoring of the Museum System. | |
| **2. Reinforce the capacity and autonomy of museums.** | 2.3. Promote the autonomy of museums of public ownership.
2.4. Provide technical and economic support to museums to rethink and innovate their museum mission, and to renew their infrastructures and museographies. | |
| **3.Strengthen national museums.** | 3.1. Reinforce national museums to increase their strategic role and improve their facilities. | |
| **4. Improve the conservation and management of collections.** | 4.4. Promote the digitalization and online access of collections. | |
| **5.Strengthen the link with society: access, participation and education** | 5.2. Promote the knowledge and development of the publics of museums.
5.3. Encourage the social commitment of the museum and the participation of citizens
5.4. Reinforce the centrality and innovation of educational action. | |
| **6.Increase the capacity for communication and visibility.** | 6.1. Improve the experience of visiting museums because it is user-centered.

6.4. Foster museums as providers of content for the cultural industry. | |
| **7.Support the professional sector.** | 7. 2. Support the training and recycling of museum professionals, as well as the incorporation of new professional profiles. | |

Law of Catalan Cultural Heritage[25]

LAW	ARTICLE	OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS
Law of Catalan Cultural Heritage Law 9/1993, September 30th.	**Objective:** The protection, conservation, enhancement, research, dissemination and promotion of Catalan cultural heritage.	The use of technologies in the cultural patrimony can find sustenance in this law as it aims not only the protection of the cultural assets, but also its revitalization that allows to have a greater impact in the society. Therefore, digital culture applications could find a funding opportunity on the 1-100% fund, destined to the protection and dissemination of the cultural patrimony as well as to support contemporary artistic activities.
	3. Collaboration between public administrations. 1. In the exercise of their respective jurisdiction, the Administration of the Generalitat, the District Councils and the Town Councils shall ensure the integrity of the Catalan cultural heritage, both public and private, and for the protection, conservation, enhancement, dissemination and the promotion of this heritage, stimulating the participation of society, so that they will be provided with the appropriate material and personal means.	
	54. General norms. Aid from public administrations for research, documentation, conservation, recovery, restoration and dissemination of the cultural heritage integrating assets, will be granted according to criteria of publicity, concurrence and objectivity and within budgetary projections. The Generalitat may encourage the participation of private entities and individuals in the financing of the promotion actions referred to in this chapter.	
	57. The cultural 1 – 100.	

---

[25]Analysis based on the Law of Catalan Cultural Heritage (Law 9/1993):https://www.boe.es/buscar/pdf/1993/BOE-A-1993-26497-consolidado.pdf

	The Administration of the Generalitat will reserve in the budgets of the public works that it totally or partially finances a minimum item of 1% of its contribution, with the purpose of investing it in the conservation, the restoration, the excavation and the acquisition of the goods protected by this Law and in contemporary artistic creation. The reserve referred to in section 1 also applies to the total budget for the execution of public works executed by individuals under the administrative concession of the Generalitat.	
	60. **Inventory of Catalan Cultural Heritage.** The Department of Culture will prepare and maintain the Catalan Cultural Heritage Inventory, which aims to allow systematic documentation and compilation, research and dissemination of all the assets that comprise it.	
	61. Public visit and dissemination. The Administration of the Generalitat will encourage the use and enjoyment of Catalan cultural heritage as a resource for social and tourism revitalization, respecting the needs of conservation and protection of the assets and their surroundings established by this Law.	
	65. Teaching. The Government of the Generalitat shall include in the curricula of the different levels of the educational system regulated compulsory knowledge of Catalan cultural heritage. The Generalitat shall promote the development of specialized education in the conservation and maintenance of cultural heritage and may establish agreements for collaboration with private entities and specialized training centers.	
	66. Publications. The Administration of the Generalitat will promote research publishing and dissemination of Catalan cultural heritage.	
	81. Functions. The functions of the Advisory Council of the Catalan Cultural Heritage are the following:...c) Provide cultural advice to the managing cultural heritage organs.	

Law of Catalan Cultural Heritage summary.

Law of Tourism of Catalonia[26]

CATALONIA

---

[26] Analysis based on the Law of Tourism of Catalonia (Law 13, 2002): : https://www.boe.es/buscar/pdf/2002/BOE-A-2002-14081-consolidado.pdf

LAW	ARTICLE	OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS
Law of Tourism of Catalonia Law 13, 2002, June 21	**Objective** To regulate the management and promotion of tourism. The provisions of this Law apply to all resources, subjects and activities that make up the tourism sector.	The law establishes the norms and regulation applied to the tourism sector, where cultural heritage, its protection and promotion are considered an important action for Catalonia tourism strengthen. Hence, the creation of new cultural products and services is highly valued by the tourism sector. ICT's in cultural heritage, as a tourism product, can find in Tourism administrations the via to access to funding and advising.
	Article 2. Definitions Tourist resources: all tangible and intangible goods and all manifestations of physical, social, historical and cultural reality that may generate or increase tourist flows to Catalonia or within its territory, the infrastructure of establishments and services aimed at tourism and the maintenance of an adequate level of quality in the provision of tourist services.	
	Article 3. Purposes In their activity, tourist administrations and tourist subjects have to pursue the following purposes: • Protect and preserve, in accordance with the principle of sustainability, the tourist resources, and ensure respect for cultural, historical, artistic, territorial, urban and environmental values that are proper to them. • Promote the creation, development, improvement and promotion of tourism resources. • Increase tourist flows, both inside and outside, with special attention to quality tourism, and boost tourism as a strategic sector of the economy and occupation and as a key factor for the territorial balance and prosperity of Catalonia. • Promote the development of new products, activities and areas of tourist interest and enhance the quality and vitality of destinations, denominations and tourist brands. • Promote tourism as a means of knowledge, communication and exchange between peoples and cultures.	
	6. Tourist resources of local interest	

	Tourism resources of local interest are tourism resources that contribute to increasing tourist flows to municipalities, counties or specific areas of the territory of Catalonia.	
	9. Planning The public action of promotion and protection of the tourist resources can be object of planning by the competent administrations in this matter, in agreement with what it establishes the present Law. The Administration of the Generalitat must promote the maximum participation of public and private stakeholders of the tourism sector in the plans that it promotes or elaborates. Administrations and individuals that promote their own tourism plans may request the Administration of the Generalitat for the information and technical support they deem necessary.	
	11. Promotion of tourist resources Tourism administrations must promote the creation, conservation and improvement of tourism resources and must support public and private initiatives that pursue this same purpose. Within the framework of this Law, and in accordance with the provisions of the Tourism Plan of Catalonia, the promotion of tourism resources is mainly carried out through the declaration of tourist municipalities and areas of tourist interest, the creation of geo-tourism denominations, the establishment of economic promotion measures and the projection of Catalonia and areas of the country as tourist brands, both in the domestic market and abroad.	
	Catalonia's Tourism Plan **13. Object, character and scope of territorial application.** The Tourism Plan of Catalonia is the basic instrument for tourism planning of the Generalitat and its purpose is the development, promotion and protection of tourism resources, the promotion of a quality touristic offer and the encouragement of actions that reinforce the consideration of Catalonia as a global tourism brand. The Catalonia Tourism Plan has as its scope of application the entire territory of Catalonia. If there are no specific criteria that discourage it, the provisions and the development of the Plan must be adjusted to the areas of application of the partial territorial plans established by the territorial policy regulations. **14. Content**. The Tourism Plan of Catalonia must contain: • The study of the touristic offer and the main deficits that it presents. • The inventory of essential tourism resources. • The basic characteristics of all tourism resources. • The analysis of the demand and the forecasts on the evolution that may have. • The criteria for evaluating the impact of tourism on the resources used or visited	

	• and the protection measures of these resources. • The list of tourist towns and areas or areas of tourist interest and the evaluation of its incidence in the general tourism offer. • The indication of the areas in which internal or external tourism should be promoted and of tourist zones that are saturated or overexploited. • The definition of the necessary measures for the improvement of quality and tourism competitiveness. • Any other data or studies that are considered of interest for the promotion of tourism or for the protection and signaling of tourism resources.	

Law of Tourism of Catalonia summary.

Strategic Plan of Tourism of Catalonia 2020[27]

The Strategic Tourism Plan of Catalonia (STPC) 2020, is based on a SWOT analysis of Catalonia's tourism sector. The data relevant to this research elucidates the weaknesses of Catalonia's tourism field due to having a low use of new communication technologies and low levels of innovation. In this context, as opportunities, it identifies the surge in the travelers' use of new information and communication technologies through mobile devices, social and local orientation. On the other hand, as a challenge, the creation of new tourism products is identified; since the strategic plan states that Catalonia is rich in tourism resources but still poor in innovative, competitive and marketable, structured tourism products. The study affirms that the combination of natural and cultural resources, together with the use of new information technologies are key factors for the progress of the tourism activity. Moreover, the plan asserts that the tourism experience is the result of a complex and extensive value chain of both, public and private actors. Therefore, it is essential to encourage collaboration.

The STPC includes five national action programs and various tourism projects. Program 5. "Excellence" includes the subprogram 5.2 aimed to promote the reduction of two of the most significant gaps in the Catalan tourism sector: the advanced use of new communication technologies and innovation, as they represent critical obstacles to achieve higher quality standards. Thus, the aforementioned projects have been proposed to comply with the objectives and strategies settled in the STPC, as a prioritization scheme was implemented (see figure 2). Within the prioritization scheme, ICT in tourism is situated on the segment of "Priority 1", in the quadrant of "rapid improvement", placing the incorporation of ICT in tourism within the quadrant of "high and rapid return". This location on the scheme highlights the ICT in tourism among the most important and beneficial projects for the fulfillment of the strategic plan.

---

[27]Analysis based on the Strategic Plan of Tourism of Catalonia 2020:http://empresa.gencat.cat/web/.content/20_-_turisme/coneixement_i_planificacio/recerca_i_estudis/documents/arxius/pla_cas.pdf

CATALONIA		
PROGRAM	OBJECTIVE	OPPORTUNITIES / INCENTIVES FOR DIGITAL CULTURE APPLICATIONS
Program of Excellence	**Objective.** The excellence program aims to act as a transversal strategic element that guides the work with criteria of excellence. Elements such as training, technology, innovation, languages and social responsibility are some of the essential aspects that the program proposes. Its purpose is the positioning of Catalonia at the forefront of international tourist.	Having determined the potential for cultural dissemination through tourism and the use of new communication technologies and innovation, as well as, the current deficit in the usage of such; shall be considered as a first step into future encouragement for further use of technologies and a compromise to innovation in cultural tourism. The focus on technology and innovation
Subprogram 5.2 Innovation and Technology	**The mission** of the subprogram is to promote two of the most significant deficiencies in the Catalan tourism sector: innovation and the advanced use of new technologies. Prepared preliminary studies tell us where these deficiencies are particularly found, as well as different action proposals that must be developed.	The plan has a budget for its development, allocating an amount to the 5.2 actions of innovation and technology. Its inclusion in the budget and the recognition of the incorporation of ICTs in the tourist activity as a priority, represent an important opportunity for the management and development of digital applications in cultural heritage.

Table 13. Strategic Plan of Catalonia 2020

Prioritization Project Matrix, ICTs in tourism as a priority. Retrieved from the matrix from the Strategic Plan of Tourism of Catalonia 2020 document, p 30.

Conclusions of Macro analysis

Firstly, it has been established that there is a European legal framework supported by international organizations and entities. These norms are oriented towards the management and influence on the development of public policies (Horizon 2020, UNWTO, EU).

In this regard, the UNWTO Strategy on Innovation and Digital Transformation (UNWTO, 2018), a World-addressed Action Plan, aims to drive the digitalization of tourism, and to create innovation and entrepreneurship ecosystems to maximize the potential of the sector in terms of economic growth, job creation and sustainable development.

Similarly, in the case of Spain, those public plans and policies arising from the international strategies, have been submitted to analysis of impacts on the science and technology, tourism and cultural sectors; which have influenced State and Catalonian laws and strategic plans. Primarily, the tourism and cultural sectors and usage of technology within them have been identified as basis of the normative analysis; considering their constant interaction, especially since there is a growing interest on incorporating technologies in cultural and tourism related activities.

There are specifically dedicated regional government agencies working on the implementation of Digital applications on CH , which allows a certain continuity in the field.

DCH penetration is deeply related and dependent on the general institutional and financial framework as well as boosted by specific active policies and initiatives of public or public/private nature.

The aforementioned sectors produce a synergy of major influence that invigorates the Catalan economy and due to its attributes and transversal nature represent great potential for the use of technologies and innovation. Moreover, these three fields converge in different points on the public policies on which they base their operational plans where technologies and innovation represent the next step in the promotion of cultural heritage in museums and cultural centers.

In this context, technologies are designated as a tool to improve the cultural products and services, regardless of the public to which they are directed, whether tourists or local habitants. Consequently, the development of technologies and their application in the tourist-cultural sector has been set as a priority within certain regulations, such is the case of the Strategic Plan of tourism of Catalonia 2020, with important public aides and investment.

The laws, strategic plans and the studies carried out, indicate particular problems that put at risk the development and the use of applied technologies in the interpretation of cultural heritage in museums. Thus, the State and the Generalitat have identified weaknesses and threats as a result of the SWOT analysis devised for the 2030 Museums Plan.

Common topics addressed by the analyzed laws and strategic plans are:
- Using technology to provide added value.
- Interdisciplinary cooperation.
- Intersectoral aspects
- Public-private collaboration.
- Impacts on education.
- Development and wellbeing.
- Budget
- Staff issues

Challenges and strengths determined on the macro and micro level analyzed

Education is constantly emerging as a key topic in the different regulations analyzed here; likewise, in our cases studies, it is in the main, museums impacts identified; where it has been identified that the technologies used in the interpretation of cultural heritage have yielded links and important collaborations at different levels of the academic sector.

3.2 REGIONAL CASE 2 MACRO LEVEL GREECE, CENTRAL MACEDONIA, THESSALONIKI

List of Stakeholders and respective responsibilities in policies related with Digital cultural heritage in the area

Municipality of Thessaloniki. The main responsibilities of the municipality of Thessaloniki are to promote the need of Digital Cultural Heritage projects and also participate in such projects in national and international levels, so that people will understand the importance of Digital Cultural Heritage projects for Thessaloniki. Moreover, the municipality of Thessaloniki (and all the municipalities in general) should contact the responsible ministries in order to take actions regarding Digital Cultural Heritage.

General Secretary of research. The General Secretariat for Research and Technology is tasked with designing and coordinating the implementation of the policy of Research, Technological Development and Innovation. It strengthens the activities of research and productive organizations through competitive research programs with an emphasis on economic efficiency and socially just distribution of the product. The GSRT oversees Research Centers and Technology Bodies that support local communities with the necessary skills to produce knowledge and innovation. In addition, it monitors European and international developments on RTDI issues and represents the country in the European Union and International Organizations in its fields of competence. This is applied for Digital Cultural Heritage as well, since this field is directly connected with technology and research.

Ministry of Culture. The ministry of culture is tasked with the strengthening and protection of artistic and intellectual creation, the protection and promotion of cultural heritage through corresponding legislative and institutional interventions.

Ministry of infrastructures. The ministry of infrastructures has the following responsibilities:
    a) Strategic planning and implementation of Infrastructure projects in the country.

b) Developing and implementing national policy and creating an appropriate institutional framework at European and international level to develop high-quality transport and transport services in conditions of healthy competition.

c) Specialization and implementation of national policy on public infrastructures.

d) Developing and implementing policies to develop transport and other infrastructure at national level to enhance mobility, accessibility and the empowerment of the economy.

e) Developing and implementing an integrated national policy to promote road safety and safe travel through coordinated actions and large-scale interventions.

f) Promoting security in infrastructure and transport.

g) Assisting Local Government (A and B) Local Government actions in the development of the country's basic infrastructure.

h) Coordination and participation in international organizations or cooperation instruments active in the design and development of trans-European transport networks and cross-border connections.

i) Coordinating supervised entities and overseeing these action programs.

j) All the above points are very important for Digital Cultural Heritage, as transportation is essential for tourists who travel to Thessaloniki in order to visit the virtual museums easily.

Ministry of Tourism. The Ministry of Tourism has as its main mission the elaboration of the tourism policy and the executive planning of the country's tourism development in the framework of government policy. This work is implemented through the preparation of short and long-term programs to enhance the competitiveness of the tourist product, to support investments, to promote tourism education and training, as well as to coordinate the communication of the image of Greece abroad. The Ministry of Tourism should promote the Digital Cultural Heritage projects and applications to tourists and in an international level in order to make the corresponding projects and applications popular among the rest of the world.

Ministry of Education. The Ministry of Education should promote Digital Cultural Heritage as a means of learning in schools. Digital Cultural Heritage applications and serious games are a very interesting means of transferring knowledge to students in a fun and interesting way.

institutional frameworks and policies

LAW / Regulation / strategic plan / policy	Institution in charge	General Objectives	Relative provisions and opportunities for the Digital heritage	Achievements and obstacles for digital culture in the area
Law for Research, Technological Development and Innovation and other provisions [20]	GSRT	The purpose of this law is to promote research, technological development and innovation by implementing the definitions in Article 16 of the Constitution and Article 179 of the European Union Treaty on the Functioning of the European Union.	Promotion of Digital Cultural Heritage, participation of municipalities to Digital Cultural Heritage projects and installations and usage of Digital Cultural Heritage applications for presentations of museum exhibitions.	More interesting Digital Cultural Heritage applications, realistic and even more attractive and fun for the users. Some obstacles may include difficulty of the integration of the new technologies, to already existing Digital Cultural Heritage applications, as well as the difficulty of the usage of these applications by the people.
Law for the Protection of Antiquities and the Cultural Heritage in general [21]	Ministry of Culture	The protection provided by the provisions of this law is the cultural heritage of the country from ancient times to the present. This protection is intended to preserve the historical memory for the present and future generations and to enhance the cultural environment. The cultural heritage of the country consists of cultural goods within the boundaries of Greek territory, including territorial waters, as well as within other maritime areas in which Greece exercises jurisdiction in accordance with international law. Cultural	With the protection of cultural heritage, many monuments/museums and cultural heritage sites will be available in general which can be used for the development of the field of the Digital Cultural Heritage. This law ensures the protection and conservation of Cultural Heritage sites across the country.	With a large number of Cultural Heritage sites being available thanks to this law, there is a large amount of data to be collected about these sites (such as digitization of these sites). Such information can later be integrated to Digital Cultural Heritage projects and applications which will be used to present the exhibitions of each site respectively.

		heritage includes intangible cultural goods. Within the framework of the rules of international law, the Greek state also takes care of the protection of the cultural goods originating in the Greek territory whenever they are removed from it. The Greek state is also responsible for the international protection of cultural goods that are historically connected to Greece wherever they may be.		
The pilot program of the Directorate of Museums, Exhibitions, and Educational Programmes "Green Cultural Routes" [22]	Ministry of Culture	Promotion of sustainable growth via the tripartite scheme of Education – Culture – Tourism.	Promotion opportunities for Digital Cultural Heritage for education.	An achievement could be the interaction of children with Digital Cultural Heritage content and learning from it about the history of the monument.

Impact of Macro policies

General Objectives

The general objectives of the macro policies (regarding the Digital Cultural Heritage) are to promote the importance of Digital Cultural Heritage, participation in national and international (European) project to research and develop Digital Cultural Heritage assets and finally to disseminate the results of such projects and actions in general to the public, in order to make these results popular and to contribute to the preservation of Cultural Heritage.

Achievements

The achievements of the macro policies regarding Digital Cultural Heritage in the region of Thessaloniki are notable, since different monuments and museums in Thessaloniki support modern technologies and Digital Cultural Heritage applications to present their exhibits. This contributed to the increase of the number of visitors and as a result the increase of tourism which impacts the economy of Thessaloniki in a positive way.

Challenges

The main challenges would be to motivate more museums and archaeological sites to install Digital Cultural Heritage content to present their exhibits and also keep the currently installed content up to date with regular updates. That will enhance the interest of the visitor of these museums/sites and it may convince them to visit the same museums again

3.3 REGIONAL CASE 3 MACRO LEVEL - CYPRUS

Introduction

A significant decline in economic activity spread across the island, lasting more than four years (2013-2017), normally visible in real gross domestic product (GDP), real income, employment, industrial production and wholesale-retail sale. This very difficult time period had a direct negative impact to the entire sector of Cultural Heritage. However, the awareness activities of our project had a direct influence on the latest policy making developments in the area of Cultural Heritage on the Island.

Objectives

The results of the study will identify strengths and weaknesses actions and projects in Cyprus, benchmark them with macro policy objectives and methods and lead to conclusions for improvement of framework policies.

Purpose

The main goal of this case study is to assess the potential of recent initiatives to create a national strategy for Digital Cultural Heritage (DCH).

Background information

The purpose of the study in Cyprus is to assess the potential of recent initiatives to create strategies for Digital Cultural Heritage (DCH) on the island. It is estimated that GDP grew at 3.9 % in 2017. Unemployment was estimated at 7.7%, continuing a rapid decrease in the first half of 2018. The total number of tourists arriving in Cyprus in 2017 was 3.652,073, the largest number ever and an increase of 14.6% on the previous year. The contribution of travel and tourism to GDP was 21.4 %, up from 19.4 % previous year.

Much of the tourist industry relies on "sea sun and sand" to attract tourists. This reflects in the seasonal distribution of tourist arrivals with a disproportionate number arriving during the summer months. Whereas most eastern resorts like Protaras and Ayia Napa lie dormant in the winter months the west of the island remains open to tourism with the promotion of Cypriot history culture, art and specialized sports such as golf and tennis. The World Travel and Tourism Council 2016 report on the island outlines that the total investment in the Travel & Tourism industry in 2015 was EUR273.7mn, or 14.0% of the total investments. It projected a rise by 5.3% in 2016 and 2.9% pa over the next ten years to EUR 384.6mn in 2026[28]

---

[28] http://www.visitcyprus.com/index.php/en/

Theoretical framework

The Cyprus study adopts the same theoretical framework as that described for the Catalonia regional case but reflects a perspective in which the holistic documentation of heritage is considered critical to maximizing long-term audience interest, including through the development of applications. The ViMM experts have studied the regional policies as elaborated by the respective agencies, the identified the available sources of information and they conducted contacts and meetings with government officials (

Stakeholders

Central Government

Department of Antiquities. The Department of Antiquities is responsible for the management of the archaeological heritage of Cyprus. The Department's main areas of activity and responsibility are: systematic and rescue excavations as well as archaeological surveys; the establishment, management and operation of archaeological museums; the conservation, restoration, protection and promotion of Ancient Monuments in the First and Second Schedule of the Antiquities Law, of archaeological sites and of monuments of architectural heritage.

One of the aims of the Department of Antiquities is also the use of both ancient monuments and archaeological museums for educational purposes and cultural activities, as well as for the stimulation of cultural tourism. In order to achieve the above, the Department of Antiquities organises conferences, exhibitions and lectures both in Cyprus and abroad. An activity which has emerged over the last few years is the contribution of the Department of Antiquities towards the establishment of private/thematic museums. In this case the Department acts as a consultant and as a guide by offering its personnel's specialized knowledge. In the past participated in a number of Interreg projects.

National Committee for the Digitisation and e-Preservation at Ministry of Education and Culture. In 2018 the CY Government council of Ministers established the national Committee for digitization and e-presentation. The main objective of the committee is to establish a road-map for the Cypriot digital heritage era and to develop a national aggregator and a sustainable macro-economic master plan, which will be accompanied by a reasonable budget for the implementation of this strategic development plan until 2027. The Committee consist with multidisciplinary professionals, who represent all the Cultural Heritage stakeholders on the island.

Cyprus Tourism Organisation (CTO). CTO is a semi-governmental organisation under the responsibility of the Ministry of Commerce, Industry and Tourism. CTO was established and operates according to the provisions of the Cyprus Tourism Organisation Laws 1969–2005 and the related Regulation on Structure and Terms of Employment and Administration and Finance. The CTO is responsible for regulating and monitoring the tourist enterprises and professionals based on the relevant legislation.

Cyprus Organisation for Standardisation (CYS). The Cyprus Organisation for Standardisation (CYS) was established by the Government in 2002 to undertake the standardization activities that were under the jurisdiction of the Ministry of Commerce, Industry and Tourism. CYS, is the National Standardisation Body of Cyprus, whose principal activity is the production of standards and the supply of standards-related services. Under the heading of 'a visit to the museum' it has produced a graphic depiction of standards applicable to museums and relevant to the quality of the environment, the conservation of cultural heritage and the safety of visitors.

A visit to the museum, relevant standards: Cyprus Organisation for Standardisation

Research institutions

Cyprus University of Technology (CUT). CUT aims to become a modern and innovative university with international recognition which promotes excellence in education and research in cutting-edge fields, aiming at the scientific, technological, economic, social and cultural upgrading of the country. Through its commitment to promoting research excellence, CUT is gaining international distinction in research, especially under the European HORIZON 2020 programme where over 9 million Euros has been secured through 23 research proposals, the highest rate of success in Cyprus. Recent successes include two ERC strategic projects totaling 3.3 million Euros, two "Teaming for Excellence" research proposals led by the CUT, which ensured the highest pan-European rating and participation in the creation of a RISE Excellence Center for technological and business innovation. The Director of Its Digital Heritage Research Laboratory (DHRLab), Dr Marinos Ioannides, was appointed UNESCO Chair of Digital Heritage in late 2017, providing significant potential for influencing the status of and investment in DCH in the years to come. Under Horizon 2020 DHRLAB is Coordinator of the ViMM Coordination and Support Action for Digital Cultural Heritage and Virtual Museums and has been awarded a 5 year-single institution project as European Research Area (ERA) Chair in Digital Heritage, beginning in January 2018. It was previously the coordinator of the successful ITN-DCH research training project under the Marie Curie programme and is a partner in several other projects.

University of Cyprus. The Department of Architecture, as an outstanding academic centre of studies in the wider European region, aims at educating students to become successful architects who can perform worldwide, but who will also have the knowledge and sensitivity respond to and to influence positively the formulation of the built environment in the eastern Mediterranean region. Central to the philosophy of the programme in the study of architecture, are the synergies achieved through the dynamic synthesis of design emanating both from the humanities and the technological dimensions of Architecture

Cyprus institute (CyI). CyI has been developed as an international science and technology organization, to strengthen the research community of Cyprus, help transform its economy to a knowledge-based economy and to create a research hub for the Eastern Mediterranean region. The Science and Technology in Archaeology Research Center (STARC) of The Cyprus Institute is devoted to the development, introduction and use of advanced science and technologies in the field of archaeology, cultural heritage and history of the region. Research scientists and doctoral students, often in partnership with national or international research

organizations, utilize physical and chemical measurements with sophisticated instruments in a fixed and mobile laboratory to participate in collaborative research in Cyprus, the Eastern Mediterranean and Europe and also take advantage of high-performance computing capabilities hosted at The Cyprus Institute to perform research requiring intensive computing or data storage and management. New perspectives on archaeological and cultural heritage in the region are achieved through strong collaboration with research in climate, environment and unmanned aircraft at The Cyprus Institute.

Local Authorities with DCH potential. The list following includes the local authorities, responsible to the Ministry of the Interior, that have expressed explicitly their interest to develop new policies or have implemented existing projects on the DCH.

Pafos District Administration	Keryneia Municipality	Agros Community Board
Latsia Municipality	Athienou Municipality	Pelendri Community Board
Paralimni Municipality	Ardana Community Board	Lofou Community Board
Engomi Municipality	Salamiou Community Board	Communal Council of Komi Kebir
Agios Athanasios Municipality	Community Council of Kakotopia	Arsos Community Association Development Association Community
Lemesos (Limassol) Municipality	Saint Demetrios of Leonarisso Refugee Association	Gerani Community
Yeri Municipality	Lania Community Board	Peristeronopiyi (Piyi) Famagusta Community Board
Lefkara Municipality	Karakoumi Community	

The Pafos region case attracts particular attention in the DCH actual and potential impact because of the very valuable cultural heritage and is a UNESCO WHL City and 2017 EU CH Capital. The name Pafos is directly related to Aphrodite and Pafos is in mythology the Birthplace of Venus – The Goddess of Beauty and Love. It was the first place, outside Palestine, in which Christianity was taught by the Apostle Paul. The district of Pafos has the majority of Medieval monuments and Byzantine monasteries (still active) on the island.

98% of all the visitors of Pafos visit the sites of the city and 91% of all foreign visitors in Cyprus visited Pafos district sites . Tourism is ranked first as a source of Pafos income. but with the existing infrastructure it has not been able to exploit this for the benefit of the local community and wider society. The award of 'Pafos 17' has allowed the city to rethink itself and through various architectural initiatives to create infrastructural changes and develop new cultural buildings or enhance old ones   Problems identified in its strategic plan for structural funds include inadequate physical infrastructure for cultural activities (such as theatres or a Conference Centre) and projects with serious technical and functional deficiencies/weaknesses. A recent study has proposed four projects to ameliorate these problems and to contribute to the emergence and creative exploitation of the cultural heritage of the city. These involve the regeneration of a number of important old buildings.

After the invasion of 1974 Cyprus lost its biggest contribution to the economy, Famagusta Varoshia, which was the largest tourist destination at that point. A whole series of fast 'non-organic' developments swiftly spread along the coast to Ayia Napa, Larnaka, Limassol and Pafos in an effort to regenerate mass tourism. The rapid growth in visitors to Pafos, a that time a small pace, led to cultural heritage being destroyed or becoming hidden within the urban fabric.

One of the main challenges is that Pafos is a seasonal city with an economy dependent on the tourist industry, in which most inhabitants work. Since the economic crisis of 2013, hotels in Pafos have adopted 'all-inclusive' business models to the detriment of other local businesses depending on the same visitors. An effort is needed to attract visitors to want to explore the city and experience it in ways which will allow new business and skill sets to develop. During the winter, the city goes into hibernation: a major inhibition of sustainability. To counteract this, the Municipality aims to attract various institutes for higher education (including the private Neapolis University) with the aspiration to grow its declining population of young people.

Pafos also has set its sights on becoming the first 'smart city' in Cyprus by 2017, following in the footsteps of major cities around the globe in technologically advanced nations, to coincide with its selection as the European City of Culture 2017 by incorporating technological innovations into existing communications infrastructures, including systems for electronic announcements, electronic timetables for buses, a network for electronic bicycles, a network for charging electronic cars, an upgraded network of public lighting and the creation of a high speed Wi-Fi network covering all the central and tourist areas of the municipality.

The city aims to show that it can support Europe in opening new avenues of cultural coexistence and cooperation with cultures in the broader Middle East and North Africa. It plans to implementation of a programme to transform the town and district into an 'open-air factory' for Pafos 2017, utilizing the natural elements of the area: warm climate, clear skies and abundance of outdoor spaces, the history and traditions of Pafos, features from the cultures of Europe and the Eastern Mediterranean. This is aimed to promote development of genuine products with the active involvement of local groups, European and international partners and provide space for exploration of questions about: European identity and values, conflict resolution, migration, the environment, tourism and urban development.

The potential of new technologies to stitch together a sensorial experience of the layers of information that will give visitors and locals a sense of place, history, time and culture, for example through the creation of a Virtual City Museum, portraying 'smart archaeology' and inviting industry to work together with archaeologists to enhance education opportunities, tourism and local identity is a role which the Mnemosyne CoE will be positioned to take up actively, through its planned location in Pafos.

Legal framework/body of law
The Antiquities Law, published in 1960, and amended in 2012 also covers the activities of museums and advisory bodies in the field of antiquities.

Tourism in Cyprus has evolved into one of the most important socioeconomic activities and the undisputed most important industry for the country's economy. The legal framework that coacts the operation of the tourism establishments and services aims to safeguard the value and quality of these services. A legal framework governing the activities and operations of CTO was first established in 1969 and followed a succession of laws, last consolidated in 2012.

Analysis of public policies/strategies
Since its economic crisis in 2013, investment in CH in general and DCH in particular has been low to non-existent. Nevertheless, the potential to leverage Cyprus' impressive Cultural Heritage for economic growth and social benefit is very large, along with its tourism industry. The island of Cyprus, exemplified by Pafos, has highly symbolic and world-renowned heritage resources from the ancient pan-Mediterranean civilizations - Pharaonic, Phoenician, Hellenistic, Roman, Byzantine, Venetian, Ottoman - capable of attracting international interest and producing good transferable examples. Cultural Heritage is a core asset of Cyprus and the surrounding region. Cyprus itself boasts well over a thousand Listed Monuments. The island is an open-air museum of prehistoric settlements, classical Greek temples, Roman theatres and villas, Early Christian basilicas, Byzantine churches and monasteries, Crusader castles, Gothic cathedrals, Venetian fortifications, Moslem mosques, and British colonial-style buildings. The old ways of life, customs and traditions are still preserved in the rural villages, and interesting elements of the island are captured in the many museums and galleries. Nevertheless, there has been considerable destruction and deterioration of monuments, principally in the North of the island, since it was divided in 1974.

The Smart Specialization Strategy for Cyprus, launched in 2015 as a conditionality during the programming period 2014-2020, for the exploitation of resources from the European Structural and Investment Funds for enhancing Research and Innovation (R & I) in areas where each country has a competitive advantage, identified its priority areas as: Energy, Tourism, the Structured Environment/Construction Industry, Transport/Marine, Agriculture/Food Industry and the sector of Health. Cultural Heritage has a key role to play in several of these areas.

Also, in the second half of 2017, the government established a new committee to develop strategies for its digitization of cultural heritage. As its first initiative, the committee commissioned from consultants which was completed during the Spring of 2018. The study I recorded the current situation regarding the digitization of the cultural wealth of Cyprus, as well as an analysis of internationally applicable practices in this field. It is planned to result in submission of proposals for the Development of Actions for the exploitation of the cultural stock of Cyprus. The results of the study should demonstrate the priorities that the state needs to set in terms of digitization of the cultural heritage (e.g. digitization prioritization in religious tourism or other areas with added value to the country's economy). The analysis should have three levels of response: Now (by 2020), in the medium term (2025) and in the longer term (2030).The objectives of the strategy should also be highlighted, bearing in mind the national, European, regional and international realities. Points to be included in the study are as follows:

- Use of ICT to promote cultural heritage
- Electronic / Digital Tourism/ Virtual Cultural Heritage
- Linking monuments to local society and history
- Linking with Destination Management (DMOs, DMCs)
- Developing relevant skills
- Sustainability and enrichment of data and applications
- New business models
- Need to create a digital platform for the Cypriot digital cultural heritage
- Proper investment of the available European Structural Funds for long-term preservation of the effect of various digitization.
- Need for training and retraining of staff and generally human resources. Exploitation of European funds for education and retraining of young unemployed.
- The dimension of regional cooperation with neighboring countries and in relation to other vital areas.

Institutional framework and policies

LAW / Regulation / strategic plan /, policy	Institution in charge	General Objectives	Relative provisions and opportunities for the Digital heritage	Achievements and obstacles for digital culture in the area
National Committee for the Digitisation and e-Preservation at (established 2017)	Ministry of Education and Culture	The main objective of the committee is to establish a road-map for the Cypriot digital heritage era and to develop a national aggregator and a sustainable macro-economic master plan, which will be accompanied by a reasonable budget for the implementation of this strategic development plan until 2027. The committee will develop strategies for its digitization of cultural heritage. As its first initiative, a study from consultants was completed during Spring of 2018, which recorded the current situation regarding digitization of the cultural wealth of Cyprus, as well as an analysis of internationally applicable practices in this field. It is planned to result in submission of proposals for actions to exploit the cultural stock of Cyprus. The results of the study should demonstrate the priorities that the state needs to set in terms of CH digitisation (e.g. in religious tourism or other areas with added value to the country's economy): now (by 2020),medium term (2025) and longer term (2030).	The potential to leverage Cyprus' impressive Cultural Heritage for economic growth and social benefit is very large, along with its tourism industry. The island of Cyprus has highly symbolic and world-renowned heritage resources from the ancient pan-Mediterranean civilizations - capable of attracting international interest and producing good transferable examples. Cyprus boasts well over a thousand Listed Monuments. The Smart Specialization Strategy for Cyprus, launched in 2015 as a conditionality during the programming period 2014-2020, for the exploitation of resources from the European Structural and Investment Funds for enhancing Research and Innovation (R & I) in areas where each country has a competitive advantage. Cyprus, identified its priority areas as: Energy, Tourism, the Structured Environment/Construction Industry, Transport/Marine, Agriculture/Food Industry and the sector of Health. Cultural Heritage has a key role to play in several of these areas.	Since its economic crisis in 2013, investment in CH in general and DCH in particular has been low to nonexistent. There has been considerable destruction and deterioration of monuments, principally in the North of the island, since it was divided in 1974.

Department of Antiquities / The Antiquities Law		The Department of Antiquities is responsible for the management and preservation of the archaeological heritage of Cyprus. Main areas of activity and responsibility are: systematic and rescue excavations, archaeological surveys; archaeological museums; the conservation, restoration, protection and promotion of Ancient Monuments in the schedules of the Antiquities Law ((published 1960, amended in 2012) which also covers the activities of museums and advisory bodies in the field of antiquities.	One of the aims of the Department of Antiquities is also the use the sites, ancient monuments and archaeological museums for educational purposes and cultural activities, as well as for the stimulation of cultural tourism. In order to achieve the above, the Department of Antiquities organises conferences, exhibitions and lectures both in Cyprus and abroad. In recent years, the Department has contributed towards the establishment of private/thematic museums, acting as a specialized consultant. The Department has participated in a number of EU and regional projects such as Interreg projects.	
Cyprus Tourist Organisation .	Ministry of Commerce, Industry and Tourism	(CTO) was established and operates according to the provisions of the Cyprus Tourism Organisation Laws 1969–2005 and the related Regulation on Structure and Terms of Employment and Administration and Finance. The CTO is responsible for regulating and monitoring the tourist enterprises and professionals based on the relevant legislation	Tourism in Cyprus has evolved into one of the most important socioeconomic activities and the undisputed most important industry for the country's economy. The legal framework that coasts the operation of the tourism establishments and services aims to safeguard the value and quality of these services. A legal framework governing the activities and operations of CTO was first established in 1969 and followed a succession of laws, last consolidated in 2012.	
Local authorities	Ministry of Interior	A large number of local authorities have expressed explicitly their interest to develop new policies based on DCH. Much of this interest resulted from their participation in the LoCloud Best Practice Network funded under the EU IST-PSP programme 2012-15, which submitted local digital content to Europeana through CUT.	Pafos is a UNESCO WHL City and in 2017 was EU CH Capital. The Municipality aims to attract various institutes for higher education (including the private Neapolis University) with the aspiration to grow its declining population of young people. Pafos also aimed to become the first 'smart city' in Cyprus to coincide with its selection as the European City of Culture 2017 by incorporating technological innovations into existing communications infrastructures.

The potential of new technologies to stitch together a sensorial experience of the layers of information | Existing infrastructure and access to skills have not been adequate for local authorities to exploit DCH for the benefit of the local community and wider society.

After the invasion of 1974 Cyprus lost its biggest contribution to the economy, Famagusta Varoshia, which was the largest tourist destination at that point. A |

			that will give visitors and locals a sense of place, history, time and culture, for example through the creation of a Virtual City Museum, portraying 'smart archaeology' and inviting industry to work together with archaeologists to enhance education opportunities, tourism and local identity.	whole series of fast 'non-organic' developments swiftly spread along the coast to Agia Napa, Larnaka, Limassol and Pafos in an effort to regenerate mass tourism. Many hotels have adopted 'all-inclusive' business models to the detriment of other local businesses depending on the same visitors. An effort is needed to attract visitors to want to explore the city and experience it in ways which will allow new business and skill sets to develop.
The Cyprus Organisation for Standardisation	Ministry of Commerce, Industry and Tourism	CYS (established 2002), is the National Standardisation Body of Cyprus, whose principal activity is the production of standards and the supply of standards-related services.	Under the heading of 'a visit to the museum' CYS has produced a graphic depiction of standards applicable to museums and relevant to the quality of the environment, the conservation of cultural heritage and the safety of visitors.	
Cyprus University of Technology (CUT)		CUT aims to become a modern and innovative university with international recognition which promotes excellence in education and research in cutting-edge fields, aiming at the scientific, technological, economic, social and cultural upgrading of the country.	CUT is gaining international distinction in research, especially under the European HORIZON 2020 programme where over 9 million Euros has been secured through 23 research proposals, the highest rate of success in Cyprus. Recent successes include two ERC strategic projects totaling 3.3 million Euros, two "Teaming for Excellence" research proposals led by CUT and participation in the creation of a RISE Excellence Center for technological and business innovation. The Director of Its Digital Heritage Research Laboratory (DHRLab), Dr Marinos Ioannides, was	

			appointed UNESCO Chair of Digital Heritage in late 2017, providing significant potential for influencing the status of and investment in DCH in the years to come. Under Horizon 2020 DHRLAB is Coordinator of the ViMM Coordination and Support Action for Digital Cultural Heritage and Virtual Museums and has been awarded a 5 year-single institution project as European Research Area (ERA) Chair in Digital Heritage, beginning in January 2018. It was previously the coordinator of the successful ITN-DCH research training project under the Marie Curie programme and is a partner in several other projects.	
University of Cyprus		The Department of Architecture aims to educating students to become successful architects who can perform in the eastern Mediterranean region and worldwide.	The Lab has received within the last 5 years a total budget of seven (7) Million Euro from highly competitive FP7 and H2020 Grants in the area of Digital Cultural Heritage. This is a unique achievement on the island of Cyprus in this new promising and growing area of work.	
Cyprus institute (CyI)		CyI has been developed as an international science and technology organization, to strengthen the research community of Cyprus, help transform its economy to a knowledge-based economy and to create a research hub for the Eastern Mediterranean region.	The Science and Technology in Archaeology Research Center (STARC) of CyI is devoted to the development, introduction and use of advanced science and technologies in the field of archaeology, cultural heritage and history of the region. It utilises sophisticated instruments for physical and chemical measurements in a fixed and mobile laboratory to participate in collaborative research in Cyprus, the Eastern Mediterranean and Europe (including under Horizon2020) and also takes advantage of high-performance computing capabilities to perform research requiring intensive computing or data storage and management. New perspectives on archaeological and cultural heritage in the region are achieved through strong collaboration with research in climate, environment and unmanned aircraft.	

| Operational program of Cyprus Structural funds | Regional Authority / Ministry of Education and Culture | Cyprus has been allocated EUR 874 million from ESI Funds over the period 2014-2020. Given the additional national contribution of EUR 246 million, the total amount will be EUR 1.12 billion. These funds will be invested in various areas through four national programmes, leading to job creation and growth, improved environmental protection, sustainable land management in agriculture and forestry, resource usage efficiency, increased competitiveness for its SMEs as well as significant investments in transport and energy network infrastructure. | Potentially relevant priorities for ESI funds in Cyprus include:
• Diversify the structure of the economy and make it more competitive.
• Strengthen business innovation and encourage cooperation between businesses and research facilities in all sectors of the economy, including agriculture and forestry.
• Increase employment opportunities, focusing on vulnerable groups such as the unemployed, the long-term unemployed and especially young people.
• Help the shift to a low-carbon and resource-efficient economy.
• Promote the sustainable management and use of natural resources, adaptation to climate change and conservation of biodiversity and ecosystems related to agriculture and forestry.
• Promote economic development and the creation of new jobs in rural areas.
• Support the protection and rehabilitation of marine biological resources.
• Promote entrepreneurship and the competitiveness of SMEs, in particular in the tourism, agri-food and aquaculture sectors.
• Help to fight poverty and support social inclusion.
• Promote the improvement of vocational and technical education systems.
• Help to improve the efficiency of public administration.

Several regional Interreg projects in the broad field of Heritage Buildings Information Management (HBIM) currently involve Cypriot organisations, including CUT | |
| Educational policies for learning through school visits and | | Organised school visits, sleepovers and other activities take place at a number of museums in Cyprus e.g. The Cyprus Motor | | |

connection to museums		Museum and during International Museums Day.		
Law for NGOs		In July 2017 the Parliament of Cyprus approved progressive amendments to the Law on Associations, Foundations and Clubs that improve the regulation of Civil Society Organisations (CSOs) in Cyprus.	The new law promotes financial and managerial transparency of CSOs and provides for the establishment of federations or other types of CSO unions and addresses certain previously identified issues such as: − unclear distinction between associations and clubs; − requirement for mandatory registration and annual re-registration of clubs not in line with international guarantees regarding freedom of association; − personal liability for violations of the legal entity which contradict international standards; − registration requirements for associations are excessively strict; − excessive interference in the internal affairs of institutions and the rights of the Attorney General exceeding what is necessary to guarantee the public interest.	

Impact of Macro policies

Achievements

Cyprus is now well advanced towards recovery after a long period of economic recession, following the banking crash of 2013,which retarded attention to and investment in one of its greatest economic and social assets: its cultural heritage. Significant attention is now being paid to research, development and infrastructure in this field through strategic infrastructure and the development of multi-faceted research capacity, including in the key new digital aspects. Considerable success has recently been achieved in gaining

- EU funding under Horizon 2020, Interreg and other programmes. The Cypriot institutions are beginning to develop a regional role.
- Cultural Heritage is strongly-placed to become a major resource for tourism, education, creativity and economic growth in Cyprus and the Eastern Mediterranean and this is recognized by national stakeholders. The potential reunification of Cyprus may provide scope for DCH applications in support of social cohesion. EU – funded initiatives in particular are providing a promising basis for strengthening human resources and coordination in the field of DCH

Policy is now in place for large-scale digitisation of digital heritage and its inclusion in Europeana through the national aggregator.

Challenges

- The national stakeholder base for DCH remains relatively uncoordinated and pipelines for the emergence of effective strategic initiatives have hitherto been rather weak.
- The preventative conservation and reconstruction of damaged heritage will require large-scale inputs of expertise.
- The number of practical applications in use emerging from DCH initiatives to date is limited.
- Little attention has yet been paid to economic and social impact assessment of CH or DCH initiatives in Cyprus, due to the economic recession in the last four years**.**
- Qualified human resources remain in short supply. Education and training facilities require strengthening.
- The NGO sector is not yet visible in DCH.
- Initiatives to encourage public participation such as co-creation, co-design crowdsourcing or citizen science in relation to DCH are few and far between
- The new National Museum and state Library buildings and infrastructures have been planned and in the next two years will be the beginning of new constructions and modern developments in this area.
- On the 6th of February 2019 will be discussed at the Cypriot Parliament the agenda on CY Digital Cultural Heritage and its impact on education, Research, Innovation and Tourism - for the first time ever in the history of the Republic of Cyprus

4. MICRO LEVEL APROACH REPRESENTATIVE CASES IN THE 3 REGIONS

4.1 MICRO REGIONAL CASES CATALONIA / SPAIN

Method and field work

Field visits to the study case sites were necessary in order to have a direct appreciation of the way in which museums promote cultural heritage and their museography characteristics; but mainly, to identify the technological applications used in cultural interpretation. The visits facilitated photographic recording and conducting interviews with the management of the sites.

Interviews - questionnaires

Having the opportunity to organize a number of meetings with the managers and other persons involved of the case studies allowed us to obtain valuable information directly from those in charge of the different tasks of management and diffusion of cultural heritage, generating a wider vision about the use of the technologies and their implications.

A questionnaire consisting of 24 questions was sent prior to each visit in order to have some basic information in advance. The semi-structured interviews and questionnaires were conducted based on the following script structure:
- Idea generation
- Design and planning
- Implementation
- Operation / evaluation internal impact

Persons in charge on stakeholders		
Name	**Position**	**Entity**
Carlos Romero Dexeus	Director of Research, Development and Tourism Innovation	Sociedad estatal para la Gestión de la Innovación y las Tecnologías Turísticas. (SEGITTUR).
Lada Servitja	Personal de soporte del SAM Girona	Servicio de Atención a Museos Xarxa de Museus Comarcas de Girona
Laura Moreno	Marketing Club de Cultura e Identidad	Patronato de Turismo Costa Brava
Ramon Viñas	Researcher	Catalan Institute for Human Paleoecology and Social Evolution (IPHES)
Narcís Parés	Tenure Associate Professor	Universitat Pompeu Fabra
Albert Sierra	Responsible in the Department of New technologies	Catalan Agency of Cultural Heritage, Generalitat de Catalunya

Interviewed stakeholders from private and public entities.

Professionals in CASE STUDIES		
Name	**Position**	**Museum**
Eudald Tomasa	General Director of Grup Transversal	Mon Sant Benet
Gabriel de Prado	Responsible of Museu	Museu d'Arqueologia de Catalunya-Ullastret
Agustí Vericat	Director	Centre d'Interpretació d'Art Rupestre Abrics de l'Ermita–Ulldecona

Albert Sierra	Responsible in the Department of New technologies	Catalan Agency of Cultural Heritage, Generalitat de Catalunya
Jordi Tura	Director	Museu Etnològic del Montseny, La Gabella

Interviewed administrative personnel.

In order to analyze the Micro level, four operational projects who have developed innovative audiovisual tools that allow interaction with users in the promotion of cultural heritage will be studied. The study cases are 4 digital museum installations that where selected because of their diversity in terms of applications, the various functions of digital technology, from content presentation to access and the diversity of organizational background.

Through the application of surveys, semi-structured interviews and literature review, information was obtained related to the processes of ideation and implementation for the development of technological projects in the museums that are part of our research, was obtained. This part of the study focuses the following points a) the process of concept creation, design, implementation and operation of concrete digital heritage projects b) the way they are linked with their institutional and operational framework c) the possibly registered impact in the organization owner and other sectors once the technological application started to operate

The representative DCH projects have been selected in collaboration with the local administration experts, taking into account their level of maturity, the variety of cultural assets, environments and technologies used, the different kinds of operational objectives (i.e. digitize cultural assets and information facilitate access to various cultural sites and projects) and the availability of information and professionals involved. The overall objective is to validate the general conclusions and generate evidence-based policy making recommendations in the micro and micro level.

Case study 1 Catalonia . Archeological Museum of Catalonia –Ullastret: Immersive installation "Ullastret 3D"
Case study 2. Mon Sant Benet: Hologram and audio-visual technology
Case study 3.Centre for the Interpretation of Rock Art "Abrics de L'ermita":
"We Hunters" Interactive digital experience
Case study 4.Museu Etnologic del Mentseny, La Gabella: Visitmuseum platform

MICRO CASE 1 CATALONIA - IMMERSIVE INATALLATION – ULLASTRET 3D

The overall project and cultural assets

The Iberian town of Ullastret (6-2 B.C.) is located on today's Empordà Plain in Catalonia, Spain; and is one of the most well-known and outstanding Girona archaeological sites on the north-west Mediterranean, built 20 km. south of Ampurias. This large urban settlement was formed by two inhabited centers, one being the Puig de Sant Andreu (Saint Andrew Hill) and the other the Illad'en Reixac (Reixac Island), separated, one from the other by a distance of only 300 meters (Agència Catalana del Patrimoni Cultural, 2018). Between them, the two settlements eventually extended a wall over an area exceeding 15 hectares and they constituted the capital of the Iberian tribe known as the Indiketes. This Iberian town lived in great splendour between the 4th and 3rd centuries BC. With a population over 6,000 inhabitants, it was one of the biggest concentrations in the pre-Roman Iberian Peninsula.

The site was discovered around 1930,and 6 years later was included in the Historic, Artistic and Scientific Heritage Register of Catalonia[29]; but it is the research that has been carried out over recent years, based in many cases on the application of the latest generation of geophysical prospection techniques, that has produced the greatest knowledge with regard to its urban and defensive structures and the surrounding area. This resulted in the development of a project for the virtual 3D reconstruction of the entire settlement, based on scientific knowledge; which in turn, has benefitted from the important advances made in the study of Iberian culture over recent years.

Because it is the best-known period from a scientific point of view, construction focuses on a specific moment in the settlement's history, around the year 250 B.C. The 3D virtual Project was under the direction of the Ullastret branch of the Archaeological Museum of Catalonia, as it promotes the Iberian culture in the northeastern area of Catalonia through the excavations carried out in the sites that make up the archaeological site of Ullastret.

Exterior of the Archeological Museum of Catalonia- Ullastret.

Project concept

The Immersive installation "Ullastret 3D", is a virtual reconstruction of the archaeological site of the Iberian town of Ullastret, considered the most important settlement of its kind in Catalonia. The virtual reconstruction developed a storytelling experience based on a 3D model and displayed by two different applications: an immersive room at Ullastret Museum, and a virtual reality headset. The new technologies together with virtual reality used in Ullastret 3D transports users 2000 years back in history, allowing them to explore the city of Ullastret[30].

The immersive room, located in the Ullastret branch of the Archeological Museum of Catalonia, consists of a multi-screen projection visible on other screens in a space of approximately 10 square meters aiming to reproduce the dimensions of an Iberian dwelling. The screens, one frontal and two laterals, allow the user to

---

[29]Museu d'Arqueologia de Catalunya (MAC) (n.a.) El referente de l'arqueologia catalana. p53.
[30]http://patrimoni.gencat.cat/es/historias/ullastret-3d-caminar-por-una-ciudad-iberica-de-hace-2000-anos

have an almost 360-degree vision. The projection is synchronized with the audio system that recalls the original atmosphere of the natural environment, intensifying the user experience while exploring the ancient Iberian city. The projection lasts 6 minutes and is available in Catalan, Spanish, French, English and German.

The Virtual Reality headset, settled in the Archaeological Museum of Catalonia, generates more complete and realistic experiences, since users are totally immersed and can navigate within the virtual space in a natural way and at a life-size scale. As in the immersive room, audio plays an important role; thus, a complex 3D soundtrack was created, thanks to which the sources of the different sounds can be located in the surrounding scene. These audiovisual experiences have been conceived as an important tool for the promotion and interpretation of cultural heritage, making learning through digital applications a fun, innovative and interactive experience.

Design implementation

The project was directed by the Ullastret branch of the Museum of Archeology of Catalonia who formed a multidisciplinary team composed of architects, hydrologists, anthropologists and naval architects, an integration of different disciplines with the firm intention of achieving a precise and detailed reproduction of the Iberian town. Within the team was the Catalan Agency for Cultural Heritage as coordinator at a technical level and alongside the Burzon Comence company, developed the 3D content.

The first step to reach the reconstruction consisted of gathering as much archaeological information as possible about the site, to be later analyzed and validated by experts in the field. Special attention was given to obtain accurate information regarding the geographical characteristics and vegetation of the area. Once the information was approved, it was passed to the design team responsible for 3D development.

The next step was to analyze the characteristics of the settlement, considering walls, roads, buildings and other constructions of the time. Thereafter, different items were included inside the buildings among which there are representative objects of the Iberian culture, similar to the ones that were found in excavations in the area, such as tools, jars, swords, shields, etc., and are currently part of the Ullastret Museum's collection. The model was constructed using 3D maps provided by the Institute of Cartography and Geology of Catalonia. The software used to develop the immersive experience allowed to create scenarios with great definition and details of the landscapes, buildings, roads, vegetation and objects.

After a year and a half of work, the first stage of the project culminated with the result of a video of the reconstruction of the town. Subsequently and considering economic and technical factors, a decision was taken to develop two applications: an immersive room in which to project an audiovisual of the virtual reconstruction (Ullastret Museum), and an adaptation of the virtual reconstruction to be experienced through virtual reality headsets (Archaeological Museum of Catalonia).

Technologies and heritage: impact assessment

People have responded enthusiastically to both the individual VR and the group immersive room experiences. With regard to the latter, the impact created by some of the scenes, such as the flight over the Iberian town, and the appearance of objects which visitors can later see in the museum display cabinets, demonstrates that this medium is highly effective. For most people this was the very first time that they had used a VR headset, and the reaction to it was extraordinary. The first thing to note is the fact that it is a medium suited to all ages, being warmly received by children of twelve years of age, to people in their 90s.

It is particularly interesting to note the impact it had on older people. Their experience was notably vivid and emotional. Furthermore, it was a remarkably striking discovery for people with restricted mobility. People confined to wheelchairs, for example, experienced a sensation of freedom of movement that was a revelatory experience for some of them, and this has led to establishing contact with hospitals specializing in rehabilitation to offer such a service to their patients.

Summary information

Process of concept creation	
Internal/external	It emerged as an internal proposal by the same personnel of MAC-Ullastret.
Direction	Archaeological Museum of Catalonia and the Catalan Agency of Cultural Heritage.
Financing	102,000 euros granted by Obra Social La Caixa. It is important to consider all the working hours that civil servants dedicated to the project and that are not considered in the budget.
Workgroup	The project was directed by the Ullastret branch of the Museum of Archeology of Catalonia and together with the Catalan Agency for Cultural Heritage integrated a multidisciplinary team composed of architects, hydrologists, anthropologists, naval architects, archaeologist and graphic designers. An archaeologist was hired to manage the transfer of information to the 3D development group. In addition, this person was advised by specialists in many different subjects to be as rigorous as possible throughout the process of virtual reconstruction.
Time of development	Four years, from 2012 with the beginning of the archeological research to the completion of the Ullastret 3D virtual model in February 2016.
Scientific advice	MAC- Ullastret (archaeologists and historians). Burzon Comence (graphic design and development). Visyon (adaptation VR glasses).
Collaboration (private/public)	MAC-Ullastret, Agència Catalana del Patrimoni Cultural and Obra Social La Caixa.
Challenges	Owing to the fact that the research team prioritized scientific rigor over other aspects, the original timeline could not have been met.
Operation/impact	
Administrative	Not identified.
Adaptation	A physical space was adapted to install the immersive room.
Challenges	From the 3D modeling other applications can be made in order to improve the interpretation at Ullastret. New applications have been considered, however, without a subsidy or external contribution to the budget, it is not possible to carry out any of the ideas explored.
Performance/evaluation	Through the Rate Now evaluation system, a series of questions on a digital platform are directed to know the age, the level of studies, the origin, the degree of satisfaction of the visitor, but there is no specific question regarding the 3D audiovisual. An evaluation of comments that appear in different communication channels, basically TripAdvisor and Google reviews. In both cases, the percentage that refers to the 3D audiovisual is similar to the previous one and moves around 15%. In social networks, however, the comments are complimentary in relation to how interesting the audiovisual is to understand the whole.
Visit flows	There is no clear evidence that the immersive room has a direct effect on the flow of visitors to MAC-Ullastret.
Academy	The school Escola L'Estany - ZER Empordanet-Gavarres located in Ullastret, a rural school that frequently participates in school activities offered by MAC-Ullastret.

Tourism	Not enough data provided. There are tour operators that visit the place on a frequent basis.
Promotion	They do not generate their own promotion and marketing strategies. They depend on the central office and are supported by the Xarxas and the Catalan Agency of Cultural Heritage.
Acknowledgement / recognition	The 3D virtual reconstruction of the Iberian city of Ullastret was chosen to participate in the international exhibition ArcheoVirtual 2016. The project has been a finalist and highly valued in the 2017 edition of Heritage in Motion Awards, European Museum Academy. It has been awarded in terms of design, in the A-Design Award and Competition, in the CULTURAL HERITAGE AND CULTURE INDUSTRY DESIGN 2017 category. Participation in The International Conference KAINUA 2017 Università di Bologna

MICRO CASE 2 CATALONIA - CULTURAL HERITAGE OF MON SANT BENET

Monastery of Sant Benet de Bages. Retrieved from Mon Sant Benet

The overall project and cultural assets

Sant Benet de Bages Monastery, located on SantFruitós de Bages, was built in 960 with Romanesque architecture, and is one of the best preserved medieval monastic sites in Catalonia, as one of the most emblematic monuments in the region. Over the centuries, the monastery has gone through striking events that marked its activities as well as its architecture: The plague in 1348, wars and conflicts, fires and a lack of maintenance sent Sant Benet into decline from the 15th century onwards. After 1620, the monastery became the site of a College of Arts and subsequently became a home for elderly monks from Montserrat. The monastery was active until 1835.

Afterwards, workers in a textile industry used the properties as homes. So it was until 1909, when the place was acquired by the family of the painter Ramón Casas who hired architect Josep Puig I Cadafalch to work on the restoration of the buildings; giving Mon Sant Benet a new opportunity to emerge. Due to its rich history and cultural heritage, Mon Sant Benet de Bages was recognized as a national monument in 1931.

In 2000 the property was purchased by Caixa Manresa (now Catalunya Caixa, a private Bank) with the aim of developing a visionary, multi- functional project that gathers cultural heritage, tourism and pedagogical activities. The Mon Sant Benet center was inaugurated on November 12, 2007.

Project concept[31]

MónSant Benet is a cultural heritage center with medieval roots that integrates cultural, tourism, leisure and scientific services, located at SantFrutós de Bages,60 km north of Barcelona. The center includes de Benedictine Monastery of Sant Benet de Bages, recognized as one of the best medieval monastic sites in Catalonia, a four stars hotel, a convention center and a research center devoted to technological innovation in cuisine hosted by the Alicia Foundation. Through guided tours and new audio-visual technologies, Mon Sant Benet offers its visitors an opportunity to become immersed in the monastic history and the modernist past of the center.

---

[31] Official website http://monstbenet.com/ca

Design – implementation process[32]

The MónSant Benet center is a project born with the aim of becoming a tourist reference in Central Catalonia. A project that seeks to foster economic development initiatives undertaken by Caixa Manresa in cooperation with public administrations and the private sector.

It all began in 2000, with the purchase of the Romanesque monastery of Sant Benet de Bages by Caixa Manresa, which entailed five years of planning and definition of content, and two more years of execution, with intense restoration actions of the monastery and construction of the new facilities, with a total investment of 71 million euros. The development of the project can be structured in three differentiated phases: a first phase (1990-2000), prior to the purchase of the monastery; a second phase (2000-2004) in which the team is united to carry out the project and the central ideas are elaborated; and a third phase (2004-2007) corresponding to the realization of the project.

Although the Department of Culture of the Generalitat of Catalonia approved a first master plan for the monastery, which included exhibitions of works of art in Sant Benet, it was decided that the restoration and arts exhibition wouldn't be enough to captivate the audience; so new strategies were implemented in order to build a story considering the values of the locality and the use of innovative tools. The museography project was placed in the hands of the company Transversal Producciones Culturales, with experience in developing image and communication projects. The project gathered, at a very early stage of the project, a multidisciplinary team specialized mainly in stage arts. This team was integrated by a cinematographic realist, a sound engineer, a specialist in show programming, later, a lighting specialist, set designers, documentary makers, museologists, historians, etc.[33]

MónSant Benet has two key thematic areas: the museographic project and the Alicia Foundation. It has an innovative medieval and modernist museography, which allows visitors to relive and understand more than a thousand years of the history of Catalonia. It provides tourism and pedagogical services, which give value to the monastery as a symbol of the history and culture of the country.

The Alicia Foundation is a research center that has the support of the Generalitat of Catalonia and the Caixa Manresa Foundation. Alicia promotes high-level scientific research in the fields of food and health. At the same time, it seeks to enhance the country's culinary heritage and scientific innovation in gastronomy.

The complex also includes a convention and congress center, with 4,000 m2, divided between the monastery and the factory building; A four-star "Hotel Mundo"; three restaurants: La Fonda, Món and L'Ó, the latter awarded with a Michelin Star; a tourist information center and a shop with the most representative gastronomical products of Catalonia.

Tours were designed for different types of audiences (children, families, specialized groups, etc.), and through projections of photographs and animations, a thousand years of history of the monastery and of Catalonia, from the medieval period to modernism, are explained. The tours seek to generate emotions and sensations through the use of new generation audiovisual techniques

Summary information

Process	
Internal/external stakeholders	Internal. The idea was generated by Transversal Producciones with Catalunya-La Pedrera Foundation.
Direction	Transversal Producciones Culturales.
Financing	Catalunya-La Pedrera Foundation 3.5 million euros for the museography.
Workgroup	Execution and coordination: Catalunya-La Pedrera Foundation. Idea, development and contents:

---

[32]Based on the research text of "MónSant Benet: Utopia, ambició I passió", by Olive et al (2010).

[33] Data collected from a publication in audiovisual and hypermedia museography in Mon Sant Benet: https://www.academia.edu/2940362/Museizar_la_vida_cotidiana_desde_el_sombrero_a_los_zapatos_problemas_y_tendencias

	Transversal Producciones Culturales. Cinematograph, a sound engineer, a specialist in show programming, later, a lighting specialist, set designers, documentary makers, museologists, historians.
Development time	2000-2007
Scientific advice	Universitat de Barcelona
Institution (private/public)	No public entities involved in the project.
Challenges	It was a great challenge to achieve the installation of technological and electrical equipment inside the monastery for the projections, while trying to affect as little as possible the architectural structure and keeping it not visible to visitors.
Operation/IMPACT	
Administrative	Not identified.
Adaptation	Not identified.
Challenges	The number of visitors has decreased. They have not been able to attract a national public, at least not in a significant way. The project is very directed to the local public of Catalonia. A way to cover the "fatigue" of the local public, ha to be found. There is a need to strengthen the relationship with government institutions, especially those related to tourism. There is no public transport system that connects the main cities with the Monastery.
Performance/evaluation	Not identified.
Visit flows	90.000 annually (decreased from 120.000)
Academy	A strong presence of from basic and elementary schools
Tourism	Agreements with tour operators. Limited communication with administrative tourism offices.
Contribution to the community	An economic activity is generated around the Monastery. Recover and save a heritage close to the collapse, in disrepair. Cultural Heritage is recovered. It promotes not only the history of the monastery, also of Catalonia. Direct occupation of approx. 100 people employed (25 in the cultural part).

MICRO CASE 3 CATALONIA - "WE HUNTERS", INTERACTIVE DIGITAL EXPERIENCE AT THE CENTER FOR THE INTERPRETATION OF ROCK-ART "ABRICS DE L'ERMITA" ,ULLDECONA

We Hunters interactive screen. Retrieved from Patrimoni Cultural website.

The overall project and cultural assets
Considered the largest set of rock-art representation in Europe, The Rock Art of the Mediterranean Basin on the Iberian Peninsula was distinguished as a World Heritage Site by UNESCO in 1998[34](UNESCO World Heritage List. n.d.). It is recognized among the most important rock art settlements of Europe due to its exceptional depiction of human life and fauna, which provides us with information about the way our ancestors lived in the post-Paleolithic era, 8000 years B.C.

The rock art sites are found in the coastal and inland mountain ranges of the Mediterranean Basin of the Iberian Peninsula, over 1,000 kilometers of coast, from Catalonia to Andalusia, and distributed across six autonomous communities: Andalusia, Aragón, Castilla-La Mancha, Catalonia, Murcia, and Valencia. The paintings appear in shallow open-air shelters, on front walls, and sometimes on the ceilings of the shelters, surrounded by areas with high ecological and landscape values. To date, 757 spots have been identified. They contain figures painted mostly in red and black colors, with a lesser presence of yellow and white (Patrimoni Cultural Generalitat de Catalunya. n.d.).

The "Godall" Mountain, located in Ulldeconais part of the World Heritage Site and displays more than 380 figures distributed through 500 meters of rock shelters. The figures contain archers, distinct animal species, abstract figures and hunting-related elements (animal prints, arrows, etc.).

In 2006, the Center for the Interpretation of Rock Art "Abrics de l'Ermita" (CIAR) was built next to the rock shelters. Its purpose was to facilitate access and to promote education and appreciation for rock art through innovative graphic resources and guided tours (Ulldecona Tourism. n.d.) CIAR is part of the Rock Art Route created by the Archaeological Museum of Catalonia.

Project concept
"We Hunters" is an interactive game displayed on a large format touch screen (240 x 180cm) installed at CIAR. This multi-user installation uses archers and animals from the rock shelters of Ulldecona to create an interactive experience in which users control a hunter with their hand and must establish collaborative hunting strategies. The aim is to provide visitors with an entertaining and educational experience about rock art history.

Design implementation process
Seeking to revitalize the activities at CIAR and to establish new ways to put into value its cultural heritage, the city of Ulldecona approached Barcelona Media[35], an international organization devoted to the creation and management of innovative digital cultural projects. A collaboration was established with the Experimental and Interactive Communication Department of Pompeu Fabra University, and the final team comprised a research leader, a computer developer, two multimedia researchers, as well as an external graphic designer hired for the occasion. They were in charge of conceptualizing and designing the technological proposal that best suited the needs and goals of the CIAR.

A first meeting was held with the main intention of identifying the objective of the intervention and the actors involved. From the meeting an important statement was made by the stakeholders: the experience should focus on the rock art of Shelter 1. This was due to its good conservation state, its historical and cultural value, as well as the fact that it clearly represents a narrated hunting scene, which constituted an important passage event in the life of young men.

An analysis of the physical characteristics of the interpretation center was also undertaken in order to establish the magnitude of the technological platform to be developed, which should maximize the visitor experience given the actual arrangement of the exhibition. The team decided to develop a digital platform that would strengthen the educational experience while being fun and easy to use, both by children and adults. This is

---

[34]To be included on the Heritage List, the sites must meet several requirements to prove its outstanding universal value. http://whc.unesco.org/en/list/874

[35]In 2015 Barcelona Media joined the Eurecat consortium, which seeks to promote innovation and technological development in Catalonia. www.eurecat.org

how the "We Hunters" interactive game was born. The Pompeu Fabra Research Team had already extensive experience in the development of interactive digital projects. Therefore, the most accessible technological elements in terms of costs, maintenance, and accessibility were identified and integrated.

The system that operates the "We Hunters" interactive game is composed of the following elements a) Infrared lights, to detect touch positions on screen; b) Furniture, to support equipment; c) Computer, to control the whole experience; d) Projector, to display the experience; e) Camera, to detect touch positions on screen; and f) 240 x 180cm screen, to display the experience and act as touch surface.
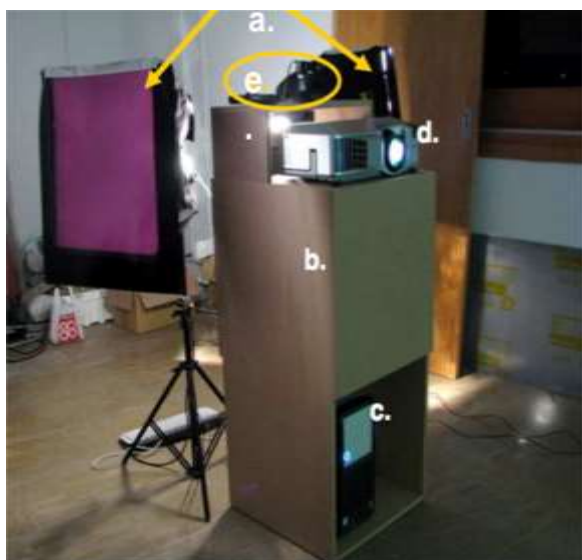
The main technological components of "We Hunters". From left to right and top to bottom: overall view; infrared lights; back side of the screen; front side of the screen. Pictures provided by the Information Center of Ulldecona.

As previously stated, the game used the scene represented on Shelter 1 to achieve a greater impact and strengthen the image of the paintings. However, during the design process, it was also considered that rock art embodies the geographical characteristics of its location, which are directly linked to hunting dynamics.

The features of the rock shelter were therefore portrayed as the staging context of the game and affected the figures' movement and hunting strategies.

To test the functionality of the game, different tests were carried out with children between ages 8 and 11, who provided practical information that allowed making the appropriate adjustments. To structure and develop the final version of "We Hunters", the understanding of the following elements was considered: game dynamics, rock art representation, movement, strategy development, and multi user interaction. The developing process lasted about 7 months, beginning in January 2008 and concluding with the application opening in July 2008.

**Technologies and heritage: impact assessment**

"We, Hunters" was a pioneering project in Catalunya. It constituted the first important research project developed by the Experimentation and Interactive Communication Group of Pompeu Fabra University in Cultural Heritage, and it was amongst the first of its kind to be implemented in Catalonia. From the perspective of Ulldecona City Council, the project aimed to develop innovative tools to promote the cultural heritage linked to the city.

Since its inauguration in July 2008, "We Hunters" has contributed, directly or indirectly, to increase the number and diversity of visitors to CIAR. Although we do not have the means to identify how many of the total number of visitors had a direct interest in the "We, Hunters" application, it is important to highlight the sustained yearly increase in visits to the center.
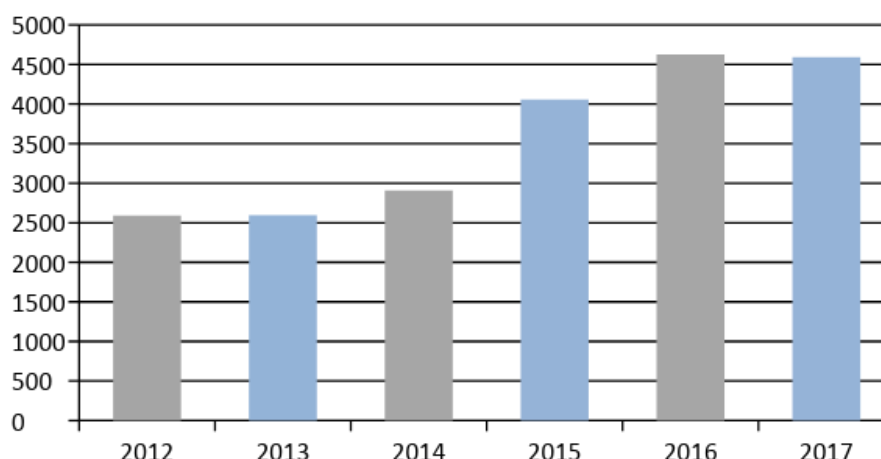
Yearly visits to CIAR from 2012 to 2017. Data provided by the Information Center of Ulldecona

Similarly, the information provided by the Ulldecona Tourist Information Office shows the popularity of CIAR as the main cultural attraction of the city, which has strengthened the image of Ulldecona as an important tourist and cultural destination.
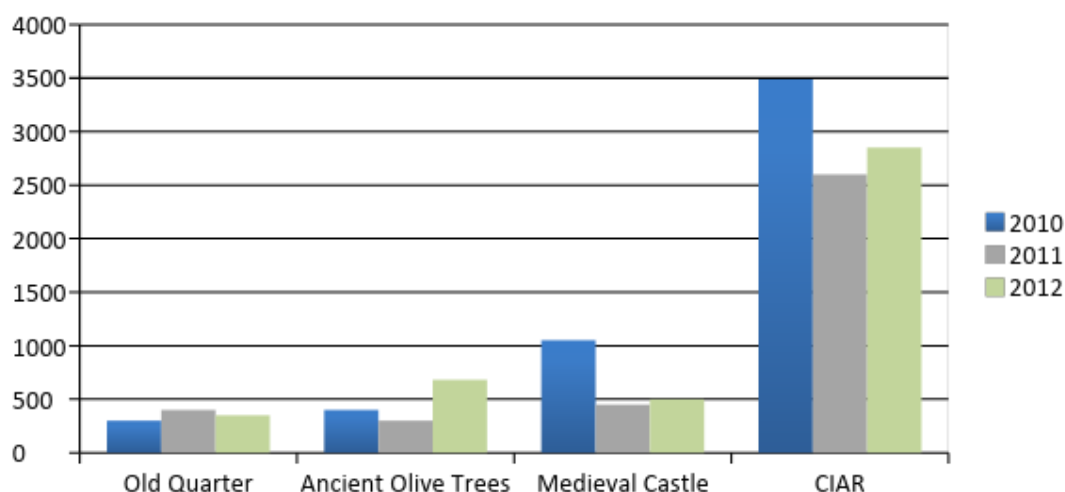
Total of annual visits to the major tourist attractions in Ulldecona (Díaz-Andreu at al. 2015).

The development of such an innovative application had different effects on the CIAR management, leading them towards new dynamics in the operation of the center. One of the main challenges (due to the increase of visitors) was the need to have more staff for visitors' assistance. Therefore, the services of the company Conficon Hostess[36] were procured, providing professional guided tours in the Interpretation Center.

The presentation of "We Hunters" in symposia, talks, meetings, and specialized publications related to Cultural Heritage and technology over the years has had an impact on the generation of visits to CIAR. It has also had an impact on the image and recognition of the CIAR, since it has been key in the more than twenty invitations received by CIAR since the inauguration of the display, to talk about their experience in the promotion of heritage and the use of technologies.

Regardless of the Interpretation Center's moderate size, with limited resources and funds, multi-sectoral collaboration allowed the development of the experience; enhancing innovation in education and Cultural Heritage and turning "We Hunters" into one of the most distinguished cultural projects in the region. The success obtained with "We Hunters" laid the foundations to develop other heritage promotion projects[37] such as e-ART (augmented reality) and 4D VULL (high-format photographs and 3D development). Furthermore, their good relationship with research institutions has allowed CIAR to participate in projects that have contributed to the development of new and less invasive research procedures in cave paintings, making new contributions to the world of anthropology.

Its educational relevance has attracted an important number of students from different academic levels, maintaining a constant flow from schools and universities that find in "We Hunters" an important educational tool. In this sense, the agreements with educational institutions to bring groups of students, has directly had an important impact on the generation of visits to CIAR. One of the agreements CIAR holds is with the Ramón iCajal public school in Ulldecona, in order to organize school trips to the Interpretation Center allowing students to enjoy a special guided tour and an opportunity to experience the We Hunters screen.

---

[36]Conficon Hostess specialized in services of stewardesses and tourist guides services. Startedtheirbusinessrelationshipwiththe CIAR in 2010 providing guided tours to the shelters and the Interpretation Center. http://www.conficon-hostesses.com/menu.htm

[37]e-ART is an augmented reality app. By means of mobile phones or tablets, it allows the user to view high-definition pictographs belonging to Shelter 1. 4D VULL is a conservation project aimed at providing a detailed state of conservation of the shelter paintings by means of high-definition photographs and 3D environments. Both projects where developed during 2015 and helped to strengthen the image of the CIAR as an important developer of digital technologies in the dissemination, protection, and investigation of Rock Art.

The scope of "We Hunters" goes beyond the facilities in which it is located. It constitutes a tool for the dissemination of cultural heritage, thanks to which adults and young people, both foreign and local visitors, can learn in an enjoyable way.

Young students at "We Hunters" display. Pictures provided by the Information Center of Ulldecona.

"We Hunters" constitutes for CIAR an important means to bring European prehistory to a diverse audience in an unconventional way. The project development itself represents a successful collaboration between private and public entities. In this context, experts and professionals from different sectors and knowledge domains worked together to generate a unique heritage interpretation tool. This experience established a reference for the development of similar projects that seek the promotion of cultural heritage through innovation and technology. After almost 10 years in operation, and despite its low budget, the "We Hunters" installation is still working and has generated multiple benefits, not only for the Interpretation Centre but also in society, especially for education and research.

The development of associated cultural projects has also had positive results in the tourist activity of Ulldecona, thanks to the diversification of audiences and the attraction of a more family-oriented visitor, interested in the gastronomy and culture of the city. The role that CIAR played in this and other innovative projects has consolidated it among the leading regional institutions regarding the dissemination and preservation of cultural heritage.

"We Hunters" constitutes an interesting study case because it gathered very diverse organizations around a non-mainstream topic related to regional cultural heritage resource to generate a low-cost, easy-to-manage, installation and a way to connect heritage with young students. It is important to continue developing and evaluating projects that incorporate digital technologies in the area of cultural heritage in order to maximize their benefits and opportunities both at local and international level.

Summary information and conclusions

concept creation	
Internal/external	Internal. The idea was suggested by personal from the CIAR.
Direction	Ulldecona City Council.
Financing	The total budget for "We Hunters" amounted to 34422€. A co-financing system was obtained between the City of Ulldecona and the Catalonia Job Service (SOC).
Workgroup	The project was an initiative of the Ulldecona City Council, which was in charge of execution, coordination, and daily management after implementation. The idea, development, and content production was the responsibility of Barcelona Media, while the technological development was undertaken by the Experimentation and Interactive Communication Group of Pompeu Fabra University.
Time of development	The development of the project, from concept to inauguration took approximately 7 months, from January to July 2008.

Scientific advice	Agustí Vericat - Director of the Center for the Interpretation of Rocky Arts Abrics de la Ermita. Ramon Viña - Researcher at IPHES, Catalan Institute of Human Paleoecology and Social Evolution. Narcís Parés – Interactive Communication Group of PFU.
Institution (private/public)	Public and private collaboration. Ulldecona City Council, CIAR, UPF.

Operation/IMPACT	
Administrative	CIAR hired the services of Conficon Hostess, a tourist guide company to attend the visitors.
Adaptation	
Challenges	There was not enough staff to assist the growing number of visitors arriving at the Interpretation Center.
Performance/evaluation	There is no evaluation system.
Visit flows	There is no clear evidence on how the We Hunters app is related to the visitors flows to the CIAR.
Academy	Agreement with the Ramón iCajal public school in Ulldecona, to organize school trips to the Interpretation Center.
Contribution to the community	The development of associated cultural projects had positive results in the tourist activity of Ulldecona, thanks to the diversification of audiences and the attraction of a more family-oriented visitor interested in the gastronomy and culture of the city. Connect heritage with younger audiences.
Acknowledgment	Invitations received by CIAR since the inauguration of the display to talk about its experience in the promotion of heritage and the use of technologies. Consolidated it among the leading regional institutions regarding the dissemination and preservation of cultural heritage.

MICRO CASE 4 CATALONIA - "VISITMUSEUM APP" – ETHNOLOGICAL MUSEUM OF MONTSENY – LA GABELLA.

Retrieved from the Museum Ethnologic of Montseny - La Gabella website.

The overall project and cultural assets

The Natural Park of The Montseny is the largest and highest massif located in the Catalan pre-coastal mountain range, covering an area of 30,120 hectares that are part of eighteen districts of the regions of Osona, La Selva and Vallés Oriental, all under the administration of the provincial councils of Barcelona and Girona. Its particular geography has provided a rich diversity of flora and fauna, and invaluable remnants from ancient cultures. Some of the remnants come from the Neolithic period with remains of megaliths, and settlements of the Iberian, Roman and Middle Age periods composed of villas, walls, castles and temples located along the massif. As a proof of these human settlements, the local communities located through the Montseny continue to celebrate different traditions such as dances (Tirabou dance) and popular festivities (Pino de Centelles) inheritance from their ancestors.

Owing to its attributes, in 1978 UNESCO included The Montseny in the World Network of Biosphere Reserves which is part of the Man and the Biosphere Program (MAB)[38].. The Reserve aims to protect The Montseny natural and cultural legacy, as there is an intensive usage of its natural resources by private owners in the region as well as by tourists and visitors[39] most of whom come from cities located nearby. Other important efforts focused on the protection of the natural park prior to the recognition of UNESCO were the creation of the Montseny Mountain Board, approved on September 15,1928; The Special Plan of the Montseny Natural Park[3], approved on July 26, 1977 and the Decree to create the Natural Park, approved by the Generalitat of Catalunya on April 10, 1987

Due to the natural richness, the beautiful landscapes and the architectural and cultural heritage, The Montseny has become an important pole of attraction for visitors and tourists, developing an important infrastructure and tourist services represented by hotels, restaurants, cabins, cultural centers, guided tours, among others, boosting local economic development. It also represents an important space for the inhabitants of Catalonia and the rest of Spain, to have a direct approach to their history and learn more about their culture and roots[40].

With the purpose of documenting, protecting and promoting the cultural heritage of the Natural Park and Biosphere Reserve, the Ethnological Museum of Montseny was created in 1985, offering different exhibition rooms explaining the evolution of the human settlements in the Montseny throughout the history.

Project concept[41]

The Ethnological Museum of Montseny (MEMGA) is housed within a seventeenth-century building called La Gabella, situated in the center of the village of Arbúcies. The museum narrates in its fifteen permanent exhibition halls, the transformation throughout history of the communities who have lived and worked in The Montseny. The visit is complemented by the projection of the audiovisuals "Montsoriu Castle" and "Legends of Montseny". The La Gabella building developed different activities over time: from a stock of basic products to a hostel for travelers and beggars. It was until 1970, when the City of Arbucies bought the building.

At the beginning it was used as a warehouse and nine years later was given a cultural purpose with the establishment of a group called "Búsqueda", which had the intention of recovering the local cultural heritage. The group was a pioneer in collecting photographic and oral information about the Montseny and its

---

[38] UNESCO's Man and the Biosphere Programme (MAB) is an Inter-governmental Scientific Programme that aims to establish a scientific basis for the improvement of relationships between people and their environments. http://www.unesco.org/new/en/nairobi/natural-sciences/ecology-man-and-biosphere-programme/

[39]The Montseny attracts close to two million visitors yearly. http://www.barcelonaesmoltmes.cat/en/web/descobreix/detall/-/dades/H0XtQmAswXNg/detall/17_17002_18/parc-natural-del-montseny

[40]As an initiative of the provincial councils of Barcelona and Girona, the Special Plan of the Montseny Natural Park was updated and approved on December 11, 2008, conceiving the new master plan called the Special Plan for the Protection of the Natural Environment and Landscape of Montseny.https://parcs.diba.cat/es/web/montseny/aprovacio-del-pla-especial

[41]Info based on data from the official museum website: www.museuetnologicmontseny.org

inhabitants. All the collected material became the basis of the MEMGA exhibitions. It was until May 1985 when the first phase of the Museum was inaugurated. Since then, the Etnològic Museum of Montseny is a center dedicated to research, conservation, dissemination, and exhibition of the cultural heritage of the Montseny massif.

Design implementation

Visitmuseum consists of a digital application developed by the Catalan Heritage Agency, with the aim of promoting museums and bringing society closer to the historical and cultural heritage of the region, while also serving as a tool for tourism promotion and usefulness. This app offers information in 5 languages (French, English, Spanish, Occitan and Catalan). The Visit museum application can be accessed from phones, tablets, and any mobile device that has an internet connection; during the visit to the museum, the app represents an important tool to enrich the user's experience since it has the possibility of accessing multimedia content through QR codes installed in the different rooms.

It contains audio visual information about the objects, works of art and exhibitions that make up the museum. It also provides basic information about the characteristics of museums such as maps, opening hours, contact numbers, etc. The museography focuses on three main stages: The First Settlers, Traditional Society and Industrialization.

In "The First Settlers" exhibition, visitors can take a trip back in time to learn about life in prehistory, the Iberian and Roman world; as well as to understand the transformation that the landscape of the massif has undergone, mainly due to a long process of interaction between man and the environment. The section dedicated to the Middle Ages emphasizes the social and economic transformation of the era, having the Castle of Montesoriu as an example of these social changes. Audiovisuals are used to enhance the learning experience of the Castle of Montesoriu, considered the best Gothic castle in Catalonia.

The second stage, "Traditional Society", was structured around the farmhouse, from which the territory was exploited, and society was organized, having as main activities agriculture, livestock and logging. During the nineteenth century these were the main economic activities of Montseny until, in the mid-twentieth century, a process of abandonment of the farmhouses began, culminating in the 1980s.

The last stage, "Industrialization "(late 19th – beginning of 20th century), was a period where some of the biggest transformations in Montseny's society and economy occurred. The process of industrialization affected not only the economy, but also cultural aspects. Coach bodies, wood turnery and the textile sector were the first industrial activities that had a strong link with the environment, either by the use of wood as a raw material or by the fundamental role played by water as a source of energy.

Guided tours are offered and designed for different types of audiences (children, families, specialized groups, etc.). The tours seek to generate emotions and sensations through the use of new generation audiovisual techniques.

Technologies and heritage: impact assessment

The application Visitmuseum, has not yet been fully implemented in the Ethnological Museum of Montseny. IN the 4 stages decision making project of ViMM it is in the implementation phase (stage 3), therefore it presents interesting aspects on the current issues and perspectives in terms of planning and expected impact, that will influence the operation phase, the overall cost/benefit and the expected impact .

Process	
Internal/external	External, as part of the
Direction	Agencia Catalana del Patrimoni
Financing	Not available.
Workgroup	Not available.
Scientific advice	Not available.
Institution (private/public)	Public.
Challenges	
Operation/impact	
Administrative	Limited staff.
Adaptation	
Challenges	Have an adequate wi-fi connection. Limited staff. The info of the Ethnological Museum is expected to be fully updated in VisitMuseum by the end of august 2018.
Performance/evaluation	The museum has an evaluation questionnaire consisting in 5 questions…
Visit flows	No info available on the web traffic (visitmuseum). At the moment there is no way to identify if the museum visitors were influenced by the Visitmuseum app.
Academy	Not available.
Tourism	Not available.
Promotion	Not available.

Conclusions Micro studies in Catalonia/Spain

With respect to the micro level analysis, the findings yielded by the present study have enabled the researchers to identify the Catalonia Museums existent shortcomings, leading to the following conclusions:

- Primarily, insufficient operational staff is one of the constant and most critical conditions found in the studied cases. Indeed, the distribution of functions and responsibilities for a regular operation is already affected by the reduced number of personnel; thereby, the members are bound to become multifunctional and their main responsibilities must be left unattended. Therefore, implementing new information and communication technologies, although desirable, might represent further management difficulties if this situation remains unsolved.

- Centralization and loss of autonomy have also an impact on the expected growth of the sector; 3 out of the 4 studied cases, are public museums and report to the Generalitat and/or the Heritage and Culture Department; leading to delays and setbacks in the budget obtention and management and in other administrative subjects related to the application of ICTs.

- Limited accessibility to museums has been detected. Consequently, improving this matter must be considered as key priority to the public administration in accordance with the current legislation.

- Moreover, fear that cultural heritage may be damaged by large numbers of tourists-visitors is recurrent. Therefore, it is fundamental to create and reinforce networking connections between tourism and cultural professionals, what would facilitate the creation of a conjoint management schema considering the requirements of both sectors. The use of DCH is essential in that aspect for regulating tourism flows to the physical monuments, and provide additional local or remote access that could reduce the damaging overflowing of the monuments, improve seasonable and time repartition, and reduce the negative impact of tourist visits , such as noise, overconcentration of visitor, improve space distribution and flow of visitors, and provide new means to enjoy the monuments limiting the annoyance to the other visitors and the damages to the monument or museum environment or physical integrity.

- Owing to the fact that there is a lack of an adequate evaluation system, visitor-oriented management is another challenge that museums must face. Practically personalized contents are the actual trends, also for cultural and heritage institutions.

- The implementation of visitor evaluation procedures would reflect in gathering accurate information, that will be essential for understanding the needs of visitors and their feedback on the existing ICT for an improved management. Automation of such systems, and integration in visitors assisting tools or visitors automated comportment monitoring could prove as efficient ways to achieve functional improvements of Cultural Heritage access.

- Certainly, due to lack of indicators, there is no information on the impacts that the museum has generated in the community. There has not been structurally recorded the economic and social impacts that the museums' ICTs have had in their communities. Further research on measurement indicators for economic and social impacts is critical.

- There is a solid link with educational institutions that guarantees a constant flow of visitors and a further reach to a young audience, approaching them to the cultural heritage, leading to community engagement.

- It was also established, that the implementation of ICTs and digital applications in the cases of study, could be considered a detonator of further digital projects in the same institutions; encouraging as well, the adoption of new technologies in other cultural venues.

- Finally, two projects from the study cases (Ullastret 3D and We Hunters) were specially recognized for its innovation or novelty at the moment of inauguration; turning the museum into a new attraction that reached new public segments and returning visitors.

These conclusions are summarized in the following table:

Conclusions	
Achievements and Strengths	**Obstacles and weaknesses**
An extensive network of Government entities and institutions in both the State and the Generalitat (local government).	Limited provisions in the business plans for the operational needs of the digital applications in terms of: • additional content integration and extension • technology infrastructure maintenance and update • sufficiently trained and available personnel for the digital applications
An important body of regulations and public support policies.	Centralization / limited autonomy of the decision-making process for the integration of digital technologies. Instead of generally available and applicable technical and methodological standards, that could facilitate initiatives of the cultural organizations and allow smooth interoperability and secure high cultural value, the process over-depends on centralized expertise provision and approvals. Out of the 4 museums, 3 are public and report to the Generalitat / Heritage and Culture Department. Mon Sant Benet is private.

Enhancement of Network of clusters and institutions dedicated to research in digital heritage, cultural heritage, education and tourism	Insufficient understanding and trust between the tourism and cultural professionals, particularly concerning potential risks for some sensitive cultural assets be of excessively high numbers of visitors, or visitors nor sufficiently aware about museum process.
	Diverging objectives and lack of conciliation and common understanding processes (such as information, training, common language and terminology, conciliation/negotiation processes) between cultural and tourist professionals
Public strategic plans that highlight and promote interdisciplinary collaboration.	Lack of an adequate standardized evaluation methodology and process in the museum in terms of • User satisfaction • Operational functionality
Tourist and cultural regulations that take into account the importance of information and digital technologies.	There is limited information on the impacts that the museum has generated in the local community: • lack of a complete and coherent set of specific economic impact indicators. • lack of a complete set of specific social impact indicators • lack of resources integrated in the initial planning for socioeconomic impact measurement in short, middle and long term.
Museum networks development and deepening in terms of know-how transfer and exemplification. Necessity of structure and amplify regionally the know-how transfer, the official and unofficial contacts among the professionals and the exemplification of successful cases as well as common obstacles and solutions.	Insufficient operational staff in terms of quantity and know-how.
Enhancement of the link with educational institutions, of various levels, mostly in the primary and secondary education and more limited to tertiary (academic) educational system. The primary and secondary education students are among the main beneficiaries of the digital applications.	
Improvement of attractiveness for younger audiences to cultural heritage.	
Detonator of new digital projects. Development of directly linked new projects based on the results of the digital applications (Ullastret 3D) Creation of new digital projects ideas in the first stage of design, mature for complete study and implementation based on the expertise acquired (We Hunters)	

Social and academic recognition of the project for its novelty, through awards and successful presentations in international conferences.	
Public private sector collaboration enhancement Involvement of private companies in the development and operation Effective use of public sector incentives and support framework (financial, institutional, and expertise provision)	
Raising of visibility of the cultural assets of the area and in general of the overall area branding in the wider public and specialized researchers.	
The digital applications improve the relation with the public and the visibility particularly of museums with limited accessibility due to their location and limited public transportation (Visit Museum)	

Conclusions – Catalonia Spain.

The lack of systematic studies on the socio-economic impacts generated by the implementation of digital applications in CH and the unavailability is an important limitation for evidence making policy making. The lack of evaluation studies on the operational level of the organization and middle term sustainability, user satisfaction and owner's satisfaction is a critical point in all projects and policies.

Consequently, it is critical to measure and analyze the economic and social indicators on the impacts that museums generate, as well as the role of museums and their influence on the development and strengthening of local identity and branding. Additionally, the implementation of standardized systems of evaluation of museums 'performance, would be recommended as a key factor for further information gathering.

Conclusively, the implementation of new communication technologies in museums represents a challenge that must be assumed as a key priority for the progress of the cultural and heritage activities and their involvement with society.

4.2 MICRO REGIONAL CASES: THESSALONIKI AREA, GREECE

The purpose of the study in Greece is the analysis of the investment, operation and impact of Virtual Multimodal Museums and digital applications in cultural heritage assets, in the region of northern Greece, and specifically it has been focused to the metropolitan area of Thessaloniki, analyzing specific examples, given the exemplarity of the city for the entire region and the Balkan peninsula, the importance of its cultural assets, and the data accessibility.

Methodology and study limitations
The purpose of this study is the analysis of the investment, operation and impact of Virtual Multimodal Museums in cultural heritage assets, in the region of northern Greece, specifically central Macedonia, the locality of Thessaloniki and in particular the Industrial Museum and Cultural and Educational Center in Thessaloniki, under the auspices of the Hellenic Ministry of Culture. In WP6 of the ViMM project, it is mentioned that each partner could focus their study in a specific "region-locality". That is why we choose the locality of the city Thessaloniki and the specific museum, which we have access to via our close collaboration with the Ministry of Culture. Furthermore, this museum already has a projection-VR installation as early example of VR technology on a CH site. Via data provided by the ministry regarding this museum, this study is expected to contribute in defining the key sectors where CH/VM have strong potential to impact economic growth and produce social benefits, to identify the 'institutional landscape' and to activate the interest of other local-regional important stakeholders.

FORTH has established a working relationship with the Greek Ministry of Culture and the Thessaloniki Ephorate of modern monuments that is an important asset for ViMM and WP6. Furthermore, the Ministry of Culture has appointed their own representative at ViMM TA4 to follow-up on all project related activities and this is an important vote of confidence from an important national culture stakeholder towards ViMM.

The main output of this study is defining the key sectors where CH/VM have strong potential to impact economic growth and produce social benefits in the region of Thessaloniki. In the macro level, the cultural and creative industry in Thessaloniki as well as the Cultural Heritage projects in which Thessaloniki is involved will be analyzed. In the micro level, the Industrial Museum and Cultural and Educational Center in Thessaloniki alongside with data that have to do with its visitors and exhibitions will be analysed.

For the purposes of this study, deployment of cutting-edge, existing VM technology from FORTH is currently taking place to the Industrial Museum and Cultural and Educational Center in Thessaloniki. For this reason, two applications, one cross/indirect reality application and one Augmented Reality application will be created. The first one of these applications will serve as a Virtual Museum where the users will be able to explore the real museum in cross/indirect reality mode. The second AR app will have to be utilized onsite the real museum and will offer extra holographic display type information about the museum exhibits in AR, based on the existing museological study from the ministry which was completed but never actually implemented. During this study, data will be collected (number of visitors, impact in the museum before and after deployment of VM technologies). These data will contribute to draw our final conclusions about a real, latest VM case study applied on an existing museum as a landmark case study from ViMM and real contribution to the relevant cultural stakeholders.

Digital Cultural Heritage in Thessaloniki

A brief history of the region of Thessaloniki
Thessaloniki was founded in 315 BC. by King Cassander of Macedonia after the merging of more than 26 settlements and areas. It soon turned into a remarkable center and evolved into one of the most important cities of the kingdom during the Hellenistic period, with limited but important political autonomy. [1] After the conquest of the Macedonian kingdom by the Romans in 168 BC. Thessaloniki became a Roman occupation, knowing at the same time great growth in every respect. It has emerged as a major crossroads connecting Europe with Asia through the Roman Via Egnatia. Some of the most imposing and beautifully decorated buildings of the city were created during the Roman period of its history when it was one of the capitals of the provinces during the rule of the Tetrarchy, and for a limited time it was the capital of all the Provinces of the Greek area. In 42 BC, "civitas libera", a free city, is being proclaimed, thus acquiring extra privileges, including the cutting of coins, which takes off trade.

Since the 1st century AD the city has become one of the earliest centres of Christianity since the Apostle Paul developed here many of his teachings laying the foundations for the new religion. During the Byzantine period, the city was largely flourished and populated, which made it the second most important city of the entire empire after Constantinople. In many parts of it were built wonderful temples and many other buildings, while a series of defensive buildings and fortifications were made.

In 1204 AD during the Fourth Crusade the city fell into the hands of the crusaders, which led to the creation of the temporary "Kingdom of Thessaloniki". However, in 1246 the Byzantines succeeded in recapturing the whole region.[42]

The Ottoman period

---

[42] The city of Thessaloniki – History Recursion. http://www.inthessaloniki.com/el/i-poli-tis-thessaloniki-istoriki-anadromi, last accessed 2018/06/25.

The Ottoman conquest of 1430 under the command of Murat II was a catalyst event in many respects. The city once again became the most important economic center of the entire region and was considered to be of the highest strategic importance due to its geography alongside the establishment of new shopping streets.[43]

In the 19th century, as part of the effort to modernize the Ottoman Empire (Tanzimat), the city acquires many and significantly beautiful buildings. The gradual use of steam as a driving force and the proliferation of railways make it the most important industrial center throughout the Balkans. Many large factories are built while the port is being created. All this leads to what historians have called "California of the East". The population is tripled from 1840 to 1912. [44]

The Dawn of the Modern Age
On the 27th of October 1912 during the Balkan wars, the Greek army brought the liberation and a few years later in 1917 Thessaloniki faced one of the worst disasters in its history as a great fire destroyed three-quarters of its center, which had multiple side effects in the years that followed. In the 1950s and 60s the city experienced an unprecedented building buildup, which led to its current form[45]. Today Thessaloniki is a modern European city while retaining its position as an important commercial and economic center connecting all the Balkan countries. In 1997, it became the cultural capital of Europe and is one of the largest centers of university education in Southeastern Europe. Most of its most important monuments are included in UNESCO's World Heritage List, while in 2004 during the Olympic Games it was one of the Greek Olympic cities hosting a large number of sports events. 2011 dominated among many candidate cities as the European Youth Capital for the year 2014. [46]

Actions concerning tourism attraction
Thessaloniki has been one of the most popular travelling destinations for many years. The municipality of Thessaloniki has taken plenty of actions to keep the city among the most popular travelling destinations. Recently, a mix of combined actions to further enhance the destination "Central Macedonia" and Thessaloniki in the global and domestic tourism market as a multidimensional competitive tourist destination have been taken, for instance. Such actions give great weight to the promotion of thematic tourism, cultural heritage of the Region of Central Macedonia and addressing seasonality. [47]

Research Cultural Heritage projects in Thessaloniki
The municipality of Thessaloniki has taken a lot of actions in order to preserve the Cultural Heritage of the region in many ways and as a result to help the visitors of Thessaloniki to conduct their explorations in a more effective and productive way. A very interesting example of such a project, is called Karabournaki and is described below.

The Karabournaki Cultural Heritage Project
Digitization And Archiving Of Archaeological Sites: "The Karabournaki Case" is a project regarding the digital documentation of an archaeological site using as a case study the site of Karabournaki located in the area of Thessaloniki (Greece). The aim of the project is to design, develop, and implement a multimedia cultural database system capturing the full amount of the available information regarding the site, including extended search and visualization capabilities that can deliver its multilingual content over the Internet. The meta-data that are produced with the completion of the project contribute significantly to the study and publication of any archaeological site as well as its preservation, succeeding the final goal of making it universally accessible.

Through the site of this project [48]which is available both in the Greek and English language, people can find useful information about the excavation site of Karabournaki and the different kinds of findings that were found in this area. There is plenty of information in the form of text as well as of photographs as well.

---

[43] See note 42

[44] See note 42

[45] See note 42

[46] See note 42

[47] See note 42

[48] Karabournaki (Recording the Past). http://karabournaki.ipet.gr/, last accessed 2018/06/25.

The meaning of Cultural Heritage to Thessaloniki

Actions of the municipality of Thessaloniki concerning Cultural Heritage

There are plenty other projects and actions in general that have been taken for the promotion of the Cultural Heritage of Thessaloniki. Some of them are online projects/websites like the Karabournaki project, which was mentioned above, and are discussed below.

Online information concerning the Cultural Heritage of Thessaloniki

A very interesting example of a Cultural Heritage online project that already exists is a website, where visitors can find information about Thessaloniki in general[49]. Another one exists, where they can find information about its history, arts, byzantine arts, different exhibitions, photographs, maps and more[50] and finally there are some websites, which are related to specific monuments like[51], for instance. These are only some of the attempts of the municipality of Thessaloniki has done, in order to promote and preserve the Cultural Heritage of Thessaloniki.

Successful attempts of the region of Central Macedonia concerning the preservation of Cultural Heritage

The Region of Central Macedonia is at the top positions among the Regions across Europe in the absorption and implementation of projects. More specifically, 30 projects of modern cultural infrastructure were implemented. The restoration and promotion of 127 archaeological sites and monuments in Central Macedonia and Mount Athos was completed. 15 major cultural institutions (Film Festivals, Documentary Festivals, International Book Fair, Lazaris Monastery Festival, Biennale, etc.) are supported. With 20 million euros from the new NSRF, projects such as the new Vergina Museum, the redevelopment and promotion of the Royal Necropolis and the Aigai Palace are being implemented.

European Cultural Heritage projects examples

The region of Thessaloniki has shown its interest about the preservation of its Cultural Heritage by participating in European projects about Cultural Heritage preservation. Specifically, some of the projects in which Thessaloniki has participated are the European projects CHRISTA[52] [4-6], Cult-RinG[53], [54] [7-8] and HIGHER [9]. By participating to such projects and preserving its Cultural Heritage as a result, Thessaloniki becomes even more popular in Europe, attracting even more population to visit and explore its monuments and exhibitions.

CHRISTA

Cultural and natural heritage is very important at all levels, at local, regional, national and European levels, which can lead to resource efficiency through the sustainable and responsible development of innovative tourism. Policies for heritage and ecotourism tourism applications need to be further developed, implemented and monitored through interregional cooperation. The overall objective of CHRISTA is to protect and conserve natural and cultural heritage assets and to use them to develop and promote innovative, sustainable and responsible tourism strategies, including intangible and industrial heritage, through interpretation and digitization, capitalizing on good practice, policy learning, policy implementation and capacity building. The expected changes concern improvement of policies in destination areas, progress in the implementation of relevant policies, upgrading of cultural and natural heritage and innovative applications.

---

[49] History Center of Thessaloniki. https://tinyurl.com/y8rxy54m, last accessed 2018/06/25

[50] Culture Thessaloniki. https://culture.thessaloniki.gr/, last accessed 2018/06/25

[51] Galerian Complex. http://galeriuspalace.culture.gr/en/, last accessed 2018/06/25

[52] See notes 49, 50, 51

[53] Region of Central Macedonia CHRISTA project.http://www.pkm.gov.gr/default.aspx?lang=el-GR&page=29&projectid=49, last accessed 2018/06/25

[54] Region of Central Macedonia Cult-RinG project.http://www.pkm.gov.gr/default.aspx?lang=el-GR&page=29&projectid=60, last accessed 2018/06/25.

Cult-RInG

Cultural Routes are used as powerful tools for promoting and preserving the common and diverse cultural identities of the European Union. The Cultural Routes (CR's) provide a better understanding of Europe's history through the interregional exchange of people of ideas and cultures. The significant contribution of CR's to the innovation and competitiveness of small and medium-sized enterprises has shown that cultural routes are at the heart of cultural tourism development. Cultural routes are a source of innovation, creativity, small business creation and the development of cultural tourism products and services.

Cult-Ring's overall goal is to highlight the value of investing in European Cultural Routes in terms of contributing to growth and employment by capitalizing on best practices, developing new cultural routes and enhancing the capacity of actors in the field. The main outcomes of the project will be action plans for the development and upgrading of European Cultural Routes by improving the relevant policy tools in the six regions of the project and enhancing the capacity of the actors to design Cultural Routes while contributing to the shaping of European policies and achievement of the EU 2020 objectives. The beneficiaries of the project are regional authorities that seek to maximize the benefits of cultural routes, both existing and new. Through the experience gained during the implementation of the project and in order to capitalize on the lessons learned from the cooperation, the Region of Central Macedonia will try to create an action plan aimed at creating a cultural path on the steps of Apostle Paul.

HIGHER

The overall objective of the HIGHER project is to achieve innovative Public Private Partnerships, capable of mobilizing investment in areas of smart specialization, enhancing the process of business discovery as a driver for enhancing the innovative character of tools policies relating to RIS3. This will be achieved by promoting a European perspective and ensuring the duration and exchange of the results achieved. The role of public authorities as drivers of innovation will be strengthened in the course of the project as well as their position as 'nodes of demand for innovation' in the knowledge-driven economy. The HIGHER project will enhance the involvement of innovation-related actors, following the four-strand approach (public organizations, science, entrepreneurship and civil society) by involving them in relevant actions.

Existing Examples of Digital Cultural Heritage in Thessaloniki

Not many actions have been made regarding the Digital Cultural Heritage in Thessaloniki. There are a very few projects that exist. One of them that was found and is very interesting is called "Thessaloniki VR" or "Thessaloniki VR (UNESCO Edition)"[55]. It is a mobile application for Android and iOS devices. With the help of this application, the user can explore the most important sights of the city such as Kamara, Galerias Palace (Navarino Square), Alatza Imaret, Aristotelous Square, Ladadika, the beach, the statue of Alexander the Great and others, in Virtual Reality (VR). This application is a great example of what can be done about Digital Cultural Heritage. There should be more applications like this, which can offer similar and even more opportunities to users.

The need for more Digital Cultural Heritage projects

Digital Cultural Heritage projects implemented through mixed-reality applications are vital to ensuring cultural institutions' sustained relevance and renewed public interest and engagement. These projects can provide far more than a supportive role, merely extending existing formats, for instance, through augmented audio-guides and automated pedagogical programs. Digital Cultural Heritage projects offer the possibility of expanding institutional capabilities by surpassing otherwise intractable limitations related to the material reality of a) the exhibits (e.g. conservation issues, unavailability of unique artworks and artifacts), b) the infrastructure (e.g. fixed space, circumscribed resources), and c) the users (e.g. safety and security constraints, limited access especially when it comes to periphery locations).

---

[55] Browsing the city of Thessaloniki from mobile device with Virtual Reality applications, http://www.voria.gr/article/i-thessaloniki-parousiazi-ton-eafto-tis-me-virtual-reality, last accessed 2018/06/25

Mixed Reality Installations that could be used

Mixed reality has the potential not only to increase motivation to learn, but also to raise interest on Cultural Heritage[56]. Apart from providing an enjoyable experience, mixed reality installations can facilitate cultural awareness, historical reconstruction and heritage awareness. There can be many different installations. In this specific case, the only thing that the installation needs is a mobile device (phone or tablet). With a phone or tablet, the user (or museum visitor) will be able to see augmented things inside the museum. Also, more users (around the user that is holding the device) will be able to see the results by looking at the screen (in contrast with Virtual Reality headsets, where the number of users that can use the application at the same time is limited due to limited number of head mounted displays).

Cultural Heritage Applications and their content

Storytelling Field

Static visualizations have been traditionally employed to support storytelling in the form of text, diagrams and images. The adoption of dynamic approaches utilizing state-of-the-art 2D and 3D graphics is emerging in an effort to explore the full potential of interactive narration. Using such 3D graphics in comparison with storytelling (making text and/or images appearing on a 3D object with a nice animation, for instance) would make the reading procedure more interesting as the user of the application would be more eager to read the written information.

Gamified Presence

Gamification is different from computer games even if it shares a lot of common theories and practices of development. The most basic objective of gamification is to keep the users interested and motivated so that they will not be bored and quit the specific application too soon. If gamification is to be combined with a Cultural Heritage mobile application, it would offer motivation to the users to continue exploring the museum/exhibition by offering mini-games like asking them to find specific objects/areas inside the museum and/or other games like quizzes. Such applications would motivate even more people to visit museums and most importantly they would motivate children as well.

MICRO CASE 1 THESSALONIKI – THE INDUSTRIAL MUSEUM AND CULTURAL AND EDUXATIONAL CENTER IN THESSALONIKI

Brief history of the museum

There is a great history behind the building of the Industrial Museum and Cultural Center in Thessaloniki. It is the only existing building of the "Hamidie" complex, founded during the last ottoman period of the city (1875) as an Orphanage ("Islahane") and a School of Arts and Crafts. The complex was located in the region of Evangelistria, at the eastern side of the city walls, both inside and outside of them. After the liberation of Thessaloniki, the building's ownership passed to the Greek state, which from 1920 onwards, rented the complex in order to accommodate uses similar to the workshops that were originally housed in the School.[57].

In 1992, the building complex, together with its equipment, was designated by the Ministry of Culture and Sports as a listed historic monument. In 2011, the project "Restoration of the listed complex of the former School of Arts and Handicrafts ("Hamidie School") and conversion into an Industrial Museum and Cultural Center", was included in the Operational Programme of Macedonia and Thrace of the NSRF 2007 - 2013. In 2015, with funding provided by the Greek state and the European Union, its restoration and reuse was completed.

---

[56] Papagiannakis, G., Geronikolakis, E., Pateraki, M., Lopez-Menchero Bendicho, V., Tsioumas, M., Sylaiou, S., Liarokapis, F., Grammatikopoulou, A., Dimitropoulos, K., Grammalidis, N., Partarakis, N., Margetis, G., Drossis, G., Vassiliadi, M., Chalmers, A., Stephanidis, C., Magnenat-Thalmann, N.: Mixed Reality Gamified Presence and Storytelling for Virtual Museums, Springer, (2018).

[57] Christoforidou S., Kondylidou A., Mesochoriti E., Syrgianni A., Valavanidou A.: The Islahane of Thessaloniki, a contemporary monument, a witness to technical education as a means of vocational training of orphan children

The museum today

The Industrial Museum and Cultural Center in Thessaloniki is essentially a museum of its own history and evolution, exhibiting industrial machines and artifacts that were found within, or related to it, in addition to highlighting its own architectural structure as the last building baring testimony to the late nineteenth century urban plan of that area. Its objective is to present the history of the technical schools that operated in similar institutions / orphanages, including the techniques of the workshops and the industries that flourished in the second half of the nineteenth century in Greece: namely the history of casting (one of the oldest of these techniques) and the operation of foundries. As required by the initial museological study, it was deemed necessary to present this material in an experiential way in order to convey the education and working conditions of that era, as well as the general operation of the production line, and in particular, the function of the machines, tools and facilities.

The exhibition was created using a wide range of cutting-edge methods derived from modern exhibition principles designed to shape and present the interpretive material both in terms of content and its formulation. The technologies and tools that were used include:
- An immersive reality application installed in a specially designed space, which experientially illustrates the evolution of the late nineteenth century city quarter into today's modern city using 3D mockups to present the different phases of the urban grid.
- An interactive multimedia exhibit (infokiosk), in which the history of technical education is presented in game form,
- QR codes to direct apps on mobile devices to display information about other technical schools of the same era,
- Video projections of interviews with people who worked there describing working conditions and sharing their memories,
- Animation, video and sound of the machines in operation,
- A virtual tour of the museum's facilities and exhibitions offered through the museum's website.

Integrating MR

The integration of MR in the Industrial Museum and Cultural Center was done after the applied museological study, following the increasing tendency to implement MR in CH/DCH. As project administrator, the Service of Modern Monuments and Technical Works of Central Macedonia embraced modern technologies right from the get-go, and further intends to invest in this domain. Indeed, when it comes to preserving and promoting intangible CH – for instance, casting techniques as well as the education and working conditions of specific eras, which are core objectives of the project – the use of MR is virtually the only way of providing in situ visualization and representation.

The visitors of the museum

The vast majority of visitors to the Industrial Museum and Cultural Center are students and people under the age of 45 with a great interest in new technologies. Thus, beside attracting more visitors, using MR supplies the cultural institution with the means to enhance and fulfill its mission of educating, communicating, promoting, and studying in an enjoyable way.

The future of the museum

Digital Cultural Heritage (VR/AR) exhibitions

Digital Cultural Heritage is very important for the future of Virtual Museums. As discussed above, there are very few DCH applications about the region of Thessaloniki/Central Macedonia. For this reason and due to the essentiality of such applications and their contribution to Cultural Heritage, there are some DCH applications under development about the Industrial Museum and Cultural Center of Thessaloniki, which are described below.

Cross-Reality Application for the Exploration of the Museum

A mobile application currently under development for the Industrial Museum and Cultural Center in Thessaloniki consists of a visit in cross-reality. In other words, this application is essentially a Virtual Museum. It is addressed to people that cannot travel to Thessaloniki or visit the museum but still want to explore the contents of the specific museum. The work that has been done until now is based on a 3D model of the institution that was provided by the museum officials.

iOS Version (Using Apple's ARKit)
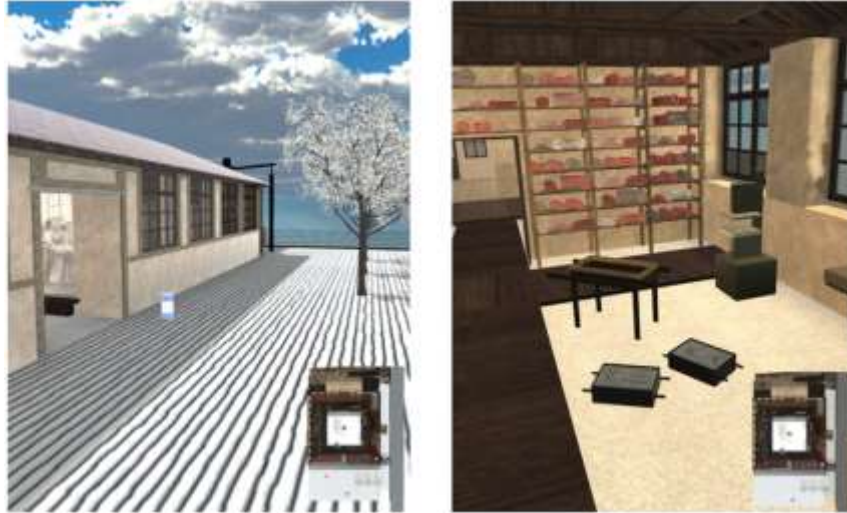
Standing outside the cross-reality museum (left) and being inside one of the museum rooms (right). In both images the mini map can be seen in the lower right corner, displaying the position and rotation of the user (small red square).

The first version of this cross-reality experience for this specific museum was created using Apple's ARKit and Unity3D. This application is designed for iOS and runs on iPad Pro 10.5-inch. The application starts with a portal. When the user walks through the portal with his/her device, he/she is transferred to the entrance of the museum. From that point, the user can walk with his/her device and explore the different areas of the museum, as if he/she was there. A number of information points have been added so that when the user gets close to those points, a board appears containing specific information about the museum and its content, allowing for the user to learn about the museum's history and discover its exhibits. Collision detection has been added, as well as animations of doors opening and closing when the user walks through them in order to make the experience more realistic. Some future improvements for this application might include adding more animations to the models of several machines to enable users to see what those machines looked like when they were in use; another possible avenue would be to add gamification elements to the application, like a quiz, in order to test the users' knowledge of the museum at the end of their virtual visit.

Android Version (Using Google's ARCore)
An Android version of the Industrial Museum and Cultural Center of Thessaloniki's cross-reality application designed for ARCore supported devices[58] [13] is under development. It is based on the latest AR technologies developed by Google and aims to extend the current device support, making it accessible to more users. Just as the application described above, the same model of the museum is used in order to create a cross-reality portal to the museum as shown in the image following:

---

[58] ARCore Supported Devices. https://developers.google.com/ar/discover/supported-devices, last accessed 2018/06/25

The portal leading to the cross-reality museum (left) and the view of the portal while being inside the museum (right).

The application detects planes in the real word using the built-in camera of the device, giving the end user the ability to place a portal and move through it into the virtual museum. Consequently, the user is able to explore it while differentiating it from the real world, thus conveying a sense of realism at the same time. The next steps for the development of this version of the application are to completely integrate the features of the iOS version, including animations, a mini map for easy transportation through the museum and gamification elements that will offer users a fun and compelling virtual museum experience.

Augmented Reality application for the Exploration of the Museum

A second application currently under development is aimed at people who actually visit the museum. This application can only be used inside the museum. It is designed to recognize the room of the museum where the user is located and provide different augmented 3D models (like boards, etc.) containing information related to specific areas of the museum. This application will be made for iOS and run on the iPad Pro 10.5-inch.

Conclusions

Key sectors in Thessaloniki where CH/VM could have strong potential to impact economic growth

It is very important to note that the field of cultural heritage strategy and policy making [3] is an essential and very important element in Greece. Many cultural heritage projects are supported as cultural heritage is directly related in Greece with domains such as industry, education, tourism (which is the most important domain of economic growth [2][4][6] due to the great number of tourists that Greece welcomes every year) etc. Specifically, the Industrial Museum and Cultural Center in Thessaloniki [5], supports many digital exhibitions with the help of modern digital media. As it was found out, these digital exhibitions were very exciting and fun for the visitors, something that could prove useful for bringing more visitors to the museum that way and thus contributing in cultural heritage preservation as well as the economic growth of the country.

Key sectors in Thessaloniki where CH/VM could have strong potential to produce social benefits

Virtual Museums and Cultural Heritage have a very important role in the production of social benefits. The CH exhibitions and the DCH applications can improve the social skills of the visitors in many ways. Specifically, visitors can discuss about their CH/VM experiences that they had, after visiting a museum or VM, exchange their opinions about different subjects regarding an exhibition that they viewed, explain things to each other that they did not fully understand to make them clear and share their knowledge in general. These ways can produce social benefits through CH/VMs that will contribute to each person by helping them improve their social skills and in a more general level, to the spreading and preservation of Cultural Heritage.

Integration of technology, museology, social and economic factors

Technology and museology are combined perfectly with the social and economic factors through DCH applications in VMs. Firstly, museology or museums combined with the rich history that Greece and in this case the region of Thessaloniki/Central Macedonia has, attract a lot of tourists. The number of tourists increases dramatically by adding technology to the combination that was mentioned before. That is because technology is able to move the museum experience of a visitor to a whole new level. More specifically, Mixed

Reality technologies can make a museum tour more interesting and fun for all kinds of people and especially children. Through interactive storytelling, the increased feeling of presence that VR provides or a gamified approach of a museum exhibition, it is clear that the visitors have more fun exploring a museum than without the contribution of technology, something that can, without a doubt, increase the number of visitors of a museum.

Also, many MR applications could support co-op modes. In a co-op mode, multiple visitors could cooperate to explore the museum in a virtual gamified experience that will enhance their knowledge through fun and also increase their social skills. This is one of many examples of the combination of social factors with technology and museology. Another example could be the development of a DCH application that could contribute in the understanding of the content of a museum. The visitors could use this application to leave messages about their museum experience and/or ask questions about things that were not very clear to them. These messages will be visible to all the other visitors that will use this application and as a result they will be able to answer questions that some visitors possibly left there. That way, the visitors who posed some questions will be able to return to the museum and find their possibly answered question. This approach is a great combination of technology, museology and social factors that could also attract even more visitors and tourists to VMs, thus leading to economic growth as well.

Results of the study in The Industrial Museum and Cultural Center in Thessaloniki

The main result of the study in the Industrial Museum and Cultural Center of Thessaloniki is that, it is crucial to invest in cultural heritage projects as well as virtual museums, as it appears to be very interesting for the people. This will bring more visitors to museums, something that will result in the greater spreading and preservation of cultural heritage across people and generations.

4.3 MICRO REGIONAL CASE: CYPRUS

MICRO CASE STUDY 1 -CYPRUS - EASTERN MEDITERRANEAN SCIENCE AND TECHNOLOGY CENTRE FOR ARCHAEOLOGY AND CULTURAL HERITAGE (MEDSTACH)

Project MedSTACH aims to establish Cyprus as an excellence hub in archaeology and cultural heritage in the Eastern Mediterranean region, capitalising on multidisciplinary research and technological innovation. To this end, key Cypriot public academic institutions and national policy makers and stakeholders are teaming up with leading international research and academic institutions to lay the groundwork towards creating the Eastern Mediterranean Science and Technology Centre for Archaeology and Cultural Heritage.

The mission of MedSTACH is the development of the necessary scientific and technological environment for the advancement of the state-of-the-art in archaeology and cultural heritage research in Cyprus, the Eastern Mediterranean region, and beyond; this will be accomplished by strengthening regional well-springs of scientific and technological expertise, capacity for innovation, and synergies among related Science, Engineering and Technology disciplines. The Centre's mission is fully aligned with the Smart Specialization Strategy for Cyprus, as it responds to the need for the study, protection, promotion and ultimately valorisation of Cyprus's unique archaeological wealth, as well as the promotion of alternative forms of thematic (cultural heritage) tourism. MedSTACH, a first-ever established alliance of this scale in Cyprus for archaeology and cultural heritage, is expected to dynamically promote excellence in relevant research fields and to enhance Cyprus's role as a pole of attraction for scientists and researchers from the Eastern Mediterranean region and the rest of the world, while promoting in a sustainable way smart specialization and new job creation. MedSTACH supports and collaborates with the UNESCO Chair on Digital Cultural Heritage.

The MedSTACH consortium is coordinated by the Department of Civil Engineering and Geomatics of the Cyprus University of Technology (lead partner), and includes as partners the Archaeological Research Unit of the University of Cyprus, the Department of Antiquities of Cyprus — the national stakeholder and policy maker responsible for cultural heritage management on the island, and the Cyprus Tourism Organisation — the national stakeholder and policy maker responsible for the promotion of Cyprus's touristic product. The consortium also includes the Laboratory of Geophysical-Satellite Remote Sensing and Archaeo-environment of the Institute for Mediterranean Studies of the Foundation for Research and Technology – Hellas (FORTH),

and the Institute of Archaeology of the University College London (UCL), both of which convey the experience and expertise of leading international research and academic institutions.

The MedSTACH proposal was ranked 1st (attaining full marks 15/15, "Excellent") on a pan-European scale, among 208 proposals submitted to Programme "Teaming for Excellence" Phase 1, part of European Union's (EU) Horizon 2020 framework for Research and Innovation. The MedSTACH proposal was awarded 0.4 million euros for a period of one year (Phase 1 of the Programme) in order to develop a business plan for the MedSTACH Centre of Excellence. That business plan will be submitted for evaluation to the EU during Phase 2 of the Teaming Programme, seeking funding up to 15 million euros for a period of 5-7 years, with the possibility of an additional equal amount of national co-funding for a period of 15 years.

MICRO CASE STUDY 2 - CYPRUS - ERATOSTHENES/EXCELSIOR

The ERATOSTHENES Centre of Excellence (ECoE) established in 2007, aspires to become a hub for the Earth Observation activities in the eastern Mediterranean area, due to the key geostrategic position of Cyprus. The 'EXCELSIOR' Teaming project (Horizon 2020) is built on the existing ERATOSTHENES Research Centre capacities and aims to further promote the existing ERATOSTHENES Research Centre (ERC), established within the Cyprus University of Technology (CUT) into a sustainable, viable and autonomous Centre of Excellence (CoE) for Earth Surveillance and Space-Based Monitoring of the Environment, which will provide the highest quality of related services on the National, European and International levels. The 'EXCELSIOR' Teaming project addresses, the reduction of substantial disparities in the European Union by supporting research and innovation activities and systems in low performing countries. It also aims at establishing long-term and strategic partnerships between the Teaming partners, thus reducing internal research and innovation disparities within European Research and Innovation landscape. EXCELSIOR also aims to create an inspiring environment for conducting basic and applied research and innovation in the areas of the integrated use of remote sensing and space-based techniques for monitoring the environment. Environment has been recognized by the Smart Specialization Strategy of Cyprus as the first horizontal priority for future growth of the island.

Five partners have united to develop a business plan for upgrading the existing ERATOSTHENES Research Centre into a CoE, with the common vision to become a world-class innovation, research and education centre, actively contributing to the European Research Area (ERA). More specifically, the project is a team effort between the Cyprus University of Technology (CUT, acting as the coordinator), the German Aerospace Centre (DLR), the National Observatory of Athens (NOA), the German Leibniz Institute for Tropospheric Research (TROPOS) and the Ministry of Transport, Communications and Works(MTCW) of Republic of Cyprus, through the Department of Electronic Communications (DEC).

MICRO CASE STUDY 3 -CYPRUS - ASINOU

The overall project and cultural assets
The famous Byzantine painted church of Panagia Phorbiotissa of Asinou lies about five kilometres to the south of the village of Nikitari in the Troodos range of mountains. The church is dedicated to the Virgin Mary and is considered to be one of the most important Byzantine churches in Cyprus. The main church is the only surviving part of the Phorves monastery. The church dates from the early 12th century AD and the murals

inside range from the 12th century through the 17th century and is recognised as a World Heritage Monument by UNESCO, as it is home to perhaps the finest examples of Byzantine Mural paintings.

Project concept
A novel approach was used across several research projects, to document the UNESCO WHL site using various modern techniques, such as UAV, photogrammetry and 3D printing. Digital 3D Models created from UAV photographs, were used for a variety of purposes related to tourism, education and HBIM.

Modeling process
Applications in progress include: Heritage Building Information Modelling (HBIM) through an accurate 3D model which holds all the available information about the monument including material architectural, historical, structural information, etc. Mobile phone and tablet Augmented Reality applications to be used as a digital tour guide since the church doesn't provide a tour guide 24/7. The priest, in digital 3D form, will explain the history and provide the information needed. The church will also act as a live museum where significant parts of it will become live during the tour.

Data from this memory of the past can generate diverse forms of multimedia such as: 3D models, images, video, audio and text. Transparent complex data can be filtered, assembled and presented in a form visible to human eye, through an installation adapted and made functional for almost any group of users, becoming a personalized educational environment. These technologies are here incorporated in an interactive e-book, in the context of this unique monument.

Technologies and heritage: impact assessment
The work is ongoing and results not yet sufficiently mature to conduct an impact assessment.

MICRO CASE STUDY 4 CYPRUS – ST NEOPHYTOS
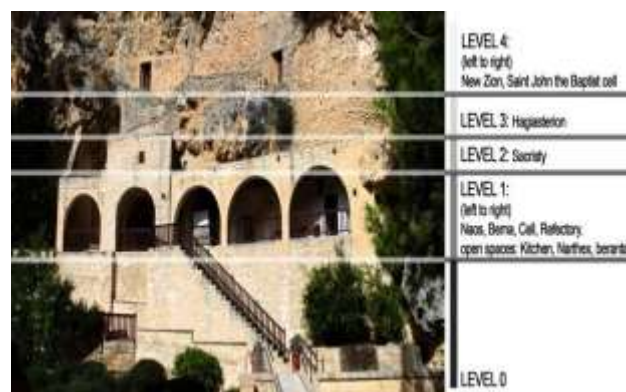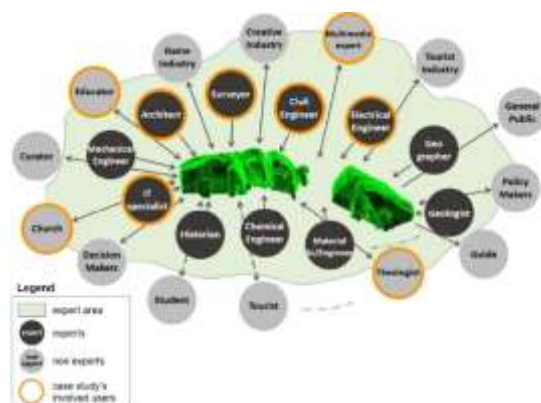
The overall project and cultural assets
The Enkleistra of Saint Neophytos is an outstanding testimony of the Byzantine art and civilization at probably the most troubled and intense moments in this part of the Mediterranean: crusaders (English, Normans), byzantine and Arab elements are clearly reflected in the Enkleistra. The paintings (frescos) are characteristic of the "Komnenian" Byzantine art period (mid-12 century), identified by strong emotions, mainly of passion and suffering and sophisticated proportions and movements of the figures who are dressed in rich clothes with wavy edges. There are few frescos saved in such good conservation state. The preservation of the Enkleistra and the extensive documentation of its origin, development and further interventions provide clear information for its interpretation and confirm the authenticity of each element.

Project concept
The emergence of a holistic approach to monument documentation is inextricably associated with the term 'monument', the quest of its meaning and its interpretation to the people involved in the documentation of the past. The main reason is the necessity to set tangible heritage in its wider context and relate it with its

physical environment and its intangible aspects (spiritual, political and social values) [1–3]. In this way, a monument can be seen as a whole, within a place with a soul – a genius loci [4]. This example focuses on the holistic approach taken to documentation activities St. Neophytos; a church with tremendous monumental interest both for its tangible and intangible aspects as well as the unique blending of natural and man-made environment.

Modeling process

The proposed methodology of holistic approach presents a workflow that could (at the full end level) answer the requirements of the monuments' digital documentation by involving all user needs from the beginning of the process. The first step is the analysis of cultural heritage users and stakeholders. They can be categorized in two major teams: experts and non-experts [6]; "experts" are users that create digital data from documenting monuments and "non-experts" are users that only use these data. Nevertheless, due to the fast development of the creative sector -especially in EU- the "non-experts" are creating new content that we cannot afford to leave outside the monuments' digital documentation, especially in the holistic approach. Hence, the boundaries of these teams are loose, expanding them is the aim. The second step is a parallel analysis of the cultural heritage information needed to extract from the monuments' digital documentation. the proposed holistic methodology requires much of the documentation to be digital and not digitized. However, obviously analogue data cannot be avoided, especially during historic research, so digitization will be applied following the same scheme of metadata. Lastly, the 3D documentation of the monument is essential for a holistic approach; documenting and creating the 3D model is a procedure that involves a number of users (experts and non-experts) that can directly benefit from the information covered by the 3D, many of them could offer data to upgrade the quality and enrich the information of the 3D model.

In the case study of Saint Neophytos[59], the proposed methodology workflow was followed. The 3D Model was the crucial part of the workflow. An example of the high value of the 3D digital model in this case study the demand for documented information to be useful for a number of areas of analysis: structural, pathology and conservation state, hazard, humanities, intervention and monuments value – each of which is relevant to different user groups.

Technologies and heritage: impact assessment

The outcome of the digital documentation of the Enkleistra of Saint Neophytos is a highly-detailed 3D model, which may act as a reference point for the creation of applications. However, the proper function of these applications relies on the existence of a corresponding database on a server and/or in cloud systems, where the acquired data needs to be stored in a format that will be accessible and easily interpreted by all. For proper interpretation, it is essential to establish standards for the collected data, leading to improved integrity and decreased storage of redundant data. Stored data should follow Open Access principles in order to ensure its wider access and reuse. In parallel, a user-friendly interface should be developed to help non-expert users to find the required information.

A full user impact assessment has not yet been conducted.

Conclusions: Regional Case

Cyprus is now well advanced towards recovery after a long period of economic recovery, following the banking crash of 2013,which retarded attention to and investment in one of its greatest economic and social assets: its cultural heritage. Significant attention is now being paid to research, development and infrastructure in this field through strategic infrastructure and the development of multi-faceted research capacity, including in the key new digital aspects. Considerable success has recently been achieved in gaining EU funding under Horizon 2020, Interreg and other programmes. The Cypriot institutions are beginning to develop a regional role.

---

[59] Marinos Ioannides, Charalambos Ioannidis, Archimadrite Neophytos Enkleistriotis, "Towards Monuments' Holistic Digital Documentation The Saint Neophytos Enkleistriotis Case Study", EuroMed 2016: Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection pp 442-473

Strengths and opportunities

- Cultural Heritage is strongly-placed to become a major resource for tourism, education, creativity and economic growth in Cyprus and the Eastern Mediterranean and this is recognized by national stakeholders.
- The potential reunification of Cyprus may provide scope for DCH applications in support of social cohesion.
- The preventative conservation and reconstruction of damaged heritage will require large-scale inputs of expertise.
- EU – funded initiatives in particular are providing a promising basis for strengthening human resources and coordination in the field of DCH.

Challenges

- The national stakeholder base for DCH remains relatively uncoordinated and pipelines for the emergence of effective strategic initiatives have hitherto been rather weak.
- The NGO sector is not visible in DCH
- The number of practical applications in use emerging from DCH initiatives to date is limited.
- Little attention has yet been paid to economic and social impact assessment of CH or DCH initiatives in Cyprus, due to the economic recession in the last four years**.**
- Qualified human resources remain in short supply. Education and training facilities require strengthening. Initiatives to encourage public participation such as co-creation, co-design crowdsourcing or citizen science in relation to DCH are few and far between.

5. OVERALL INTERREGIONAL CONCLUSIONS AND PROPOSED POLICY MAKING AND ROADMAP ACTIONS

The study in these 3 European areas has led to the following general conclusions and policy recommendations in addition of those already presented as conclusions in each of the areas.

A. Perception and aspects of DCH in the 3 regions.

DCH project development depends heavily in all 3 regions in public policies i.e. through:

- A general institutional and financial framework that allows DCH project initiation and implementation in connection with various sectors where DCH can emerge: research, education, tourism, cultural heritage.
- A specific institutional and financial framework for the development and active support of DCH penetration into the various sectors (such as specific sections and actions of the structural European and state funded multiannual programs in Greece, or the Plan of Museums in Catalunya/Spain, presented in this study).
- Both general and specific policies and institutional and economic frameworks are determined at various levels in each area.
  - Spanish state/Catalunya regional government/ local authorities/municipalities
  - Greek state/ region of Central Macedonia/Municipality of Thessaloniki).
  - Cyprus is a different case given the size of the entire country, equal approximately to the city of Thessaloniki in Greece.
- The dependence of the flourishing and long-term sustainability of DCH projects in the 3 regions on the public institutional and economic framework is also confirmed by the Micro level cases presented, where actors, stakeholders, concerns, opportunities and obstacles are mostly linked with public policies, or the lack of such policies and support.
- The impact of recent years of crisis in the 3 regions emphasises the above-mentioned link. The evolution of DCH penetration and further development has been affected by lack of funding or reduction of personnel and active public initiatives in the field. Recovery began after the end of the crisis. However vulnerabilities remained, such as lack of continuity in the case or Spain and Greece or slowing of the initial penetration time for DCH in Cyprus.

- However, economic stabilisation and recovery has had an accelerating impact on public policies in the field of DCH in all 3 regions, clearly seen in the Catalonia and Cyprus cases, with various projects emerging, although the two regions are at different levels of digital technology penetration in the cultural sector. Even in Thessaloniki/Central Macedonia, Greece, the hard-hit by the economic crisi,s innovative projects are flourishing, and public policies intend to promote digital heritage.

DCH is widely perceived positively by local societies and the public. That perception is reflected in public efforts to create planes and also to motivate private initiatives in the field, as illustrated by the public interest to promote them and by the various case studies, the support they received by the local communities, institutions and the wider public.

- DCH is also perceived as a power tool for local development, due to the potential for tourist attraction and branding. This aspect is clearly mirrored in the macro policies presented as well as in the micro examples, interviews with personnel and other stakeholders.
- However, although citizens are considered as the final beneficiaries of DCH and of private and public investment in the field, their direct participation in idea generation and design of the application are not foreseen by cultural heritage institutions (CHI), as interested citizens that could contribute ideas, promote and support design and implementation and participate popularising the process of digital heritage, rather than as scientific experts. That explains partly the low level of private funding, through voluntarism or donations to DCH projects, although fiscal motivations do exist.

The participative decision-making process (DMP) of ViMM could be part of the solution, if it is combined with the development and use of digital tools and public consultations with stakeholders, open to citizens and private companies, namely:
  – concept/idea generation
  – design planning of technologies, content and business planning
  – implementation
  – operation / evaluation of the impact in middle term.

However, there is significant lack of resources (know-how, time effort, investment, participation of stakeholders) at the first stage, insufficient investment in design and business planning driven from the operational / scientific / commercial rather than the technological priorities, and almost nonexistent medium-term studies on operational, economic and social impact.

Digital projects are mostly driven by and focused on implementation as soon as some funding is achieved. Policies and standards in order to allocate funds, resources and provide expertise and to elaborate requirements and participative procedures of stakeholders and users in the first 2 stages, together with the funding of medium-term operational evaluation and socioeconomic impact studies, are pre-requisites for reducing significantly implementation costs and time, improve efficiency and sustainability ratios, and finally raising social awareness and participation in digital culture. It is essential to document properly the importance of public and private investment in digital heritage.

B. Common challenges and recommendations

Various aspects are unique to each of the regions because of different levels of economic development and economical/institutional frameworks. However, there is a number of issues that have been identified and emerge in all 3 areas, although with different intensity and maturity.

- *The relationship of DCH with positive and negative issues of tourism.* The role of DCH in relation to tourism can be summarized as follows

  – Expectation of additional and higher quality tourism flows mostly in areas that are not currently touristic centres. The general policies outlined in the macro analysis of the 3 regions and the examples of the industrial museum of Thessaloniki, Monsteny in Catalonia, Asinou Monastery in Cyprus are sufficient illustrations of this aspect). Impact is explicit and measurable in some cases. The development of

landmark applications such as Ullastret (Catalonia) or the industrial museum of Thessaloniki form part of this response.

− Improvement in the quality of cultural services provided to visitors, improving their in-depth understanding of cultural heritage (monuments, intangible heritage, museums and history). DCH is expected not only to provide more comprehensive information but also to take advantage and provoke emotional immersion in the history and heritage of a city or region

− DCH applications are also seen as a means of *tourism flow management and regulation*. In many cases, massive touristic flows, in areas or within monuments, are creating new issues and also creating adverse social reaction to tourism, despite producing wealth. This is very clear in the Catalonian cases, with massive tourism increase and concentration. Within the Macro plans of the countries, elements of this issue are identified which (such as in the tourism plan of Catalunya). However, it is not yet sufficiently specified how the digital technologies at micro and macro level could be part of the response to this important social and economic issue. Given that the 3 regions are heavily touristic, this is an important issue where more research and effort needs. to be dedicated.

    o In the macro level applications that facilitate to lead the flow of visitors in the city and between monuments in a more equilibrated time schedule, daily, weekly and annually. Intelligent interactive apps combined with smart cities and integrating incentives and recompenses as well as intelligent crowd management interactions.

    o At the micro level, the massive tourism flow in a monument or museum should be taken into account in the digital applications design in order to contribute to the reduction of concentration, noise by large multilingual crowd groups movement, and physical damages of the monument. While at the same time increase the valid and comprehensive information and the emotional involvement of the visitor with the cultural assets, before, during and after the visit.

− There is significant lack of expertise for the management of digital heritage projects within CHI at all levels, from the directors to the operational staff. This is stated by many of the professional experts in the field, whether involved as macro stakeholders or in the micro-level management of projects. There is also a suspicion between various stakeholders who are unwilling to collaborate, lack expertise, and understanding of each others' legitimate objectives, requiring a conciliation process led by senior creative experts in DCH.

− There is an obvious need for intensification of multidisciplinary training policies for museum professionals, in order to promote a common understanding of integration of digital apps in their institutions. This aspect does not clearly appear in any of the macro policies or plans examined.

− Enhancement is needed of common training activities at local and regional level among professionals in cultural heritage management (researchers, curators, managers) and the professionals of interconnected sectors: tourism, education of all levels, technological institutions, local authorities and planners, commercial and productive representatives of local society, in order to develop a common understanding of mutual views, priorities and even a common language. This could involve activities such as regular workshops and meetings led by external experts and structured processes of regular collaboration

• *The relationship of DCH with positive and negative issues of cultural asset preservation.*

− Macro policies and plans in all three regions, consider DCH to be a part of preservation plans, mainly in a traditional way: digitising the cultural assets is seen as preserving in a digital format and make them accessible to researchers and the public. However other aspects of preservation that are in practice implemented as are not considered automatically as such: i.e. preservation of intangible and scientific knowledge about the past (not just as simple metadata but as a cultural asset by itself). The metadata sets are considered still only as metadata although they sometimes constitute important cultural assets

in themselves. This has an important impact on the lack of effective policies for the sustainability and preservation of digital applications - or at least the cultural added value parts of them – which risk vanishing in time.

− Interrelated with the above aspect, is the lack of prioritisation of long-term sustainability strategies for cultural applications, which are mostly designed in an on-going process with no strategic depth and continuity.

− The Catalonia and Greece cases, as well as the current efforts in Cyprus, illustrate that the creation of specific public agencies on technological issues can help to tackle the issue but cannot resolve them completely, because it is not only technical but cultural (valorization of digital assets) and economical regulation models to which technology will be asked to provide affordable and effective solutions.

− Last but not least comes the lack of operational medium term evaluation of the systems concerning the preservation impact within crowded monuments. The digital applications within monuments or museums or sites are mostly limited to common surveillance techniques. However, there is still limited integration of the preservation of physical assets, (monuments, sites, architectural heritage in cities, artifacts), within the content provision applications. Such policies could promote via various technologies an understanding of visitors' intentions, their comportment, interact with the visitor in case of risky behaviors , educate and guide. They could also provide valuable information in terms of visitors' collective and individual behavior and needs, which could assist policy makers and stakeholders to better protect their physical assets, responding at the same time more effectively to the practical and emotional needs of visitors.

• *Long-term sustainability and impact*

− It is clearly concluded in the three regions, that except for a major and expensive study effectuated in Catalonia, which is not yet available and presented, there are no long-term macro level studies on the impact of introducing DCH introduction on a large scale upon the economy and society, e.g. using marketing and econometric tools for cost/effectiveness evaluation of investment and precise output indicators. That is an important policy lacuna. We know, we see, we feel that DCH is a good thing, we also know, see and feel, that there is waste of money due to wrong choices that could be avoided or of failure due to the lack of/inaccuracy of business plans, but we are not able to identify and quantify this, in order to improve the processes.

− Although there are sufficient data on usability and user satisfaction in the short term, there is an important lack of impact data and evaluation studies concerning sustainability, operational adaptation and costs, social and economic impact, and medium- and long-term user and citizenship satisfaction. These types of study require significant expertise and corresponding funds, that are not usually part of usual public or other stakeholder policies. However, they are of utmost importance in order to fully understand and document the achievements and the problems of the introduction of the digital technologies for cultural assets, to both cultural operators as well as to social stakeholders. They are also very important in order to improve effectiveness and sustainability of the ever-increasing number of DCH projects.

− The involvement of the private sector is manly limited to the provision of technologies as subcontractor or support services in all three regions. Donations are also provided (the Caixa- supported example in Catalunya and the fiscal laws that are favourable in that in Greece and Spain proves evidence of this. However far more potential seems to be available. The use of images through social media and internet applications of landmarked CH in the 3 regions could be a source of income if this were allowed easily and cheaply for commercial reasons through intelligent applications that could recompense the asset owner (state, foundation, etc.) and the photographer or the designer, in an easy and affordable way within a competitive environment. The current copyright arrangements in the three countries seem contradictory

to this lucrative perspective that could also multiply the appeal and new creativity related to their heritage.

Development of the cultural assets is a common issue in the three regions. Following the previous years of economic crises, there have been important reductions in the recruitment of new personnel, leading to a generation gap in CHI for DCH and causing a loss of transition of expertise from one generation to another. Public policies integrating new digital heritage experts in CHI in a flexible way, are recommended in order to cover this gap in knowledge that is one of the most difficult 'infrastructural' problems. Preserving cultural heritage intangible assets, personnel, is also an issue to be observed in depth in economic policies at times of crisis. It appears from the experiences in the hard-hit regions studied, that this is one of the most time- and cost-consuming aspects to rebuild.

6. REFERENCES

- AA.VV (2000). Difusión del Patrimonio Histórico. Cuadernos del Instituto Andaluz del Patrimonio Histórico, Sevilla, Junta de Andalucía, Consejería de Cultura, Instituto Andaluz del Patrimonio Histórico.
- Agencia Catalana del Patrimoni Cultural Ullastret, 250 B.C., A virtual reconstruction of an Iron Age town (2017) https://www.vi-mm.eu/2017/03/13/ullastret-250-b-c-a-virtual-reconstruction-of-an-iron-age-town/
- ARCore Supported Devices. https://developers.google.com/ar/discover/supported-devices, last accessed 2018/06/25.
- AREA MOREIRA, M.(2001). Usos y prácticas con medios y materiales en el contexto escolar. De la cultura impresa a la cultura digital. Revista de Cooperación educativa, no 61, Morón (Sevilla), Escuela Popular, M.C.E.P., 2001, pp 39-41.
- BARAJAS, M. y SIMÓ, N. (1994). Multimedia en la escuela ¿Para qué y cómo?. Cuadernos de Pedagogía, no 230, Barcelona, Publicaciones Mundial, pp. 23-27. SEP
- Browsing the city of Thessaloniki from mobile device with Virtual Reality applications, http://www.voria.gr/article/i-thessaloniki-parousiazi-ton-eafto-tis-me-virtual-reality, last accessed 2018/06/25.
- Catalan Agency for Cultural Heritage http://patrimoni.gencat.cat/
- Catalan Tourism Agency http://act.gencat.cat/
- CHCfE consortium, Cultural Heritage Counts for Europe study, 2015, http://blogs.encatc.org/culturalheritagecountsforeurope/wp-content/uploads/2015/06/CHCfE_REPORT_ExecutiveSummary_v2.pdf
- Christoforidou S., Kondylidou A., Mesochoriti E., Syrgianni A., Valavanidou A.: The Islahane of Thessaloniki, a contemporary monument, a witness to technical education as a means of vocational training of orphan children.
- Ciudades inteligentes Observatori SmartCAT, http://smartcatalonia.gencat.cat/ca/detalls/article/Observatori-SmartCAT
- Culture Thessaloniki. https://culture.thessaloniki.gr/, last accessed 2018/06/25.
- Department of Culture of Catalonia http://cultura.gencat.cat/
- DÍAZ-ANDREU, M. et al. (2015).From "doodles" to world heritage: Assessing the impact of the inscription of the rock art of the Mediterranean basin on the Iberian peninsula (ARAMPI) on the World Heritage List. Actas del II Congreso Internacional de Buenas Prácticas en Patrimonio Mundial.
- Digital Recovery through innovation 2020, ΕΥΔΕΠ «ΨηφιακήΣύγκλιση», Φεβρουάριος 2013.
- Diputació Barcelona, carxa de municipios. Diputació de Girona. Pla d'ús Públic del Parc del Montseny. Diagnosi de l'ús públic a l'espai natural.
- Diputació Barcelona, xarxa de municipios. Parc Natural del Montseny. Memorias 2006. Pg.7 http://dibapn.orex.es/documents_diba/p03d205.pdf
- Diputaciò Barcelona. Barcelona is much more. http://www.barcelonaesmoltmes.cat/en/web/descobreix/detall/-/dades/H0XtQmAswXNg/detall/17_17002_18/parc-natural-del-montseny

- FALK, JOHN. Motivation and learning styles. Understanding museum's visitors' motivations and learning. https://slks.dk/fileadmin/user_upload/dokumenter/KS/institutioner/museer/Indsatsomraader/Brug erundersoegelse/Artikler/John_Falk_Understanding_museum_visitors__motivations_and_learni ng.pdf
- Fundacion Catalunya – La Pedrera Http://www.fundaciocatalunya-lapedrera.com/http://www.boe.es/diario_boe/txt.php?id=BOE-A-2011-9617
- Galerian Complex. http://galeriuspalace.culture.gr/en/, last accessed 2018/06/25.
- GARCIA, L. La salvaguardia del patrimonio cultural inmaterial en la Reserva de la Biósfera del Montseny. Septiembre 2015. http://cultura.gencat.cat/web/.content/cultura_popular/05_documents_i_recursos/02_jornades_estudi s_legislacio/02_jornades_recerca_patrimoni/Estatics/SD_LluisGarciaPetit.pdf
- Generalitat de Catalunya, Xarxa de Museos http://cultura.gencat.cat/ca/detall/Articles/Xarxa_museus_Girona
- Generalitat de Catalunya. Departament de Cultura. Centro de Interpretación de Arte Rupestre "Abrics de L'Ermita.http://www.mac.cat/esl/Rutas/Ruta-del-Arte-Rupestre/Centro-de-Interpretacion-de-Arte-Rupestre-Abrics-de-l-Ermita
- Generalitat de Catalunya. Patrimoni Cultural. Ullastret 3D, caminarporuna ciudad Ibérica de hace 2000 años.http://patrimoni.gencat.cat/es/historias/ullastret-3d-caminar-por-una-ciudad-iberica-de-hace-2000-anos
- Generalitat de Catalunya. Visitmuseum digital application.https://visitmuseum.gencat.cat/es/
- GIANNOULIS GIANNOULOPOULOS G., *(2012)* Organizational aspects of ICT applications in cultural heritage "Virtual Museum" context: the permanent challenge of reconciliation of diverging scientific, technical, operational and financial objectives., Virtual Archeology Review, Vol 3, No 7
- History Center of Thessaloniki. https://tinyurl.com/y8rxy54m, last accessed 2018/06/25.
- HOOPER-GREENHILL, E. (1998). Los museos y sus visitantes. Gijón: Ediciones Trea.
- ICOM, International Council of Museums. Museum Definition. https://icom.museum/en/activities/standards-guidelines/museum-definition/
- Karabournaki (Recording the Past). http://karabournaki.ipet.gr/, last accessed 2018/06/25.
- Law of Catalan Cultural Heritage (Law 9/1993): https://www.boe.es/buscar/pdf/1993/BOE-A-1993-26497-consolidado.pdf
- Law of Fiscal Regime of Entities without Lucrative Purposes and of Fiscal Incentives to Patronage (Law 49/2002): https://www.boe.es/buscar/act.php?id=BOE-A-2002-25039
- Law of Foundations (Law 50/2002): https://www.boe.es/buscar/act.php?id=BOE-A-2002-25180
- Law of Museums (Law 17/1990): https://www.boe.es/buscar/pdf/1990/BOE-A-1990-28240-consolidado.pdf
- Law of Science, Technology and Innovation (Law 14/2011) http://www.boe.es/diario_boe/txt.php?id=BOE-A-2011-9617
- Law of Tourism of Catalonia (Law 13,2002):https://www.boe.es/buscar/pdf/2002/BOE-A-2002-14081-consolidado.pdf
- Marc Hernàndez, formerly Chief Information Officer at the Barcelona Culture Institute, the Barcelona´s cultural digital initiatives.
- Marinos Ioannides, Charalambos Ioannidis, Archimadrite Neophytos Enkleistriotis, "Towards Monuments' Holistic Digital Documentation The Saint Neophytos Enkleistriotis Case Study", EuroMed 2016: Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection pp 442-473
- Michael Tsioumas, Records of Service of modern monuments and technical works, Hellenic Ministry of Culture and Sports, Service of Modern Monuments and Technical Works of Central Macedonia, Herodotou str. 17, 540 03 Thessaloniki, Greece, mtsioumas@culture.gr
- Ministry of Education, Culture and Sports https://www.mecd.gob.es/portada-mecd/

- Ministry of Science, Innovation and Universities www.ciencia.gob.es
- MonSant Benet oficial website. http://monstbenet.com/ca
- Municipal Tourist Office of ulldecona https://turismeulldecona.com/es/
- Museos 2030. Plan de Museos de Cataluña Museos 2030. Museus 2030, una estratègia nacional 15 Visió: els museus de Catalunya el 2030, Pla d'Actuacions 2018- Pla d'Actuacions 2018-2021, Memòria Econòmica, Sistema d'avaluació i seguiment https://web.gencat.cat/es/actualitat/detall/Museus-2030.-Pla-de-Museus-de-Catalunya
- Museos Etnologicos en Catalunya http://docplayer.es/15285943-Los-museos-etnologicos-en-cataluna-perspectivas-retos-y-debates.html
- Museu d'Arqueologia de Catalunya (MAC) (n.a.) El referente de l'arqueologia catalana. P 53.
- Museu Etnològic del Montseny La Gabella. http://www.museuetnologicmontseny.org/
- Museums Board of Catalonia. http://web.gencat.cat/ca/generalitat/cercador_organismes/index.html?codInf=2767
- Museums Network. http://cultura.gencat.cat/ca/departament/estructura_i_adreces/organismes/dgpc/temes/museus/museus-de-catalunya/xarxes-de-museus/
- National Council for Culture and Arts (CoNCA) http://conca.gencat.cat/
- National Institute of Educational Technologies and Teacher Traininghttp://www.ite.educacion.es/en/descripcion
- OLIVE , M., CASTIÑEIRA FERNÁNDEZ, Á. & LOZANO, J. (2010). Món Sant Benet: utopia, ambicióipassió: uncas de lideratge territorial a la Catalunya Central. Barcelona: ESADE. Cátedra Liderazgos y Gobernanza Democrática.
- Olivé M.,Castiñeira A. & Lozano J. . (2017). Research text of "Món Sant Benet: Utopia, ambicióipassió". Un cas de lideratge territorial a la Catalunya Central.
- Operational Program of the Region of Central Macedonia 2014-2020. https://tinyurl.com/y7yh9q6y, last accessed 2018/06/25.
- Papagiannakis, G., Geronikolakis, E., Pateraki, M., Lopez-Menchero Bendicho, V., Tsioumas, M., Sylaiou, S., Liarokapis, F., Grammatikopoulou, A., Dimitropoulos, K., Grammalidis, N., Partarakis, N., Margetis, G., Drossis, G., Vassiliadi, M., Chalmers, A., Stephanidis, C., Magnenat-Thalmann, N.: Mixed Reality Gamified Presence and Storytelling for Virtual Museums, Springer, (2018).
- Parcs de Catalunya Xarxa de Parcs Naturals Http://parcs.diba.cat/es/web/conservacio-de-la-biodiversitat/recerca-i-seguiment-medifisic?p_p_id=82&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&_82_struts_action=%252Flanguage%252Fview&_82_redirect=%252Fes%252Fweb%252Fconservacio-de-la-biodiversitat%252Frecerca-i-seguiment-medifisic&_82_languageId=ca_ES
- Parcs de Catalunya. Xarxa de Parcs Naturals.Parque Natural del Montseny, Reseva de la Biósfera. https://parcs.diba.cat/es/web/montseny/aprovacio-del-pla-especial
- Patrimoni Cultural. http://patrimoni.gencat.cat/
- Patrimoni Cultural. Ullastret 3D. http://patrimoni.gencat.cat/es/historias/ullastret-3d-caminar-por-una-ciudad-iberica-de-hace-2000-anos
- PLAN DE EQUIPAMIENTOS CULTURALES DE CATALUÑA 2010-2020, http://cultura.gencat.cat/web/.content/dgcc/08_Serveis/Publicacions/documents/arxiu/peccat_cast.pdf
- Plan Estratégico de Turismo de Cataluña 2013-2016 y Directrices Nacionales de Turismo 2020 http://empresa.gencat.cat/web/.content/20_-_turisme/coneixement_i_planificacio/recerca_i_estudis/documents/arxius/pla_cas.pdf
- Plan estratgico de Turismo en Barcelona 2020, Aayuntemiento de Barcelona, direccion de Turismo https://ajuntament.barcelona.cat/turisme/sites/default/files/documents/es_170710_resumenejecutivo.pdf

- Plan of Museums 2030: http://premsa.gencat.cat/pres_fsvp/docs/2017/09/22/12/59/7ae8204c-341e-4f4a-8727-aab5a8c997aa.pdf
- PUJOL, L (2004). Arqueologia, museus, i realitat virtual. Digit HVM Revista Digital d'Humanitats. Mayo de 2004.http://www.uoc.edu/humfil/articles/cat/pujol0304/pujol0304.pdf
- RamonLlullUniversity.http://itemsweb.esade.es/wi/research/catedra_liderazgos/Catedra_Lideratge/Publicacions/sant-benet.pdf
- Region of Central Macedonia CHRISTA project.http://www.pkm.gov.gr/default.aspx?lang=el-GR&page=29&projectid=49, last accessed 2018/06/25.
- Region of Central Macedonia Cult-RinG project.http://www.pkm.gov.gr/default.aspx?lang=el-GR&page=29&projectid=60, last accessed 2018/06/25.
- Region of Central Macedonia HIGHER project.http://www.pkm.gov.gr/default.aspx?lang=el-GR&page=29&projectid=50, last accessed 2018/06/25.
- Secretary of State for Culture http://www.mecd.gob.es/portada-mecd/
- SERRA, R., Y TOMASSA, E.(2009). La museografía audiovisual e hipermedia y susaplicaciones en el monasterio de Sant Benet de Bages. HERMES, Revista de Museología. No 1, abril-mayo 2009. https://www.academia.edu/2940362/Museizar_la_vida_cotidiana_desde_el_sombrero_a_los_zapatos_problemas_y_tendencias
- Special Plan of the Montseny Natural Park, master plan called the Special Plan for the Protection of the Natural Environment and Landscape of Montseny. https://parcs.diba.cat/es/web/montseny/aprovacio-del-pla-especial, December 11, 2008
- State Mercantile Society for the Management of Innovation and Tourism Technologies www.segittur.es
- Strategic Plan of Tourism of Catalonia 2020: http://empresa.gencat.cat/web/.content/20_-_turisme/coneixement_i_planificacio/recerca_i_estudis/documents/arxius/pla_cas.pdf
- The Catalan Institute for Cultural Heritage Research -ICRPC http://icrpc.cat/
- The city of Thessaloniki – History Recursion. http://www.inthessaloniki.com/el/i-poli-tis-thessaloniki-istoriki-anadromi, last accessed 2018/06/25.
- The Strategy of Research and Innovation for the Intelligence of Specialisation of Catalonia (RIS3CAT): http://catalunya2020.gencat.cat/web/.content/85_catalunya_2020/documents/castella/arxius/10_pa_ris3cat_201511_es.pdf
- UNESCO. Rock Art of the Mediterranean Basin on the Iberian Peninsula. http://whc.unesco.org/en/list/874
- UNESCO's Man and the Biosphere Programme (MAB) is an Intergovernmental Scientific Programme that aims to establish a scientific basis for the improvement of relationships between people and their environments. http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/
- UNESCO's Man and the Biosphere Programme (MAB). http://www.unesco.org/new/en/nairobi/natural-sciences/ecology-man-and-biosphere-programme/
- VERSHUREN, P. (2003). Case study as a research strategy: Some ambiguities and opportunities. International Journal of Social Research Methodology, 6:2, 121-139, DOI: 10.1080/13645570110106154
- ViMM deliverable 3.2. Seven TA Working Group Composite Reports ,http://www.vi-mm.eu/
- Virtual Multimodal Museums Https://www.vi-mm.eu/
- WAGENSBERG,J. (2012). El museo "total", unaherramienta de cambio social. Revista Ciudades Creativas de Fundación Kreanta, correspondiente a las IV Jornadas Internacionales Ciudades Creativas organizadas por la Fundación Kreanta y el Ayuntamiento de Madrid los días 24, 25 y 26 de noviembre de 2011. https://www.ciudadescreativas.org/2018/04/01/el-museo-total-una-herramienta-de-cambio-social-jorge-wagensberg/
- WORLD TOURISM ORGANIZATION (2018). UNWTO Strategy on Innovation and Digital Transformation.
- ZHANG R., ET AL. (2017). Digital heritage theory and innovative practice. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XLII-2/W5 pp. 335-342.

APPENDICES

Appendix 1 – Interview Summary, Tourism Patronage of Costa Brava.

Thursday, June 21st. - 13:30 hrs. Office in Girona

Laura Moreno. Marketing Department –Director of the Culture and Identity Club

About technologies applied in museums:

"The technological tools used in museums narrative are a differentiating element and make heritage interpretation more accessible to visitors. They are definitely a plus in the cultural offer of a tourist destination. " When the Patronato attends events and promotes the museums, there is an interest in the innovations that is going on in museums. Ullastret 3D is one of the most striking cases and people enquire about it. In the words of Laura Moreno "Technologies have become a claim. - "They have a super positive impact" on museums.

About the efforts of the Culture and Identity Club:

The annual operating plan for Culture and Identity Club is formed according to the themes and activities that members request to attend throughout the year. The Club is composed of 90 associates among museums, galleries, cultural centers and different stakeholders (all the museums in the Xarxa are participants).

The Patronato de Turismo, through the Culture and Identity Club, manages different activities to include the museums as part of the tourist-cultural offer of the Costa Brava. Their actions are mainly focused on developing marketing strategies.

- They mainly counsel museums on topics related to digital marketing.
- About links (joint) with other actors in the tourism sector:
- There is no direct link with SEGITTUR.
- There is no direct link with VisitMuseum project.
- The Annual Operational Plan of the Patronato de Turismo is not based on any of the regulations or laws analyzed in this work. Its activities correspond to petitions from the tourism sector represented by the associates of the Patronato

Appendix 2 – Interview summary, Research, Development and Tourism Innovation (SEGITTUR).

Thursday, July12. 12:00 hrs. SEGITTUR

Carlos Romero Dexeus. Director of Research, Development and Tourism Innovation

Regarding management of SEGITUR

They facilitate the interaction between characteristic businesses of the tourism sector (hotels, restaurants, travel agencies, transporters, etc.) and companies providing solutions and technologies. They put together diffusion days to explain the possible applications that technology would have on the tourist destinations or in a company within the sector.

Regarding the technologies applied in museums

There's no direct contact to the world of culture, except for some specific collaborations, such as the Minister of Culture webpage www.espanaescultural.es, where they support with maintenance and incorporating content.

They've collaborated in the development of the Factoria Cultural, a support initiative to entrepreneurship projects within the cultural sector, some of them with innovation and technology elements. They've had collaborations with some museums such as the National Archeological Museum and the ARQVA of Subaquatic Archeology, as well with the information center of the Monastery of Monserrat where they supported with the installation of screens.

SEGITUR is contacted to participate in European projects, an example being the design of the Route of Napoleon, a transnational tourist route Spain-France.

They maintain contact with business that turn out technologies in virtual reality, immersive, augmented and mixed, etc., and they facilitate communication between prospective clients of the tourism sector. They also enable the approach with sources of financing through Emprendetur, a program that supports companies with a technology base in the tourism sector.

They recently formed the IFEMA laboratory which focuses on 5G technologies and their application in the realm of mixed reality. In FITUR 2018 they provided some demonstrations of applications with VR devices.

Regarding the linkage with other participants in the tourism sector in Catalunya

As indicated by Carlos Romeo, their natural partners are the DMOS and the tourism authorities.

The communication between participates of the tourism sector occurs through the tourism council of each destination when they request to address a particular topic.

There is communication with the councilor of Barcelona.

There is no direct contact with the cultural sector of Catalunya.

There is no direct contact with the Xarxa of Museums

APPENDIX 3 – Museums Network of Girona (Xarxa de Museus)

Monday, July 9th. 12:41 hrs.

LadaServitja, interview summary. Support staff at the Service of Assistance to Museums (SAM)

Regarding applied technologies within the museums

The topic of incorporating technology into the narrative of museums is not a topic of recurrence within the members of the Xarxa. Lada considers "it's mainly due to budget issues," the majority of museums operate with a limited budget and investing into technological equipment would be a costly investment.

The Xarxa ran a study where different aspects of the museum are analyzed. The study presented an important fact, one which indicates that all museums need to improve their image and museography.

Regarding management of the Xarxa Museums

The Annual Operation Plan for the Xarxa is shaped according to the topics and activities that the associates are tending throughout the year. The Xarxa is constituted by 26 museums in the Catalunya region. Each museum puts forward the topics and activities that it would like to develop during the next year. A vote is held to determine the priority activities for the Xarxa.

The efforts put forth by the Xarxa that benefit its members are varied. Workshops are offered in different interest areas for the museums. Promotional material is designed (digital and print). Events, fairs, congresses where the museum can participate are sought.

Regarding interaction with other participants in the tourism sector
There's no direct connection with SEGITUR

There's no direct connection with Tur España

For this reason, Lada mentions that "if necessary, the Patronat de Turismo and the Agencia Catalana the Turismo can act as a middleman between the Xarxa and other entities." She indicated that for the moment the museums have not requested any intervention from SEGITUR or TurEspaña.

They actively participate with VisitMusuem. The Xarxa facilitates the exchange of information between the application and the participating museums.

The Annual Operating Plan of the Xarxa Museums is not grounded in any rulings or laws analyzed in this work. Its activities correspond requests of the tourism industry represented by the members of the Patronat.

APPENDIX 4

Interview with Alberto Sierra , New Technologies department, Catalan Agency of Cultural heritage

The main points of the interview have been integrated in the document and the conclusions. Agencia Catalana del Patrimonio Cultural. In his interview the director mentioned one more case study of exit, in order to support some of his arguments, the mapping of **Mapping of St. Climent de Taüll**.

The main points and recommendations have been integrated in the conclusions of the study, particularly the points 1-4 in his interview :

Decentralization in parallel with technological and scientific standardization, to simplify administrative processes. He mentioned the difficulties faced by the museums to take autonomously the decisions to develop digital projects, and he proposed further decentralization along with standardization in order to avoid incompatibilities and conflicts of the various projects and work repetition

The need of Multidisciplinary and multi sectoral policies to improve understanding of professionals of CH and the other involved sectors. He mentioned the lack of understanding of the legitimate objectives of the various actors inside the cultural sector and among the professionals of various sectors (tourism, education, urban policy makers, local authorities, etc.). That is an issue that has to be faced with intersectoral policies

The need for investment in the design phase of digital applications and to the study of impact. M. Sierra confirmed that no adequate middle and long-term studies are conducted for the evaluation and operation of impact of CH and particularly the Digital CH projects, in order to evaluate also the budget assigned to the museums. He informed the ViMM experts that the local Government has ordered an in-depth study by experts, in 2016, concerning the impact and satisfaction, however it was not yet presented in the directors of the administration.

At the end he provided additional information and examples documenting his arguments based on cases that Catalan Agency has developed in Catalunya, some of which are studied in this document.

Sábado, 8 de Septiembre de 2018, a las 15:00 hrs.

En continuación con el trabajo de investigación, en relación a la identificación de las entidades a nivel macro y las gestiones que realizan para fomentar o impactar el desarrollo de tecnologías para la interpretación del patrimonio cultural, el día sábado 8 de septiembre, se llevó a cabo una entrevista con el Sr. Alberto Sierra, integrante del área de Nuevas Tecnologías en la Agencia Catalana del Patrimonio Cultural.

Durante la entrevista, se trataron los puntos derivados del análisis macro y micro, resaltando temas relacionados con museos en Catalonia como planificación, personal que trabaja en museos, capacitación, proyectos de patrimonio cultural que emplean recursos tecnológicos, sistemas de evaluación, estudios de impactos socioeconómicos, etc.

Interview with Alberto Sierra / Catalan Agency of Cultural Heritage

Entre los temas antes sobresale lo siguiente: mencionados,

1.- Sobre políticas públicas vinculadas al sector cultural

Sierra comenta que varios de los puntos en las leyes y planes estratégicos catalanes resultan "muy generales". Se refirió al modelo de gestión cultural adoptado en Catalunya como uno basado en el Sistema Francés, en el cual existen "Muchas leyes, y poca libertad", comparándolo con el sistema anglosajón, en el cual "existen pocas leyes y mucha libertad".

2.- Respecto a la capacitación y participación interdisciplinaria en la gestión del patrimonio cultural

Sierra comenta que se realizan encuentros y talleres con personas tanto del sector cultural como del turístico, sobre los cuales afirma que se organizan de manera poco estructurada. Comenta que considera que existe un problema en la gestión del patrimonio, debido principalmente a que el personal administrativo y directivo en los museos, generalmente cuenta con poca formación en temas de marketing/orientación de producto, afectando la manera en que se administra y promueve un museo.

La crisis económica, indica Sierra, marca un antecedente en la gestión cultural en Catalunya, limitando los recursos económicos para los museos, y, por ende, frenando muchos proyectos encaminados al fortalecimiento de las gestiones del patrimonio. Una de las principales afectaciones identificadas, fue en el sector de recursos humanos, ya que se dieron recortes de personal, y por aproximadamente 10 años la platilla de personal no creció, evitando que los museos crecieran y se fortalecieran incluyendo nuevo personal, con nuevas visiones y conocimientos.

3. Respecto planificación y estudios de impacto

Existe poco interés en el sector por desarrollar estrategias que permitan el análisis de desempeño de los museos, así como de conocimiento sobre los niveles de satisfacción de los usuarios. En este sentido, Sierra comenta que "no se ve (por parte de los administradores de museos) la utilidad real de contar con estos datos… por lo cual no se consideran dentro de la planificación… Los resultados de estudios de evaluación no representan un mayor impacto en la elaboración/asignación de presupuesto para los museos". Alberto Sierra mencionó la existencia de un estudio de "análisis de satisfacción"[60] realizado por la Agencia Catalana del Patrimonio Cultural en el año 2016. La intención inicial es realizar un nuevo estudio cada 18 meses aproximadamente, para dar seguimiento a los resultados. Hasta el momento no se ha realizado un segundo estudio. El "análisis de satisfacción" aún no ha sido presentado al sector.

4. Sobre proyectos en Catalunya que utilicen tecnologías en el patrimonio cultural

Alberto Sierra se refirió a tres proyectos que considera son importantes referentes en cuanto a la incorporación de tecnologías y sistemas innovadores para la promoción e interpretación del patrimonio cultural catalán: Mapping St. Climent de Taüll, Casa Batlló y el caso de transformación de operativa turística-cultural en Ampurias. Reconoció el Mapping St. Climent de Taül como un verdadero caso de éxito, con importantes impactos socioeconómicos.