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# DIGITAL INNOVATION FOR CULTURAL HERITAGE: LESSONS FROM THE EUROPEAN YEAR OF CULTURAL HERITAGE

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**Abstract**

The European Year of Cultural Heritage (EYCH) was a significant step towards public participation and a dialogue among experts and non-experts on what cultural heritage is and what it will be. Digital Innovation for Cultural Heritage (CH) was an important element of EYCH, as it offers the tools to view and activate culture not as a snapshot of the past, but as an ever-evolving element of societal growth and prosperity shared by all. During the EYCH, we interacted with a variety of European projects, research groups, and stakeholders on the topic of Digital Innovation for CH and specifically on how cultural heritage can be coupled with cutting-edge technology to allow future innovation. In this paper, we summarize lessons learnt through these interactions, as well as through reviewing meeting reports and relevant research literature, across three main dimensions: Digital CH innovation facilitators, Evaluation and Intellectual Property Rights issue.

**Keywords**

Digital Cultural Heritage, Innovation, EYCH

## 1. *Introduction*

The European Year of Cultural Heritage (EYCH) aimed at encouraging European citizens to engage actively with cultural heritage, explore a common past and enhance the sense of a common European identity. It required the intense cooperation of 19 different services of the European Commission, working in a transversal manner in order to:

1. Break down cultural heritage research silos and allow synergies to evolve,
2. Support the democratization of culture and cultural heritage, bring cultural heritage to a wide audience and allow bottom-up processes to emerge,
3. Speed up innovation processes in the context of cultural heritage.

During the EYCH there were 11,700 events organised in 37 countries attracting 6.260.000 participants[11]. The various events organised, brought together specialists, cultural heritage stakeholders and the wider public, accelerating communication and cooperation procedures.

Especially in regards to cultural heritage innovation, the EYCH made it clear that this is a multidimensional challenge. It includes aspects like technological, social, policy, entrepreneurial, economic and methodological, involves multiple fields of expertise, and requires multidisciplinary approaches. In the present work, we will focus on digital innovation aspects in cultural heritage, following the lessons learnt during the EYCH. Our main question can be summarised as follows: "How can cultural heritage be coupled with cutting-edge technology to allow future innovation?"

## 2. *Methodology*

During the EYCH, we attended and organized a series of events that aimed to strengthen stakeholder collaboration in the domain of digital innovation for cultural heritage. These events include:

- Four stakeholder events, bringing together municipalities, venues, businesses, and researchers.
- Three conferences/workshops, involving policy makers, researchers and European projects.

[1] https://europa.eu/cultural-heritage/eych-events-grid_en

- Two inter-project collaboration workshops, involving multiple European projects and research groups.
- One high-level policy debate, involving policy makers, researchers and European projects.
- One innovators fair, involving policy makers and European projects.

This allowed us to discuss digital innovation in cultural heritage with experts from many different backgrounds, and to form a broader picture of the ongoing processes in the field.

The interactions during the above meetings, the meeting reports and relevant research literature, enabled us to identify the current and future directions of the field of Digital Innovation for Cultural Heritage (CH), from a macroscopic perspective. We present these directions in the rest of this paper, organised in distinct categories starting from digital innovation facilitators, continuing with key elements to take into account

**Tab. 1:** Cultural Heritage and Digital Innovation – Events attended during EYCH

| Column 1 | | Column 2 | |
|---|---|---|---|
| Stakeholders meeting in Vigo | February 2018 | CrossCult | University of Vigo, Vigo |
| Innovation & Cultural Heritage Conference | March 2018 | European Commission | Royal Museum of Arts and History, Brussels |
| Athens meeting for inter-project collaboration | May 2018 | CrossCult | University of West Attica |
| Stakeholder meeting in London | June 2018 | CrossCult | University College London |
| Stakeholder meeting in Tripolis | September 2018 | CrossCult | University of Peloponnese, Tripolis |
| Stakeholder meeting in Padova | September 2018 | CrossCult | University of Padova, Padova |
| Cultural Informatics workshop, Cyprus meeting for project collaboration | November 2018 | University of Peloponnese | Collocated with EUROMED 2018, Nicosia |
| Projects on Cultural Heritage and ICT Workshop in the European Year of Cultural Heritage | November 2018 | European Commission | REA, Brussels |
| Fair of European Innovators | November 2018 | European Commission | The EGG, Brussels |
| Symposium Horizon for Heritage Research | March 2019 | REACH | REA, Brussels |
| High Level policy debate | March 2019 | European Commission | House of European History, Brussels |


Table 1 illustrates the details of these events, while Figures 1 and 2 illustrate participants from some of these events.

During these events, we interacted with multiple projects and specialised research groups, as shown in Table 2.

for the evaluation of this field and Intellectual Property Rights issues, and ending with future directions and conclusions

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## 3. *Digital CH innovation facilitators*

The facilitators presented below are a set of key elements, which were reported repeatedly by a variety of stakeholders with whom we discussed, as the most important pillars to enable the Cultural Heritage domain benefit from Digital Innovation

### *3.1 Innovation ecosystems*

What is the role of technology in the context of Cultural Heritage? How can the use of technology align with the objectives of cultural heritage visitors and institutions? Eventually, how can technology help improve the position of Cultural Heritage in the Digital Age?

Across Europe, there are currently more than 19.000 museums and cultural venues. By 2016, one third of European museums had invested in some sort of digital transformation (EGMUS, 2016), creating a wealth of data, technologies and expertise. In the period 2007–2013 alone, the EU invested approximately 4.5 billion EUR in cultural heritage and related research. When standing alone, certain of these developed technologies have limited value; they can only reach a fragmented portion of potential visitors and stakeholders, and they risk being quickly outdated.

To make this investment in digital culture worth more than the sum of its parts, it is necessary to work through innovation ecosystems.

Innovation ecosystems are a widely used approach in the industrial world for more than 15 years now. Based on the notion that innovation and entrepreneurship need an extended network of stakeholder collaboration in order to thrive, ecosystems have transformed the software development industry (Mason & Brown, 2014). The current trend in ecosystem implementation is based on flexible architectures of technology modules (such as micro-services) contributed by a variety of actors and hosted in the cloud, instead of monolithic technological solutions that are difficult to sustain in the long term.

Driven by the same shift that drove the industrial world 15 years ago, this calls for a radical reframing of how we view technology in the context of Cultural Heritage: from internal and siloed collections of cultural digital assets to a broad network of cultural innovation ecosystems.

After a year of interacting with different digital innovation projects in the context of the EYCH, we now know that it is feasible with the appropriate technology choices to create flexible, open and collaborative environments, which are also secure and privacy-aware by design; environments that allow cultural institutions, visitors, companies and independent researchers to feel welcome to contribute and want to be part of. These collaborative environments enable people to access, share and build on one another's results, and eventually create digital cultural heritage ecosystems that can keep growing further than the initial EU funding of any specific project.

The EU CrossCult platform is an example of such an ecosystem. It is orchestrated as a rich portfolio of technology contributions made by multiple independent actors, who create heterogeneous but complementary technologies around a stable platform core. It follows a "software as a module" approach. Instead of designing a complex, monolithic system, each technology contributor (project partner, individual developer, etc.) creates smaller pieces of reusable software, which are easy to combine to create diverse cultural heritage applications, adapted to the needs of different venues and audiences.

Examples of technology services include gaming modules, recommender systems, semantic reasoning, storytelling interfaces, geolocation, social media, analytics and crowdsourcing service elements. Using this flexible architecture the project has created four different mobile applications, which target different cultural venues and audience needs: from large established museums to smaller ones, and from distributed cultural venues to European cities (CrossCult, 2017).

Overall, each separate service of such a

platform has limited value on its own. However, by placing them together in a way that promotes reusability, extensibility and maintainability, we can indeed achieve *an innovation value that is larger than the sum of its parts*.

### *3.2 Dialogue between ICT and Social Sciences and Humanities*

The second important facilitator is promoting a dialogue between ICT and Social Sciences and Humanities. This dialogue is neither evident nor straightforward. Experts from each domain often exhibit a resistance to shifting their viewpoint to accommodate discussions with experts from other domains (Marzano et al., 2006). ICT experts often view SSH colleagues as too theoretic, while SSH experts often view ICT colleagues solely as technology providers. Despite good intentions, this mind-set is more often than not present across projects of Digital Innovation in CH, and it does hamper the possibilities of a fruitful collaboration. Innovation however mandates a mind-set shift, and a good understanding of the domain of expertise of the other, to enable truly multidisciplinary solutions to emerge.

Through our discussions and observations, we have identified two key elements that can be used to develop a fruitful dialogue between ICT and SSH, with concrete outcomes for the field of Digital CH Innovation: 1) shared (online) spaces for joint experimentation, such as Living Labs, and 2) interdisciplinary training.

A Living Lab constitutes an interdisciplinary space for sharing practices and ways to work together (Bergvall-Kåreborn & Ståhlbröst, 2009). From the elicitation of requirements and evaluation metrics, to the development of software, experimentation and iterative improvement, it helps promote dialogue between Humanities and the IT experts; a dialogue which, as mentioned above, is not always given in Digital Cultural Heritage initiatives. It allows us to gradually record and streamline these processes so that newcomers can catch up faster, while at the same time it permits a loose collaboration with enough freedom to do things otherwise if needed, thus promoting scalability of the innovation ecosystem. A Living Lab is also a flexible vehicle for the continuous involvement of external stakeholders, to participate and co-design together with the core actors of Digital CH. Through a Living Lab, citizens can experience hands-on and co-shape new digital cultural heritage applications and approaches. For cultural venues and public stakeholders, a Living Lab can provide the means to examine digital innovation services, and re-use and re-purpose them for their own needs and audiences. Finally, for practitioners and researchers a Living Lab can offer an environment where they can exchange expertise and forge new collaborations.

Training can be either direct in the form of short tutorials or indirect through the continuous collaboration and exposure over a certain period to another expert's domain. This is crucial to develop a common vocabulary of shared concepts across domains, leading to not only a mutual understanding but also to idea cross-fertilisation (Jiang et al., 2015), which reduces idea fixation (Jansson and Smith, 2003) and eventually leads to ground-breaking innovation. In the long run interdisciplinary training creates groups that have learnt to work together, and have developed the so-called "transactive memory" and ways to efficiently work together (Wegner, 1987), as well as individuals that can easily collaborate with others across fields. Given the high level of interdisciplinarity involved in Digital CH, it is our belief that investing on interdisciplinary training can create a wealth of human resources that will benefit the field significantly.

### *3.3 Project and stakeholder networking*

Throughout our interactions with the different projects and stakeholders in the Digital CH area during EYCH, we often participated in discussions around the problem of "re-inventing the wheel". Many projects seem to start from scratch and to need to develop similar technological solutions. Given that the lifecycle of the typical EU project is three years, this means that a considerable amount of financial and human resources are often spent on creating solutions that another project may have already created.

The reason for this include the high degree of fragmentation in the field, and the fact that projects tend to work in silos, due to the need to manage their own internal complexity. Another reason is that EU projects generally function in a competitive setting, which blocks their willingness to share expertise and resources, as well as the lack of common and easy-to-use repositories. A final reason is that although the technological solutions may be reusable, they are often bounded by Intellectual Property Rights (see also section 6).

Despite the above, our experience has shown that projects are now more than ever willing to discuss. In fact, during the EYCH we successfully organized two workshops for inter-project collaboration and building future synergies (Antoniou & Wallace, 2018), while a third one is underway. These workshops attracted 23 projects and many research groups, which represent a considerable portion of the active scientific stakeholders in the Digital CH domain today.

Best practices and principles to enable the above include:

- Project and stakeholder networks must be built on trust,
- Projects and actors must clearly recognize a value for themselves to participate,
- Flexible participation structures are needed (e.g. no presentations rather based on ad-hoc discussion topics),
- Avoid a single actor (e.g. project) that claims ownership of the event
- Avoid imposing a certain perspective and allow room for multiple issues to emerge (e.g. semi-flexible agendas),
- Participants should have a sense of collective ownership of the results,
- Regular meetings and communication are required to maintain a good level of continuation, and sustainability of the newly built network.

### *3.4. Intermixing top-down and bottom-up digital innovation processes*

During the Innovation and Cultural Heritage Conference, marking the start of the EYCH, commissioner Moedas stressed the importance of a bottom-up approach (Vahtikari, 2018): "*instead of imposing co-operation from above on researchers from different disciplines, the idea of mission driven research could encourage bottom up joining forces around a common problem related to cultural heritage*".

In line with our own observations, the above statement summarizes a need to mix top-down and bottom up digital innovation processes, and it is linked to the notion of the democratisation of science (Kitcher, 2011). Combining the two approaches can bring on multiple advantages, i.e. the "best of both worlds". On the one hand, by putting the user in the centre and by involving citizens with a role more than that of cultural heritage consumer, we can reflect on and enable a diverse wealth of knowledge, ideas and perspectives to emerge, thus paving the way for disruptive innovation. Leading-edge technologies, from interactive storytelling to ubiquitous cultural experiences, and from crowdsourcing to emotional computing, can help strengthen the social dimension of CH online and in physical spaces, reinforce cultural diversity and multivocality, and eventually help position Cultural Heritage as a true "melting pot" in the mind-sets of Europeans. On the other hand, by highlighting the role of the expert, not any more as a distant authority, but as a change broker, we can promote dialogue, help institutions and user communities adapt to change, and eventually co-evolve.

Challenges that still lie ahead include:

- Content validation, since content can be now co-created by experts and non- experts.
- Identification of new aspects of life that digital cultural heritage can influence, to enable citizens to keep pace with societal demands.
- Handling of user feedback coming from various sources and in large quantities.
- Enabling collaboration at scale and creating environments for collective intelligence to emerge.

## *4. Evaluation of digital CH innovation*

Measuring the impact of innovation is a complicated task, with many different levels that need to be addressed (Smith, 2005). In regards to digital innovation in cultural heritage, there seems to be a multi-dimensional perspective in measuring impact: technology, scientific, as well as economic, cultural, environmental and societal (Sanetra-Szeliga, 2015).

### *4.1. Short-term impact*

During a project's lifetime, a digital innovation can be evaluated in terms of technology uptake by its intended users. Aspects that can for example be measured in this context include interface design and accessibility. Scientific impact can also be measured, focusing on different domains spanning from ICT to Humanities and Social Sciences. To support the above, experiments can take place both in controlled conditions, as well as in the wild. Thus, during a project's lifetime it is important to adopt a holistic approach of evaluation, which

mixes qualitative and quantitative approaches, and respects the multi-dimensionality of cultural heritage innovation.

Specifically for EU projects, in addition to the evaluation metrics and techniques that have been pre-defined at the beginning of the project and usually have a strong scientific ground, it is also important to foresee room for flexible, creative and potentially less strict forms of evaluation. For example, new evaluation needs may emerge during the project, either from the users – in line with the bottom-up character of CH innovation – or driven by technology changes. It is alsoimportant to remember that evaluators are not only the officially assigned ones (e.g. a project's reviewers), but also future generations, who may have new criteria as times evolve.

### *4.2 Long-term impact*

In the long term, the weight of evaluation falls more on the economic, cultural, environmental and overall societal impact that digital CH innovation can have.

On the economic level, key criteria to measure include return-on-investment of the developed innovation, and regional competitiveness growth over time. On the cultural level, the impact of innovation can be measured in terms of the new contemporary forms of culture that it helps create, including the creation of new cultural images and symbols. Environmental impact can be measured in terms of the level of attractiveness that the digital CH innovation helped a specific region or city attain. It can also be measured through the boost of responsible tourism, awareness of environmental issues and the preservation of the cultural and natural environment that the innovation achieves. Finally yet importantly, societal impact needs to be measured for example in terms of social cohesion, degree of community participation, continuity of social life, new education and knowledge, sense of place and identity creation.

At this point, it is important to mention that measuring the long-term impact is not a straightforward task, especially given the specific timeframe of EU projects and actions. Nevertheless, finding a concrete and sustainable way to assess this is of outmost importance to society. A possible idea to realize the above is the development of an EC initiative for a common long-term impact assessment framework for digital CH.

## *5. Intellectual Property Rights (IPR)*

A potential blocking point in the road towards the sustainability and continuity of digital innovation for CH is related to IPR issues. It is very common for innovation technologies and tools to be created by a specific project or partnership, and then to remain inactive due to unsolved IPR issues or lack of knowledge in regards to IPR. Although certain industries, like the gaming or the music industry, have progressed in resolving such issues, this is not entirely the case for the domain of digital CH. An evident solution towards promoting reusability and avoiding "reinventing the wheel" is open access. Traditionally, open access has been viewed by the cultural heritage sector as a threat to innovation. However, this is not the case if appropriate business models are applied.

To promote technology reusability we suggest the creation of an Open Software Pilot for EU-funded projects on the digital CH domain, following the example of the recently started Open Data Pilot. The need for such an initiative is also in line with ethics obligations towards society, since EU and national projects are supported by public funds. A second way to support innovation technology reusability can be the development of an EU-wide repository for digital CH software artefacts, accompanied by proper documentation and manuals. Such a repository could be used by both publicly funded digital CH projects, as well as by private contributors, with the attribution of proper rights. It can thus serve as an EU-managed network connecting contributors and developers, speeding up innovation processes.

A final way of overcoming IPR issues is training, for example in the form of an online knowledge centre, which can help educate digital CH researchers and developers to choose the appropriate license for their artefacts.

## *6. Conclusion*

We summarized lessons learnt during the EYCH, driven by our interactions with multiple projects and research groups, meeting reports and research literature. Our analysis included the dimensions of digital innovation facilitators, evaluation for digital CH innovation, and IPR issues. It is our hope that this analysis will serve as a ground for further reflection and a fruitful dialogue between researchers, citizens, policy makers and stakeholders on the future directions of Digital Innovation for Cultural Heritage.

**Tab. 2:** Interaction with projects and research groups

| Name | Short Description | Link |
|---|---|---|
| ArchAIDE | EU H2020 project, targeting a new system for automatic recognition of archaeological pottery. | http://www.archaide.eu/ |
| ARCHES | EU H2020 project, aiming to create inclusive cultural environments for people with differences and difficulties. | https://www.arches-project.eu/ |
| Biennale of Western Balcans | Arts and culture institution, bringing intangible heritage and community values in the contemporary content. | https://bowb.org/ |
| ΓΑΒ LAB | Academic Lab and research group, examining the role of knowledge and uncertainty in the theory and application of information technology. | http://gav.uop.gr/ |
| CrossCult | EU H2020 project, empowering reuse of digital cultural heritage in context-aware crosscuts of European history. | https://www.crosscult.eu/ |
| EMOTIVE | EU H2020 project, using emotional storytelling to change the experience in heritage sites. | https://emotiveproject.eu/ |
| GIFT | EU H2020 project, exploring hybrid forms of museum experiences, merging the physical with the digital. | https://gifting.digital/ |
| HCI-VR Lab | Academic Lab and research group, supporting research and teaching in HCI-VR systems and applications. | http://hci-vr.dit.uop.gr/ |
| i-mare-culture | EU H2020 project, using VR and AR tools to raise awareness and access to European underwater cultural heritage. | https://imareculture.weebly.com/ |
| i-Media-Cities | EU H2020 project, using audio-visual content to allow search functions, information addition, etc. with the use of innovative tools. | https://imediacities.eu/IMC/ |
| Inception | EU H2020 project, realising innovation in 3D modelling of cultural heritage. | https://www.inception-project.eu/en |
| Intelligent Interaction | Academic Lab and research group, active in the cross-section of Intelligent Systems and HCI with applications in the Digital Cultural Heritage domain. | http://ii.ct.aegean.gr/ |
| meSCH | EU project, aiming at co-designing novel platforms for the creation of tangible exhibits at heritage sites. | http://www.mesch-project.eu/ |
| Kalamata 1821 | GR national project, studying and presenting unknown aspects from the Greek war for independence. | https://www.kalamata1821.com/ |
| NETMODE | Academic Lab and research group, which supports teaching & research in Internet Technologies - Distributed Network/System Management. | http://www.netmode.ntua.gr/main/ |
| PALIMPSEST | GR-IT Interreg project, aiming at developing open-air museum experiences in public spaces. | https://www.facebook.com/gritpalimpsest/ |
| PLUGGY | EU H2020 project, which creates a social platform bridging the gap in the creation of heritage communities. | https://www.pluggy-project.eu/ |
| POEM | EU H2020 project, which uses participatory memory practices for a socially inclusive European future. | https://www.poem-horizon.eu/ |
| Postdata | EU H2020 project, attempting to make poetry available online as machine-readable data. | http://postdata.linhd.uned.es/ |
| REACH | EU H2020 project, aims at creating tools and instruments to trigger debate on participatory approaches in common understanding in CH. | https://www.reach-culture.eu/project |
| RISE | Research centre, focusing on Interactive media, Smart systems and Emerging technologies aiming to become a centre of excellence empowering knowledge and technology transfer in Cyprus. | http://www.rise.org.cy/en-gb/ |
| SILKNOW | EU H2020 project, aiming at improving the understanding, conservation and dissemination of European silk heritage. | http://silknow.org/ |
| TRACE | EU H2020 project, aiming at sustainable urban mobility using ICT tracking technologies. | https://www.h2020-trace.eu/ |
| TROMPA | EU H2020 project, attempting to make public-domain digital music resources more accessible. | https://trompamusic.eu/ |
| ViMM | EU H2020 CSA project, aiming at bringing together organisations working on Virtual Museums. | https://www.vi-mm.eu/ |
| WhoLoDance | EU H2020 project, applying technologies to dance learning. | http://www.wholodance.eu/ |

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