



eCult Vision Paper

on the Use of Technologies for Cultural Heritage



Table of Contents

1	INTRODUCTION	3
1.1	AIMS AND BACKGROUND	4
1.2	STRUCTURE OF THE VISION PAPER	6
2	THE ECULTVALUE VISION	7
3	MAIN RECOMMENDATIONS	8
3.1	INSTITUTIONAL LEVEL	9
3.2	NATIONAL LEVEL	9
3.3	EU LEVEL.....	10
4	ANALYSIS OF RECOMMENDATIONS	11
4.1	DIALOGUE AND COLLABORATION	12
4.2	TECHNOLOGY STRATEGY	15
4.3	EDUCATED STAFF	18
4.4	FINANCIAL SUPPORT	20
4.5	TARGET AUDIENCE.....	23
4.6	TECHNOLOGICAL NEEDS.....	25
	COPYRIGHT AND DISCLAIMER	27

1 Introduction

1.1 Aims and background

The aim of the EU funded project eCultValue, is to encourage the use of new technologies that have the potential to revolutionize the way to access Cultural Heritage (CH) and offer enhanced experiences by cultural resources in real and virtual environments or a mix of both. In the previous two years (2013 and 2014) eCultValue has organized and participated in numerous workshops and events¹, has conducted face to face interviews with technology providers and CH stakeholders, and has operated a group of experts in the field, who provided advice and recommendations².

The “golden thread” of all these activities has been to promote the technology use by CH institutions, by showcasing concrete solutions developed through European funded efforts, to discuss about the needs and priorities that the CH and Information and Communication Technologies (ICT) communities have and, last but not least, to create a sustainable network of “Ambassadors”, who will further spread the word and act as enablers between ICT providers and CH stakeholders. This work has been accompanied by a number of deliverables and reports that captured the state of the art in Europe³, presented the views of mostly European stakeholders and technology providers⁴ and identified their needs⁵.

In the process of promotion or even adoption of the current technological solutions, it has been ascribed (by almost all CH stakeholders and technology providers we have discussed with) a particular importance to the role that policy makers on national or European level can play. To this end, it has been mentioned that there is often a little awareness about existing solutions and a scarce understanding of the developments in the area. This missing knowledge results either in the underestimation of the importance that related policies have, or in the drafting and proposing of policies that don’t really reflect the priorities and needs that the main “actors” in this process have.

¹ http://www.ecultobservatory.eu/ecult_events

² <http://www.ecultobservatory.eu/about/experts>

³ eCultValue D1.2 Stock taking Analysis Report

⁴ eCultValue D1.1 Interview Summary Report

⁵ eCultValue D1.3 Needs Analysis



Figure 1: Collection of input for Vision Paper

The objective of this vision paper is to identify and provide decision makers (on European, national, local or institutional level) with the important topics that need to be put in their future agendas. Our hope is that it can contribute to the shaping of a vision related to the adoption of ICT by Cultural Heritage institutions. In particular, we hope that it will help clarifying the why and the how of the ICT adoption, what could be the role of national agencies, what are the immediate steps that can be taken by the museums and finally highlight where investments (both, in terms of finances and effort) are necessary in order to increase the use of IT in the cultural heritage environments.

The starting point for our work has been the needs of the CH stakeholders and technology providers, as they have been captured through the activities described above. We analyzed this input and identified recurring patterns that lead to the categorization of the needs into a number of following main categories⁶:

1. Dialogue and Collaboration
2. Technology Strategy
3. Educated Staff
4. Financial Support
5. Target Audience
6. Technological needs

For each need we provide a mid-term prognosis and propose a list of concrete actions,

⁶ For a more thorough analysis of the needs please refer to the eCultValue deliverable D1.3 Needs Analysis

addressed to decision-makers and all other stakeholders involved (museums, public institutions, technology providers). Many of the actions we propose are cross-cutting and require a high level of collaboration between all parties involved.

1.2 Structure of the Vision Paper

In general this Vision Paper has by design a straightforward structure. After the short introduction about aims, rationale, and background, we provide the eCultValue vision for the CH and ICT collaboration. We then continue by highlighting the main action points / recommendations included in Chapters 4 - 9. This summary is followed by a concise and concrete list of proposed actions for the adoption of ICT in Cultural Heritage environments, based on the identified needs. For every need we first provide a short mid-term outlook and then continue with the proposed actions.

2 The eCultValue Vision

The **expectations** towards what Cultural Heritage Institutions should offer, are rising. In parallel Cultural Heritage Organizations find themselves in a **highly competitive environment**, where technology is part of our everyday life. If they want not only to survive but also to engage visitors and offer them enhanced experiences, they need to **include innovate aspects** in the way they present artefacts and attract visitors. Thus, **technology is not an option, but essential part of an integrated strategy** that should include **multiple layers and actors** of the **Cultural Heritage Ecosystem** (people, culture professionals, technology providers, policy makers).

3 Main Recommendations

3.1 Institutional level

- Act collectively and build partnerships that would allow stakeholders to take advantage of a common portal and enable networking on national level in a standardized way.
- Include the staff in the technology decision, encourage them to become engaged, involve them in all steps of the process;
- Hire at least one person with strong technological awareness, if not an ICT specialist to support the everyday and long term technological needs;
- Use the funding possibilities from the European Structural Funds;
- Consider crowd-funding;
- Make a "business plan". Museums need to valorize their (digital) assets in order to increase the potential benefit out of them;
- Survey visitors; analyze attendance data before and after the implementation of ICT.

3.2 National level

- Foster the clustering of regional / national public museums and cultural heritage institutions in proactive dialogue and collaboration with European clustering initiatives
- Evaluate the impact of the deployment of ICT solutions on access to the heritage assets, on education (both conventional and lifelong learning), and on tourism;
- Create a curriculum and training programs for emerging digital cultural heritage with the aim to educate mediators or ambassadors;
- Respect the categorization and prioritization of audiences, as made by the museums;
- Provide support, especially to smaller museums, to conduct visitor surveys

3.3 EU level

- Provide continuous support for the clustering of CH institutions at European level. Clustering plays an invaluable role in terms of supporting the opportunities of economies of scale and proactively offering common tools and services;
- Establish guidelines to help heritage institutions and collection decide which digital technologies they could implemented for which purposes and in which order;
- Create a curriculum and training programs for emerging digital cultural heritage with the aim to educate mediators or ambassadors;
- Provide support, especially to smaller museums, to conduct visitor surveys.
- Support the development of generic (but customizable) sub-platforms and applications clustered around Europeana. Support the role of Europeana as de facto technological standard setter in the CH area at European level;
- Support the design and development of tools that are created upon the principles of open-source and interoperability.

4 Analysis of Recommendations

4.1 Dialogue and collaboration

a. Current status and Future evolvement

There is still sometimes a scarce dialogue between CH stakeholders and ICT providers. Museums have been reluctant to enter the dialogue and take up new technologies, without careful assessment of all relevant costs. They include not only time, money for purchase of new solutions and licenses but also human resources and maintenance costs. Museums are looking for solutions which can clearly prove value for money and will provide them with relevant arguments for decision-makers. We are, however, observing a change of attitude in the recent years since the dilemma to use technologies or not almost disappeared and now the focus is how to find suitable solutions. That shift will become even more obvious in the next period. Museums are more open to enter this dialogue, as some early results are available and they realize the benefits that this collaboration includes for them. They can also better formulate their requirements, namely that they are looking for efficient and long-lasting solutions without hidden costs. Thus, initial difficulties will be much easier to be overcome, as ICT and CH can look back on several years of collaboration and are now in a position to better understand one another's needs and find a common language. Thus, building trust, making friendships and acting collectively will be also in the future essential for museums in addressing most practical needs concerning ICT and other resources, and help them take better strategic decisions.

b. Actions proposed/ Recommendations

Cultural Heritage Stakeholders and Museum Managers should:

- Act collectively and build partnerships (e.g. a community of ICT managers in CH institutions) that would allow stakeholders to take advantage of a common portal (see e.g. Estonians museums public portal) ensure economies of scales (e.g. NIMOZ's Centre of Excellence for Digitisation in Museums in Poland)⁷; and enable networking on national level in a standardized way.
- Look first what is close to you, in terms of geographical distance, language, and attitude;
- Spread and disseminate best-practices and success stories, but also examples of

⁷ Both examples presented at the 2nd Dialogue Day in Tallinn

failures. Learn from others' mistakes;

- Express and spread the needs and issues your institution has. Share problems and solutions;
- Build trust relationships with other institutions through targeted events, e.g. EMYA or Best in Heritage;
- Associate end-users (museum visitors) to your choices by allowing them to express their preferences ex ante and provide feedback ex post. The Living Labs concept could enable end-users to take actively part in the change processes, but also on-line engagement;
- Organize face-to-face meetings and events with ICT solution providers at which you can clarify your individual and collective needs, screen solutions and (potentially) engage into collective bargaining to obtain best value for money;
- Support ICT-related educational programs, seminars, tutorials in house;
- Encourage and take part in cross-community and cross-disciplinary conversation;
- Foster mentality of change by highlighting the benefits of ICT through concrete success stories;
- Look for analogies and potential synergies in other related fields such as Libraries and Archives, Tourism, Marketing, Creative Industries etc.;
- Be open! ICT are just another set of tools that you can use to achieve your goals.

European decision makers should:

- Provide continuous support for the clustering of CH institutions at European level. Clustering plays an invaluable role in terms of supporting the opportunities of economies of scale and proactively offering common tools and services;
- Consider funding projects at European level which add substantial value at European level and are geared towards clustering (around existing clustering points such as Europeana);
- Create a European Observatory to facilitate knowledge exchange and discussion.

Regional/National decision makers should:

- Foster the clustering of regional / national public museums and cultural heritage institutions in proactive dialogue and collaboration with European clustering initiatives
- Support the digitization and digital exploitation of CH content e.g. via national funds

or European funds (e.g. the European Structural & Investment Funds⁸-)

- Promote ways to turn research outcomes into new development opportunities for European business, for example through regional clusters of businesses in partnership with cultural institutions and universities, or through strategic partnership at European or international level in the area of new technologies and cultural heritage.
- Establish a central information system, beneficial for both – public and cultural institutions. The first group has an access to museums and their digital collections while museum professionals have efficient tool to manage and describe collections, generate statistics or implement conservation activities.
- Create National Observatories to facilitate knowledge exchange and discussion among the actors within the country.

⁸ http://ec.europa.eu/contracts_grants/funds_en.htm

4.2 Technology Strategy

a. Current Status and Future evolution

Adoption of ICT was in the past and still is a marginal aim for many museums and collections, due to the fact that the scarce available resources are used for storing original artefacts in proper conditions, for keeping the relevant documentation, for doing restorations, and for hiring the necessary staff to handle museum's activities from education to social engagement programmes. In this context, a general -European or national (in addition to the institutional)-, independent technology strategy is definitely needed. The lack of such a strategy means that CH institutions will continue to spend substantial sums for adopting and maintaining new technologies, and in many cases, without having a clear understanding as to whether this technology is the most suitable or beneficial option. Moreover, without a strategy, priorities for creation of digital materials will not be complementary and coherent between heritage institutions, neither suitable to be adopted according to European models for CH effective circulation (e.g. Europeana); and, of course, it will be impossible for funding agencies to prioritize the relative benefits of the proposals coming forward for support. The increased acceptance of novel technologies in CH environments nowadays also creates a new understanding about the necessity for and the central role of an ICT strategy within the heritage sector and for each institution separately.

b. Actions proposed / Recommendations

The technology strategy of the **CH organisations** has to:

- Be realistic, respect the capacity and capabilities that the museum has, and understand risks and limitations;
- Have a long term planning;
- Underline the necessity of generation turnover in the personnel of museums;
- Address different areas of museum work: a) collections (access to, research, exhibitions, documentation and collection management), b) preservation (conservation, restoration, maintenance), c) communication (education, social engagement, inclusive and participatory museum, entertainment and free time, marketing and PR activities); Museums have already developed an elaborate system of documentation divided into three groups (primary, secondary and tertiary documentation) and this field of museum work has been very willing to employ new technologies that can help organizing documents and information flow in a better way.

The technology strategy on **European level** has to:

- Support the consolidation of common digital online platforms (such as Europeana) providing a one-stop-shop focal point for the pooling, preservation, exploitation and valorization of digital cultural assets, a clustering environment for add-on services and – ideally – an “ecosystem” conducive to the emergence of a thriving applications (“apps”) market;
- Encourage the use of technologies, and identify best practices and standards that will produce consistent and interoperable digital resources;
- Establish guidelines to help heritage institutions and collection decide which digital technologies they could implemented for which purposes and in which order;
- Support the museums to participate in related research projects and disseminate and exploit the results;
- Enhance the synergy between projects creating digital resources;
- Give focus on the creation of an ICT manager’s network in museums, archives, libraries, and other cultural institutions which will link up with both technology suppliers and CH **stakeholders in order to draft applicable strategic models for museums**. Many technologies can be easily incorporated into the already existing goals of museums. The main and specific goals therefore can be incorporated into the present strategic plan or museum plan and in some larger institutions a separate strategy can be proposed.
- Provide continuous support for EUROPEANA as the European platform for cultural content. A one-stop-shop platform at European level is the only chance to ensure that European culture remains independent. While Europeana may partly fund itself from subscriptions, the provision of services, etc. its role as key infrastructure provider at European level should be supported through steady and reliable public funding. Europeana should be further developed to become the reference point for European cultural content. In the following years, should explore the opportunities of cloud computing, should add to its portal application platform, and main activities related to the digitization and preservation of Europe’s cultural heritage should be linked to the site. Furthermore, regarding the technical development of the site, particular attention should be given to multilingual aspects.
- Cluster European projects from different programmes e.g. in the area of data, multilingualism, tourism, etc. to create beneficial synergies for cultural heritage and its accessibility
- Encourage ICT adoption in new areas and institutions that have not received much attention thus far, such as small and decentralized museums, university museums, galleries, and private collections.

The technology strategy on **national level** has to:

- Encourage the use of technologies, and identify best practices and standards that will produce consistent and interoperable digital resources;
- Establish guidelines to help heritage institutions and collection decide which digital technologies they could implemented for which purposes and in which order;
- Support the museums to participate in related research projects and disseminate and exploit the results;
- Establish clear priorities for the adoption of ICT in the heritage sector in infrastructure creation, staff training, and research into the effective use of different technological tools;
- Promote the commercial exploitation of digital assets through the dissemination of the expected return on investment in heritage resources when created in digital form. Promote the uptake of ICT skills by human resources in museums and face the fact that many museums are suffering from a severe reduction, or even the loss of scientific and technical expertise;
- Evaluate the impact of the deployment of ICT solutions on access to the heritage assets, on education (both conventional and lifelong learning), and on tourism;
- Identify core areas of general needs and examples of best practice, in order for the ICT to be views by museums as a mechanism for developing the heritage resources for maximum public benefit.
- Encourage ICT adoption in new areas and institutions that have not received much attention thus far, such as small and decentralized museums, university museums, galleries, and private collections.

The revised strategy (institutional, national, European) should also take into account the new technological landscape (please refer to Chapter 4.6 Technological needs)

4.3 Educated Staff

a. Current Status and Future evolution

As technology is a way of everyday life, the adoption of ICT solutions in one way or another is a matter of survival for CH institutions. The institutions have currently to balance the needs and capacity of the human resources, including training of museum staff in new technologies. The best use of resources doesn't, however, necessarily mean that the curators / museum staff should be trained on all available technologies (e.g. how important is it that they learn 3D-scanning?). Undoubtedly, there is a lot of work that needs to be done in the area of training of museum professionals, as it has become obvious from the extremely varying quality of content submitted to Europeana.

Under this perspective, technology savvy staff must become part of the core staff of museums (also in terms of their capacity to weigh in on the decision making process). Big, successful museums (e.g., V&A) have added digital programs to their curricula, have the financial capacity to offer vocational training, and have specialized personnel to support and promote these activities. The creation of new jobs will certainly be influenced by the introduction of new technologies into museum work.

The question is how the process will be developed – by new profiles that will enter the museum sector as “outside” professions (some may be outsourced in that case) or the existing profiles of museum professionals will need to evolve in terms of acquiring new skills related to technologies.

b. Actions proposed / Recommendations

Managers of museums and institutions need to consider the following actions in order to support their technological needs in terms of human resources:

- Include the staff in the technology decision, encourage them to become engaged, involve them in all steps of the process;
- Hire at least one person with strong technological awareness, if not an ICT specialist to support the everyday and long term technological needs;
- Ensure that the technology savvy staff, will have not only the technical knowledge but also the understanding of the museums' mission and sensitivity towards the collections and their value;
- At the same time ensure that the non-technical staff, will have not only an understanding of the museums' mission and sensitivity towards the collections and

their value, but is also trained in the technical knowledge for their preservation, exploitation and valorization;

- Allow the ICT savvy staff to serve as a mediator between CH and external ICT experts and suppliers, in case of the museum's involvement in a larger project of ICT adoption. Museums and CH in general share some needs, however, each museum has its own profile, mission and also peculiarities. ICT savvy staff becomes a necessity for identifying the actual needs of the museums. They should be able to articulate the requirements and propose a list of potential ICT solutions;
- Support long term education of existing staff, organize tutorials and workshops in view of facilitating their acquisition of ICT skills and keep themselves up-to-date, in case the museum budget cannot afford extra personnel.
- Exploit the possibilities offered by Lifelong Learning Programmes carried out by the EU (also to accomplish the bullet above);
- The rapidly changing and increasing technological offer requires an almost constant training, in order for the museum staff to be up to date. Museum directors must carefully assess training needs in relation to capacities and museum priorities.
- If the level of technology awareness needed is far above the in-house capacities, the museum should consider to seek for alternatives and engage a commercial provider. This will certainly allow for a positive ratio between costs and results and will also ensure (in most cases!!) that the goal will be reached on time.

EU Regional/National decision- makers:

- Increase the educational offer in graduate and postgraduate courses in the field of CH and ICT;
- Create a curriculum and training programs for emerging digital cultural heritage with the aim to educate mediators or ambassadors;
- Support the creation of territorial ecosystems that will serve as knowledge hubs.
- Foster the co-creation of solutions between several actors, for more access and better learning experience of the emerging digital cultural heritage for the general public and especially the youth.

4.4 Financial Support

a. Current Status and Future evolvement

Despite the fact that many museums undergo digitization processes, only about 10% of Europe's cultural heritage is digitized⁹. Many countries have established national agencies whose main tasks are to plan and implement digitization projects in museums. Besides they also manage electronic inventories and set rules for thesaurus usage and promote multilingualism. Assets with intangible value have also real costs attached to them and digital preservation is an unfunded mandate for most memory institutions. Huge costs of large-scale projects reveal that money is today the major problem for the CH organizations and will continue to be in the future. The research conducted in Estonia for example showed that data volumes are increasing 60% annually; data storage is increasing 25% while data budgets are increasing 2% therefore not following the needs¹⁰. The fundamental question for decision-makers may be how to implement a preservation infrastructure for digital cultural heritage and help all relevant stakeholders to plan ahead and make right decisions related to digital preservation.

The decision makers have to realize that the steps taken now will be crucial for future. It is important to think about users but also about the preservation (storing space, maintenance, technical update) and enhancement of digital contents in order to find models affordable in the future. It is certainly a very important question and a complex task, how to keep all necessary activities within the realistic budgets.

Moreover, in recent years, the economic downturn has generated a drastic decrease in public and private financial support in the cultural heritage sector, especially when it comes to European museums. It is expected that this trend will not change in the near future. Taking this into consideration, as well as the multiple uses of museum funds –operating costs, art acquisitions, construction of new facilities, insurance and security, etc.– it is easy to understand that there is little or, in some cases, no funding available for ICT adoption and technical support. Museums also usually have very high infrastructural costs (mainly housed in protected historic buildings with high maintenance costs). Taking, however, into account the increased role of ICT in the museum collections, we can predict that the

⁹ Antoine Isaac, R&D Director of EUROPEANA at the LT Accelerate conference 5 December 2014, Brussels

¹⁰ Presented during the 2nd eCult Dialogue Day in Tallinn

structure of costs for museum activities will shift in the next years so as to correspond to the new needs. An additional problem that this evolution will bring and which has to be considered as well, will be the rise of ICT related costs of the museums, including higher expenditures for back-up services, digital content acquisition, regular updates etc.

Museums and other cultural content keepers have to create economy of scales when procuring technical solutions. It is not likely that a simple up-take of solutions from EU projects by museums will occur unless the question of scales is taken into consideration in a serious way and in consultations with national authorities.

b. Actions proposed / Recommendations

Museums and CH institutions should:

- Include in their technology strategy a part on financing so as to convey the message to public authorities, who usually fund them, that a museum generates new income;
- Use the funding possibilities from the European Structural Funds;
- Consider crowd-funding;
- Achieve economy of scales through shared services;
- Valorize and exploit their assets (notably through digital means which do not impinge on the preservation of the original objects) in view of raising their income;
- Make a "business plan", as much as this is sometimes against the common understanding that museums have of their collections, being "beyond economic value". Museums need to valorize their (digital) assets in order to increase the potential benefit out of them;
- Make their digital assets widely available through online platforms that are adequately equipped to optimize the return on investment (such platforms cannot be too numerous by nature – there might be space in the market for only a handful, hence the importance of reinforcing Europeana);
- Consider how they can be coupled with Living Labs in order to create territorial cultural entities to evaluate new models for the involvement of stakeholders and to stimulate new participation modalities.

Long-term strategic issues have to stand up against short-term proposals. **National, regional and / or European policy makers should:**

- Respond sufficiently to their funding obligations toward cultural organizations;
- Increase the percentage of Gross National Product assigned to museums and other cultural heritage, in particular when it is below the European average in order to

attain European standards;

- Increase, or at least maintain the resources for museums as permanent cultural institutions so that they can effectively adopt innovative tools;
- Promote citizens' participation in museum activities on a voluntary basis;
- Encourage donations and activities in favor of museums and cultural heritage by means of tax relief.

4.5 Target audience

a. Future evolvement

Audiences are an important element, the *raison d'être* of museums. But audiences are not homogeneous. They comprise sub-groups of individuals who display similar needs, characteristics, behaviors, motivations and attitudes. Museums have understood that attempting to attract members of all these groups at the same time and through the same activity is unrealistic.

Moreover, due to the digital growth, the communication within the sector and with different audiences has become almost instantaneous, particularly with virtual, mobile and interactive applications. This speed of creation and implementation of digital developments can often be seen by museums as “moving too fast” or as putting on museum professionals additional ‘things’ which may not be needed. Museum organizations feel urged to use digital media but at the same time they would seek reliable and professional technologies and services. The institutional collaboration related to initiatives which are creating contents accessible to wider audiences and specific groups of users are crucial in making further developments in the field. Quality and relevance are key words when cultural heritage institutions establish a platform for access to cultural content by multiple users either in a national or in international community.

In the near future cultural organizations will try even more to satisfy the different sub-groups, by further addressing needs of each target group and adequately segmenting their marketing functions. Implemented tools will be more user -and visitor-centered. Their aim will be that visitors appreciate the experiences on offer and return more often as a result.

b. Actions proposed / Recommendations

In this context, every CH organization should build a concrete strategic communication plan in order to identify who it must serve to achieve its mission regarding the adoption of ICT. **Museums** should go about this in many ways and on a constant basis, with clear focus on the following:

- Identifying primary, secondary, and emerging audiences;
- Surveying visitors; analysing attendance data before and after the implementation of ICT; and sometimes conducting audience research; if not possible to conduct an in-house survey, use results of national ones;
- Describing the audience as a whole in a meaningful way and clarifying how the

technology will meet and cover the needs of the various segments of the audience. This should be easy by stating the museum's purpose, the usability of each technology solution that is to be adopted and, of course, the targeted audiences. Therefore, it is very important to identify smaller groups, and then prioritize them so as to make the right choice in the adoption of ICT and to achieve the optimal results;

- Evolving the models of engagement with audience and visitors;
- Using museum resources –staff time and expertise, museum spaces, and information on and from the audience– to maximize the possibility of effectively serving those who will most use and benefit from the use of ICT tools.
- Encourage communication across disciplines, the context and environment in which new solutions are used by re-contextualizing information, making it more accessible for various users.

Policy makers should:

- Respect the categorization and prioritization of audiences, as made by the museums;
- Provide support, especially to smaller museums, to conduct visitor surveys.
- Draft policies that encourage technological solutions that increase participation of disabled persons and their access to CH sites.

4.6 Technological needs

a. Current Status and Future evolution

To a large extent the tendency is to leave behind custom-made, expensive and ad-hoc solutions, and move towards generic (but customizable) platforms, and applications where each museum or institution can easily access and manage its own content. Robust centralized e-infrastructures, and core technologies, such as repositories and cloud-based ICT can and must function as a spine for the support of CH technological needs. Last but not least, as ICT will serve the role of attracting and engaging a larger and wider audience for the museums, a big deal of ICT for CH research will even more focus on user-centered design, personalization and ICT for supporting the interaction with and engagement of the end-users and visitors. One of the hot questions is how to balance interoperability and re-use of software with satisfying the needs of a wide range of users from scientists and CH experts to different (age) categories of everyday CH users.

At the same time the pace of technologies opens new possibilities for museums like multisensory experiences which are considered to be one of the current trends in culture, tourism and other fields. Museums may be affected with this technological advancement by higher-expectations from the visitors – once they tried the multisensory approach they would expect them in museums, too. On the other hand technology providers are being more and more aware of those new demands and offer new products for museums and cultural sector in general.

b. Actions proposed/ Recommendations

CH Technology providers and decision makers (both public and private) should encourage investigation of the following technological topics, in order to deliver high quality, flexible and sustainable ICT solutions meeting the needs of CH collections and institutions:

- Big-data solutions customized for the growing amount of CH related data;
- Mobility and communication technologies (Smartphones, Tablets, RFID, i-Beacons, GPS) as museums and CH sites need technology solutions and tools that are agile and flexible;
- Cloud based ICT supporting repositories and large-scale infrastructures;
- 3D technologies (digitization, scanning, printing, modeling and semantic description);
- Virtual Reality and Augmented Reality, as they are key technologies for supporting

all of scientific, educational, but also entertainment applications related to archaeological monuments and objects;

- Site experiences – immersive rooms, multimedia renderings of lost spaces, etc.;
- Content management platforms with usable interfaces (APIs), for a wide range of user groups, contexts, and objectives;
- Engaging and motivating interfaces facilitating multi-modal interaction for a variety of visitors;
- Links with education – learning outside museums, e-workbooks ; interactive on-line knowledge check-ups;
- Interactive games based on collections;
- Methodologies for supporting searchability and presentation of the content;
- Technological development in accessibility and inclusivity;
- Crowd-sourcing methodologies and tools;
- User-centered design, adaptivity and personalization;
- Metadata standards, linked data and semantic technologies;
- Language technologies, automated translation and localization – not just into a few, but into the widest set of languages (including non-European languages) to facilitate the exploitation and valorization of CH digital assets online in a global context;
- Computational creativity (e.g., digital story –telling) and interdisciplinary research.
- Finally, it is of great importance that technological solutions should be compatible with specific museum profiles and needs. In many cases solutions are established in other sectors and migrated “as is” into offers for museums – this trend should be modified and museum professionals should be involved in the process at earlier stage – or should even attempt to steer this process through better collective organization and systematic interaction with the technology suppliers.

EU decision-makers should:

- Support the development of generic (but customizable) sub-platforms and applications clustered around Europeana as the central platform allowing CH institutions to pool, manage and exploit their content individually and jointly. Support the role of Europeana as de facto technological standard setter in the CH area at European level;
- Consider the wide range of aforementioned technological tools and related issues and support R & D funds in these fields;
- Support the design and development of tools that are created upon the principles of open-source and interoperability;
- Support the design of flexible and usable interfaces for CH, possible to be customized according to the needs that CH organizations have.

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