



The ViMM Manifesto for Digital Cultural Heritage – Introduction

ViMM is a Coordination and Support Action, funded under the European Union (EU) Horizon 2020 programme from 2016-19 in order to define and support high quality policies, strategic and day-to day decision making, the utilisation of breakthrough technological developments and to nurture an evidence-based view of growth and development impacted by Digital Cultural Heritage (DCH) and virtual museums (VM) in particular. All the results of ViMM are visible on its platform www.vi-mm.eu.

The ViMM Manifesto is directed towards strategic decision makers, funding bodies, institutions, practitioners and industries in the Cultural Heritage sector who share a common interest in the digital future and who need to act in concert. The document should be read as the first stage in a process of stimulating policy, investment and action by all of these parties in order to secure the most fruitful and rewarding future possible for Digital Cultural Heritage. By defining and creating widespread awareness, understandings and support, based on common principles and evidence in relation to the development and goals of DCH/VM. ViMM seeks to pave the way for rapid growth in its implementation, accessibility and use across Europe. It is our belief that a high impact and systematic programme of EU intervention in this sector, similar to that embarked on for the environment and other key sectors, is needed in order to pave the way for rapid growth in the implementation, accessibility and impact of DCH. Whilst some of the content of the Manifesto has a more permanent relevance, ViMM is looking in particular to the period 2021-25.

This process involves the publication and validation by March 2019 of a series of three inter-related documents– a Manifesto, a Roadmap and an Action Plan - of which this is the first. These are defined as follows:

MANIFESTO: a published verbal declaration of the intentions, motives, or views of the issuer.

ROADMAP: a plan or guide to show how something is arranged or can be accomplished, indicating priorities.

ACTION PLAN: a document that lists what steps must be taken in order to achieve a specific goal. The purpose of an action plan is to clarify what resources are required to reach the goal, formulate a timeline for when specific tasks need to be completed and determine what resources are required.

The work of ViMM is founded on building a consensual framework directly involving DCH decision-makers and practitioners in defining and resolving existing issues spread across 7 interlinked Thematic Areas (TA): *Definitions – Directions – Documentation – Dimensions – Demand- Discovery – Decisions*. Within this framework, during 2017, 21 Working Groups deliberated over a period of 9 months on a set of defined topics. The resulting 48 'Propositions' were then discussed in depth and refined at a two-day Consensus meeting in Berlin during April 2018, leading to their subsequent synthesis into the ten areas which form this Manifesto. An initial draft of the Manifesto was given wide circulation through the ViMM Platform, social media, advisory board and professional networks during May and June 2018. An impressively high number of substantive contributions was received towards its improvement.

The current document is the result of this intensive process. It links together ten key areas in which there is a clear need for further activity to secure the benefits of DCH. These involve: positioning the DCH sector; improving audience participation; harnessing technologies; incentivising funding; opening up; giving the whole picture; powering contextualisation; frameworks and standards; driving organisational change; and developing the human resource.



The ViMM Manifesto for Digital Cultural Heritage

We, the ViMM Coordination and Support Action and its wide interdisciplinary community of experts and advisors¹, believe that the following ten areas require attention and action by all interested parties in the near future in order to secure our vision for the potential social and economic benefits of Digital Cultural Heritage in the years to come.

1. Positioning the DCH sector

Cultureⁱ is increasingly a precondition of all kinds of economic and social value generation, a process driven by two concurrent streams of innovation: digital content production and digital connectivity. It is critical to Europe's economy and society that the significance of Digital Cultural Heritage (DCH) in general, and virtual museums (VM) in particular, is described and well understood, to ensure that this heritage benefits from necessary investment and sustained funding at the EU, national, regional and local levels.

Culture - and the heritageⁱⁱ which derives from it - are economic and social assets. The ideas defined for Culture 3.0ⁱⁱⁱ have identified key links with innovation, welfare, sustainability, social cohesion, new entrepreneurship, soft power, local identity and the knowledge economy. Policies are needed leading to initiatives which gain maximum effect, bringing the potential further into the public domain and moving to a system-wide competitiveness strategy through strategic investment.

Society is increasingly dependent on and driven by digital technology: Cultural Heritage Institutions (CHI) must adapt and become engaged with this development. Therefore, clear and tangible policies are needed from governments and managements of CHI. The conceptualisation of VM, as promoted by ViMM^{iv}, should be further developed to generate relevant policies towards research, education^v, tourism and other key sectors. stimulate investment and inspire novel implementations. Platforms are needed not only to focus on information about and dissemination of cultural heritage but also to contribute to its conservation and safeguarding.

Synergies between EU policies, in the light of the Council Conclusions on the need to bring cultural heritage to the fore across policies in the EU^{vi}, the Commission proposals for a New European Agenda for Culture^{vii}, relevant documents of the European Parliament Think Tank^{viii} on the one hand, and the strategies for DCH of key international organisations and leading players in the CH field (listed on the ViMM Platform) such as UNESCO's Sustainable Development Goals (SDG)^{ix}, on the other hand, should be leveraged and coordinated for maximum advantage.

We believe that the relationship between 'virtual and digital heritage' and 'real heritage' (tangible or intangible) should be strengthened rather than dissociated. Clarification is also needed to understand the potential for inherent ephemerality of documents and platforms directly produced via digital media, often without concern for preservation, which may significantly affect the future of social memory, institutions and communities. The relevant EU institutions, UNESCO and other related international organisations should agree common definitions in this area.

¹ A list of Experts contributing to the Manifesto process can be seen at <https://www.vi-mm.eu/vimm-experts/>

In order to improve cost/impact efficiency and achieve greater sustainability, effective operational and business planning is needed. An important gap can be identified between investments in implementation of digital projects on the one hand and ‘backbone’ or infrastructural actions, on the other. The role of digital initiatives in supporting rather than threatening ‘physical heritage’ should be widely understood.

Within this proposal for coordination, we recognise the significance of such recent strategic documents (together with the bodies responsible) as:

- the ICOM New Strategic Plan 2016 - 2022^x.
- the ICOMOS future strategic plan: The World Heritage List: Filling the gaps - an action plan for the future^{xi}.
- The Action Plan 2015-2017 - Network of European Museum Organisation^{xii}
- Council of Europe Strategy for the 21st Century, based on the Recommendation of the Committee of Ministers to member States, 2017^{xiii}.
- on the European Cultural Heritage Strategy for the 21st century (CM/Rec(2017)1) Adopted by the Committee of Ministers on 22 February 2017.
- ‘A Call to Culture’: Europeana 2020 strategic update^{xiv}.
- the Strategy for the Reinforcement of UNESCO’s Action for the Protection of Culture and the Promotion of Cultural Pluralism in the Event of Armed Conflict^{xv}.
- The Berlin Call for Action: Cultural Heritage for the Future of Europe^{xvi}, resulting from the European Year of Cultural Heritage summit, June 2018.

Likewise, we acknowledge the large body of cultural heritage research and development carried out within the EU Research Framework and in other programmes^{xvii}. This has promoted the creation, study and preservation of reliable and sustainable virtual cultural heritage. Major outputs include charters, standards, good practice guides and other resources.

2. Improving audience participation

It is important that citizens are not restricted to being consumers of DCH, but that they should be enabled to participate actively and to develop a sense of ownership of their cultural assets, not least within research and innovation projects and pilots involving co-creation and co-design.

We identify a clear need to identify and classify in more depth the target audiences who can benefit from DCH, in order that well adapted products can be provided. A sustainable future for DCH will benefit greatly from a wide sense of involvement and ownership of cultural assets by the communities concerned^{xviii}. As DCH initiatives apply global strategies, steps should be taken to increase the potential social and economic benefits by involving the entire education system, starting from elementary schools, including minorities, increasing accessibility and engaging local enterprises in product promotion and open content.

By focusing on interaction and conceptual design, virtual multimodal museums and other CHI will be able to offer diversified, collaborative, tailored experiences and novel exhibition design concepts that adapt to the different needs of audiences and stakeholders, including the public, students, curators and museum decision makers, researchers, technical specialists, partner organisations and other industries.

Graphics and interactive design are implemented into digital technologies in many different ways and exist in different forms, but their main importance is for user experience and user involvement, thereby creating interest in further digital discoveries. The best user experiences

in CH are those created with a combination of virtual and real worlds, incorporating knowledge of the past: the storytelling behind this is of immense importance. Without a stimulating and motivating story, the experience is not successful.

In line with the Culture 3.0 concept and in order to better serve its audiences and to maximise efficiency of economic and social efforts, the DCH community needs to shift towards participatory design strategies and a collaborative approach e.g. by enhancing on-site, technology-oriented museums as high-technological CH spaces: domes, deep spaces, immersive environments etc. with user-oriented perspectives, such as:

- providing the option to design individual tours, offering tools to better understand CH objects through Artificial Intelligence (AI) and/or Augmented Reality (AR), superimposing a virtual world onto the physical one or guiding users with interactive real-time maps
- interactive user experiences on the internet from anywhere in the world - sharing CH experiences with social community networks. This involves mapping social needs and goals and considering innovation not only as the creation of new technology but also as the novel use of existing technology.

In this respect, we believe it is important that European Commission (EC) and other programmes and projects carry out evaluations which study feedback on issues such as: audience appreciation, understandability and usability of technology applications; their impact on participation and revenues; and that they assess and verify the future expectations of audiences compared with those of professionals and curators.

3. Harnessing technologies

In common with other key social and economic sectors, rapidly emerging technologies will have increasing relevance for the Cultural Heritage Institutions (CHI) which preserve Cultural Heritage. These are likely to include: artificial intelligence; computer vision; deep learning / machine learning; cloud computing, complex big data and adaptive cognitive methods^{xix}. It is important that CHI are aware of and informed about technologies which become available to support their requirements in order to plan and design new DCH applications to support their requirements.

New XR (Extended Reality)^{xx} technologies in combination with AI offer more opportunities to interpret and visualise elements of history such as wall paintings and mural decoration, making it possible to assimilate more elements about the history of the specific monument/exhibit, for instance its shape, colour, materials, constructive elements and more. Widely-used platforms such as iOS and Android platforms continually offer greater capabilities for devices to exploit

To this end, the use and success rates of technologies, for example: high speed, realistic 3D models, Virtual Reality, Augmented Reality, and use of devices should be tested and documented systematically within EU and other funding programmes. Success may be defined in terms of the contribution of each technology involved in a CH application, for instance: whether computer vision really contributed in image recognition or whether the AI of a virtual 3D character really contributed to making that character look more realistic, judging from user responses. Comparative analysis of different technologies should be carried out beforehand as a prelude to supporting further development for CH applications. EU research programmes would be a natural and effective home for this type of work.

CHI and everyone involved in handling, exploitation, research and valorisation of DCH should be made aware of the usefulness of XR technology that can support their internal and external



processes, not only by extending existing formats, but also by exploring new ways of presenting cultural content and contributing to standardisation. This should not compete with but extend institutional capabilities, beyond the limitations of material reality, as they relate to e-exhibits, infrastructure and users. This requires the readiness of museums and other CHI to embrace and use them. We believe that the general public will only accept XR in the context of CHI, if this technology is smart and easy to use, adds value to the personal experience and matches the visitor's expectation regarding performance.

CHI (representing the tangible part) often deal with a very large number of three-dimensional objects, e.g. It is impossible for archaeological museums with millions of pieces to document each single fragment manually. Automated information extraction on a massive scale with the support of AI is needed to enable mass digitisation. The next generation of AI systems may be enabling technology for this, especially as more data becomes available. This is an area of investigation and future investment. Therefore, new novel, smart immersive environments are required that enhance interaction between human and machine activity, together with efficient interfaces for semantic tagging by humans.

4. Incentivising funding

While there is an apparent demand for DCH in general (although work to obtain solid evidence of this should be strengthened within the framework of European and national funding), there is sense that resources are lacking for its creation, management and promotion and also great imbalances between institutions in relation to their scale, legal statutes, location, and content. This need, however, remains largely unquantified and we believe that further study is needed at institutional, regional, national and Pan-European level to ascertain its extent.

In order to address financial shortfalls and imbalances, policies for the incentivisation of funding from both public and private sources may need to be developed, including a mixture of direct public subsidies, tax incentives and encouragements for private funding, sponsor visibility, crowdfunding and other fundraising initiatives. The adoption of efficient low-cost techniques, where available, will remain important.

We believe that the EU, in cooperation with international heritage organizations should play a strong role in co-ordinating and promoting the means of funding for DCH, through its museums and CHI – including funding key initiatives directly - as a vital ingredient in Europe's economic prosperity and social cohesion. Collective investments on an EU-wide scale are likely to be needed in new technologies, since few individual institutions could make them on their own. The EU should consider promoting inclusive technology that can assist the delivery of DCH through targeted co-funding with private sector, local and national funds, supporting the, still costly, technology for XR experiences and for (cloud-based) infrastructural upgrades which address interoperability problem and provide economies of scale.

Advances must not be limited to larger institutions which already have greater resources and opportunities for grant-capture. The much larger number of smaller institutions, which have a high impact on local communities and their economies, often have difficulty in securing expertise or funding for innovation. Such institutions can be seen as the SMEs of the cultural heritage sector: the realisation of their full potential can be substantially assisted through targeted new EU, regional and national initiatives.

5. Opening up DCH

We hold that museums and other CHI should be open-minded, working together with a variety of creative producers, to provide virtual applications and products that promote cultural heritage beyond the limitations of a physical museum or site. Greater openness to partnerships (especially with industry) is an important pre-requisite and a challenge for future progress. The heritage sector (including its policy makers) should collaborate more as part of the broader cultural sector with professionals such as architects, engineers, designers and photographers to reach out to the public and ensure that creativity from the past continues to be used in the future. To achieve this, both content and software should be under free licenses (open source) to ensure that others can easily (re-)use it, thus creating potential for commercial derivation.

Museums should open their doors to the outside world to offer meaningful narratives for collections and displays and story-led interpretation within VM/DCH and address the fundamental issues required to make this happen e.g. workable frameworks for image rights and the ability of museums to support new smart technology.

The EU should give further impetus through its policies, funding programmes and initiatives (such as the EYCH2018) to the Open Culture movement, promoted e.g. by Europeana. Further support should be given to the wider adoption of Open Access policies and frameworks for digital data (e.g. Creative Commons, The EU Directive on Public Sector Information^{xxi}), Open Source infrastructure for digital content management and Open Frameworks for object visualisation and dissemination. Within this overall approach, accessibility should remain in focus and the provisions of European web accessibility legislation^{xxii} adopted and promoted by the sector as a whole.

For achieving sustainability, digital cultural information should be based on internationally recognised open formats and metadata standards, such as the ones provided by the Europeana Service, supporting long-term availability. It is strongly recommended that CHI make their data available through open licence, taking into account all the relative EU recommendations and directives (such as those on PSI, orphan works, copyrights, etc.).

It is important to consider the use of open source software tools and standardised cloud-based solutions as a first priority in order to ensure long-term usability of the material created, promoting public availability of open source authoring tools for Cultural Heritage assets. Such an approach will enhance the benefits to creative industries and strengthen developments such as Citizen Science, Crowdsourcing and Open Science.

For this, both content and software should be under clearly stated licenses so that everyone who wants to re-use some information can address the rights owner a secure access (either for free or by payment), thus creating potential for both commercial and non-commercial derivation. Working in an open way will ensure better possibilities for fundraising since value is transparent. It will also increase the opportunity to increase public engagement, crowdsourcing and create other benefits for institutions.

6. Giving the whole picture: digitisation, data, documentation, semantics

Over the past two decades, digitisation of Cultural Heritage has happened in a fragmented way, following different kinds of standards. Currently, only 15% of cultural heritage resources held by CHI have been digitised^{xxiii} and much of that which is, is not freely accessible or suitable for current re-use. The proportion of DCH items in European CHI to which descriptive metadata has been applied is around 50%^{xxiv}.



Digitisation should scale using current globally accepted standards: mass digitisation, also of 3D objects, will provide a strong basis for implementing many of the other points in this Manifesto. As a flagship EU initiative, Europeana should extend its role as the central platform for digital cultural heritage, incrementally increasing the amount and quality of 3D, interactive animations and Extended Reality (XR) content. If necessary to enable Europeana to adapt to this approach, one or more interim solutions to storing and preserving content in these DCH formats should be identified or established with EC funding support, ensuring longer-term compatibility with Europeana.

Following the recent environmental and man-made destruction of CH, the EU needs urgently a strategic action plan, agreed by its member states, for massive high-quality 3D digitisation, documentation and availability in the Cloud of museums and sites.

Increased awareness and acceptance of the “Digital Turn” and the primary importance of data, especially structured and harmonised data, is central to the future of DCH, given the heterogeneous nature of its data, contents and formats are heterogeneous (3D/2D, textual, audio, video, multilingual). Therefore, quality standards such as the FAIR (Findable, Accessible, Interoperable, and Reusable) data principles^{xxv} need to be prioritized in order to achieve an excellent level of integration, enrichment, retrieval and reuse of content. Standardizing DCH data and metadata will help secure interoperability and interconnection to geo-spatial, bibliographic and archival metadata thus offering a more holistic approach to cultural information, which should be supported by the opening of channels with international standards bodies (such as CEN).

Linked (Open) Data (LOD) performs a critical role in transforming cultural heritage collections. LOD requires semantics – ontologies^{xxvi}, standardised controlled vocabularies, thesauri/authority files - and mapping models, and its impact is improved by contextualization of the material. There is a critical need to develop shared LOD frameworks covering the core concepts relevant to cultural heritage: such as people, organisations, [historical] places, and events. Europeana, major cultural heritage institutions/organisations, education and research institutions can play an important role in developing, promoting and implementing such shared frameworks in collaboration with key research infrastructures such as: Digital Research Infrastructure for the Arts and Humanities (DARIAH)^{xxvii} European Research Infrastructure for Language Resources and Technology (CLARIN)^{xxviii}

Management of cultural information is challenged by issues such as knowledge representation and information integration from different contexts. There is a need to establish and support expert-driven methodologies for managing holistic and user-oriented documentation of DCH in order to increase the scientific, economic and social potential of advanced services to users. Complex data structures from cultural heritage data can be an important and revealing source for big data analytics and the recovery of knowledge.

Many, especially older, cultural heritage objects are only partially preserved. The missing parts are then reconstructed while building 3D-objects. For scientific purposes each reconstructed part needs to be not only identifiable, but also holistically documented as to how the reconstruction was conducted and why the part has the actual dimensions, materials, actual colour, artistic outlook, etc. This holds true especially when elements of intangible heritage are incorporated into virtual reconstructions, such as in Historic Buildings Information Modelling (HBIM) systems^{xxix}. There remains a need to distinguish the ‘fictional’ and the scientific in virtual models, drawing on principles established in the London^{xxx} and Seville^{xxxi}



Charters and by ICOMOS^{xxxii} : Each tangible object has a story to tell and represents an important part of human memory.

A vast amount of cultural assets, highly valuable for historical research, are now 'born digital'. Private born-digital archives held by CHI create a need for further research to define authenticity and for intensive curation, quality standards, policies for long-term preservation, access rights and a code of ethics. The EU should develop a new pan-European strategic plan for the sustainable future preservation of this content.

Personal Digital Archives represent the largest stream of born digital cultural content creation globally, through the recording activities of individuals using smart devices and social media. The management and preservation of the vast amount of all the content created by these means represents a daunting and practically impossible task. Despite this, many specific endeavours to archive, curate and make available certain types of cultural content exist, for instance through, family history projects, community photo preservation, oral history, community-based history, thematic crowdsourcing and event archiving. The dissemination of best practices in this important area can play a vital role in diffusing DCH widely and in engaging audience participation.

7. Powering contextualisation

Reusability of DCH means putting it into a specific context to create a meaning for the user. In our view, substantial further momentum is needed to ensure that everyone involved in creating virtual objects provides sufficient contextual information about them. DCH projects, such as those funded under EU programmes, should emphasise the historical and cultural background context of what they are presenting. Improving contextualisation will have an important bearing on policy, research, innovation and education

The reusability of digital cultural material depends not only on the quality of the visual representation of its physical counterpart, but also on the metadata and the related story and knowledge associated with it. Therefore, rich metadata regarding content, technical or administrative information is an essential accompaniment to the digital cultural asset, supporting the current and future use of DCH. For example, many 3D models created in the past are difficult to understand and allow limited meaningful insights, due to lack of associated metadata and/or may be obsolete on format, technical or aesthetic grounds.

Pan-European and International Standards and methodologies should be followed or initiated, and sufficient relevant metadata provided, whenever possible, for a range of different contexts. In some areas, such as 3D and Intangible Heritage, standards are still lacking, and their development should be supported through CEN and other standards bodies.

Storytelling is an important example of contextualisation and is one of the key methods for CHI to communicate content to the broad public. 3D, AI and XR technologies provide environments with their own possibilities (such as immersive storytelling) to tell stories of cultural heritage both tangible and intangible, which should continue to be explored and exploited. They offer opportunities, with the support of smartphone/tablets and other personal devices, to personalise, engage, teach and involve. CH storytelling will be an important part of digital/virtual exhibitions which transmit both tangible and intangible cultural heritage. Immersive storytelling through XR playful learning (learning through story, play and interaction) in cultural heritage experiences is an important objective. New areas of creating and representing meaning, in order to provide for personalised experience should be explored along with increased interaction through research programmes and commercial development.

Presence can be defined as a psychological perception of being immersed in the AI and XR environments and is essential for engagement and cognitive connection to the content. This involves high quality and authentic/certified content, which is relevant and coherent in terms of social and cultural factors, including aspects such as cultural values, recognition and significance, representation of emotional intelligence, semantic time, space, provenance and uncertainty and emotion-based user interfaces.

Methods of visualisation based on new technologies should also be exploited. It is essential to visualize the information that will be presented (e.g. for the 3D model of a monument, rather than offering only text), since this makes the whole experience more interesting and exciting. The visualization of the acquired information is in many ways the most important activity, since it is the one which is transferred to and perceived by the user. Visualisation contexts must be based on the newest technologies, in order to be able to provide innovative features which meet user expectations. Methods of visualisation based on new technologies should be exploited by developers to create innovative applications for different platforms and devices that will make museum experiences more interesting for the visitors and also contribute to the preservation of Cultural Heritage. Easy-to-use instruments should be developed to support the integration of new technologies in digital exhibitions and other storytelling applications, amplifying open innovation through methods such as co-creation.

The purpose of a holistic 3D world is to simulate an environment and be able to transfer a person to this environment in the most realistic way. For that reason, interaction with any kind of human being, in any language and with any aspect of the environment are important features which can allow richer and more informative educational experiences. Ancient language, for example, can help people understand ancient civilization, traditions and their culture in a more 'alive' way.

The integration of sensory aspects as touch, smell and sound makes the final simulation more realistic, for example causing users to touch a screen and/or speak to the microphone of the device to interact with the 3D world and adding features that at present do not exist in 3D experiences and consequently fall short of being fully multidimensional.

Gamification is a feedback loop that incentivises the user to progress in the experience or learning process. We believe that care should be taken to use gamification elements judiciously so as not to overpower the story or learning objective. To sharpen their successful use, gamification techniques should be mapped to their emotional results achieved to provide further high-quality information for the purpose and outcome of the game. For example, face simulation needed in an application can be better performed if not only geometrical content is provided but also emotional semantic information. If an application creates emotional results of intense joy and vigilance, the gamification elements for this application should include user requirements of high speed (e.g. time-based tasks). Conversely, if an application creates emotional results of tranquillity or nostalgia, the gamification elements for this application should include user requirements of knowledge or being observant (e.g. quiz or object finding tasks). In general, gamification elements must follow the flow of the presented story, in order to sharpen their successful use.

8. Frameworks and standards: a navigable map

More powerful, intelligent and interconnected standards are required that can be used across domains, creating open and standardised formats, based on ontologies, that are interoperable in different systems and disciplines. More powerful, intelligent and interconnected standards



are required that can be used across domains. Open formats, based on ontologies, that are interoperable in different systems and disciplines should be encouraged.

Emerging open interoperable frameworks and standards which support, create and share DCH such as the International Image Interoperability Framework (IIIF)^{xxxiii}, Copernicus for Cultural Heritage^{xxxiv} and others, should be promoted and fast-tracked. However, current standards should be preserved and continuity through backward-compatibility thus sustained. It may be useful for the DCH community to become more involved the decisions of standards bodies such as the Worldwide Web Consortium (WC3)^{xxxv}, International Standards Organisation ISO^{xxxvi} and the European Committee for Standardization (CEN)^{xxxvii} in order to better informed and consulted about key changes and the emergence of important standards.

Standards need to be agreed internationally, so that digitised content (tangible and – especially - intangible) and the related metadata becomes seamlessly accessible in the long term to all. Metadata may include access to complementary material such as images, books, descriptions and drawings, illustrating the cultural and historic significance of the sites or artefacts. The EU, in cooperation with International organisations/institutions and key academia and research bodies should agree a pan-European action plan with a realistic time frame for the development of standards.

We also believe that an ethical framework of ‘virtual values’ is needed to underpin DCH strategies and development, and to provide museum-staff with a comprehensible direction for the museum’s approach to virtual and augmented content. The Virtual Values identified by ViMM include: “Virtual for all” Rule; Layered Content; Accessibility, Sustainability, Complementarity, and Data Protection/Digital Privacy. In the last of these contexts, attention should be paid to applicable privacy requirements of the General Data Protection Regulation (GDPR). These values not only affect the originality, the trustworthiness and the innovation of each DCH project, but also protect people’s privacy. An ethical framework is needed for DCH projects which combines all of these aspects.

9. Driving organisational change

All of the foregoing entails the full engagement of the cultural heritage sector in a generational switch towards a process of Digital Transformation which supports and conforms with other EU modernisation policies e.g. in the environment sector^{xxxviii}. In many cases, there needs to be organisational change in order to be able to make the most of modern technology. CHI departments should incorporate technology solutions within their day-to-day responsibilities.

Managements of CHI, which frequently depend on public administrations and need to convince the agencies which govern them, should prioritise digital transformation and lead organisational change, cooperating in a shared digitisation process. This should be reinforced by a common pan-European strategy which tackles interoperability problems, creates workable frameworks for rights and strengthens the ability of CHI to support new technology.

The vision for technology take-up should be mapped to the institution’s mission so as not to miss out on opportunities, entailing a regular assessment of organisational ‘readiness’ for DCH. Training, accessibility, sustainability and interoperability should be among the key foci. EU bodies and agencies remain a central actor in the continuing development of such a strategy. Practical guidance and support to institutions in achieving Digital Transformation should be provided by European and national bodies, including training initiatives and on-line guidance such as that presented by the decision support structure available on the ViMM Platform.



.In order to improve efficiency and effectiveness of the use of resources, impact assessment studies, based on mature and standardised processes and tools^{xxxix}, are needed as a fundamental commitment of CH institutions and as part of projects funded and/or carried out by public and private institutions.

10. Developing the Human Resources

In the current transition period for CHI, professional and vocational training for those in work, together with continuous development of new curricula, syllabi and courses at undergraduate and postgraduate level are a vital requirement. Innovation in education and training for DCH will enhance awareness of and openness to digital initiatives. European and national policies and initiatives such as Erasmus+ should address systematic involvement and training of teachers, curators, administration and governance staff, using methodologies that promote understanding of different media paradigms. There is a strong case to carry out such European initiatives in cooperation with international bodies in the field of DCH. We support, for example, the recent recommendations of the Council of Europe's 'Strategy 21'^{xl} in the areas of Knowledge and Education for Cultural Heritage, together with those of UNESCO's Education 2030 Framework for Action and propose that they are recognised and developed for DCH.

The accelerated development of ICT does not correspond to an effective capacity of DCH researchers and practitioners to work with programmes, tools and devices. In general, relatively few people have the knowhow and ability to master digital tools and platforms for example, to promote extensive involvement and social participation in the conservation of heritage, increase respect for the cultural diversity, etc. We believe that it is necessary to balance the continuous technological development with social needs in order that ICT becomes a fully effective resource for heritage development and awareness.

To assure the skills and capacities of the next generation of digital curators, museologists and archaeologists, the question 'who needs to be trained, for what purpose and at what level' should be directly addressed, not least within the programmes supervised by DG EAC, from a lifelong learning perspective, taking into account secondary, undergraduate, postgraduate, professional and vocational training and the needs of creative industries as well as the engagement of volunteers and the public community in general. Remote and e-learning can play an important role.

Training offers, accompanied by meaningful certification, should be stimulated. These should be addressed to the different target groups involved in Cultural Heritage and their position in the 'digital workflow', broken down into different steps or stages and distinguished between technology skills, curatorial issues and decision or policy making needs. Interdisciplinary approaches are necessary to address all the needs and skills required for DCH. Training programs with e-learning possibility, for higher specialization. Such trainings should lead to a recognized certification that will ensure specialization or a multidisciplinary profile. In general, theoretical and technical parts should be taken into consideration together, in order to create a complete training programme. Universities and schools conducting technical education should teach the relevance of cultural background information for the understanding of digital representations of cultural heritage objects. Universities and schools conducting education in history, art history, archaeology and related sciences should teach the relevance of technical education.

Endnotes

- ⁱ There are various definitions of ‘Culture’ e.g. ‘the social behaviour and norms found in human societies’, ‘characteristics and knowledge of a particular group of people, encompassing language, religion, cuisine, social habits, music and art’.
- ⁱⁱ Cultural Heritage is an expression of the ways of living developed by a community and passed on from generation to generation, including customs, practices, places, objects, artistic expressions and values. Cultural Heritage is often expressed as either Intangible or Tangible Cultural Heritage (ICOMOS, 2002).
- ⁱⁱⁱ Culture 3.0 <https://ec.europa.eu/assets/jrc/events/20131024-cci/20131024-cci-sacco.pdf>
- ^{iv} VIMM Definition <https://www.vi-mm.eu/2018/01/10/the-vimm-definition-of-a-virtual-museum/>
- ^v UNESCO Leading Education 2030 <https://en.unesco.org/education2030-sdg4>
- ^{vi} European Council conclusions May 2017 <http://data.consilium.europa.eu/doc/document/ST-8544-2018-INIT/en/pdf>
- ^{vii} A new European agenda for Culture
https://ec.europa.eu/culture/sites/culture/files/commission_communication_-_a_new_european_agenda_for_culture_2018.pdf
- ^{viii} European Parliament Think Tank and related documents such as:
Access to culture in the European Union
[http://www.europarl.europa.eu/RegData/etudes/IDAN/2017/608631/EPRS_IDA\(2017\)608631_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/IDAN/2017/608631/EPRS_IDA(2017)608631_EN.pdf)
Cultural heritage in EU policies
[http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/621876/EPRS_BRI\(2018\)621876_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/621876/EPRS_BRI(2018)621876_EN.pdf)
Cultural heritage in Europe: linking past and future
<http://www.europarl.europa.eu/news/sv/press-room/20180618IPRO6041/cultural-heritage-in-europe-high-level-conference-on-26-june>
Arts, culture and cultural awareness in education
[http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/608807/EPRS_BRI\(2017\)608807_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/608807/EPRS_BRI(2017)608807_EN.pdf)
Major challenges for EU tourism and policy responses
[http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/603932/EPRS_BRI\(2017\)603932_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/603932/EPRS_BRI(2017)603932_EN.pdf)
Sustainable tourism: the environmental dimension
[http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/599327/EPRS_BRI\(2017\)599327_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/599327/EPRS_BRI(2017)599327_EN.pdf)
Contracts for the supply of digital content and digital services
[http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/614707/EPRS_BRI\(2018\)614707_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2018/614707/EPRS_BRI(2018)614707_EN.pdf)
- ^{ix} UNESCO Sustainable Development Goals <https://en.unesco.org/sdgs>
- ^x ICOM New Strategic Plan 2016 – 2022 <http://icom.museum/the-vision/strategic-plan/>
- ^{xi} ICOMOS future strategic plan. The World Heritage List: Filling the gaps - an action plan for the future
<https://www.icomos.org/en/newsletters-archives/116-english-categories/resources/publications/258-monumentsasites-xii>
- ^{xii} The Action Plan 2015-2017 - Network of European Museum Organisation
<https://www.google.com.cy/search?q=future+action+plan+nemo&og=future+action+plan+nemo&aqs=chrome..69i57.6382j0j4&sourceid=chrome&ie=UTF-8>
- ^{xiii} European Cultural Heritage Strategy for the 21st Century. Council of Europe, May 2018
<https://rm.coe.int/european-heritage-strategy-for-the-21st-century-strategy-21-full-text/16808ae270>
- ^{xiv} A Call to Culture’: Europeana 2020 strategic update <http://strategy2020.europeana.eu/update/>
- ^{xv} Strategy for the Reinforcement of UNESCO’s Action for the Protection of Culture and the Promotion of Cultural Pluralism in the Event of Armed Conflict
https://en.unesco.org/system/files/private_documents/strategy_comprehensive_en_0.pdf
- ^{xvi} The Berlin Call to Action: Cultural Heritage for the future of Europe http://european-cultural-heritage-summit.eu/wp-content/uploads/2018/06/BerlinCall_Layout_final_WEB.pdf
- ^{xvii} Mapping of Cultural Heritage actions in European Union policies, programmes and activities.
Latest update: August 2017 http://ec.europa.eu/assets/eac/culture/library/reports/2014-heritage-mapping_en.pdf

- xviii Policies and good practices in the public arts and cultural institutions to promote better access to and wider participation in culture (2014)
http://ec.europa.eu/assets/eac/culture/policy/strategic-framework/documents/omc-report-access-to-culture_en.pdf
- xxix Adaptive cognitive systems are capable of sensing the internal state of a user and of adapting their behaviour appropriately to those measurements to improve the usability of the system
- xxx XR is used by ViMM as a current way to express all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables i.e. the ‘reality continuum’ encompassed by virtual reality (VR), augmented reality (AR) and mixed reality (MR).
- xxxi EU PSI Directive <https://ec.europa.eu/digital-single-market/en/european-legislation-reuse-public-sector-information>
- xxvii <https://www.w3.org/WAI/policies/european-union/>
- xxviii Digitisation <https://www.governmenteuropa.eu/digitising-cultural-heritage-europeana/85551/>
- xxviii Metadata <https://pro.europeana.eu/page/metadata-cataloguing>
- xxv The FAIR Guiding Principles for scientific data management and stewardship
<https://www.nature.com/articles/sdata201618>
- xxvi A major example in the cultural heritage domain is the CIDOC Conceptual Reference Model (CRM)
<http://www.cidoc-crm.org/>
- xxvii DARIAH <https://www.dariah.eu/>
- xxviii CLARIN <https://www.clarin.eu/>
- xxix Historical Buildings Information Modelling (HBIM) <file:///C:/Users/DHRL/Downloads/HBIMaReview.pdf>
- xxx the London Charter for computer-based visualization of cultural heritage, 2009; see Principle 4: Documentation “4.1 ... 4.2 Documentation strategies should be designed to enable rigorous, comparative analysis and evaluation of computer-based visualizations”
- xxxi Principles of Seville, 2011, International principles of Virtual Archaeology, see Principle 5: “Historical rigor”
- xxxii ICOMOS (2008). The charter for the interpretation and presentation of cultural heritage sites
- xxxiii International Image Interoperability Framework <http://iiif.io/>
- xxxiv COPERNICUS for Cultural Heritage <http://workshop.copernicus.eu/cultural-heritage>
- xxxv W3C Linked library data incubator group <https://www.w3.org/News/2011.html#entry-9239>
- xxxvi ISO <https://www.iso.org/standard/57832.html>
- xxxvii CEN <https://www.cen.eu/Pages/default.aspx>
- xxxviii <https://ec.europa.eu/research/environment/index.cfm?pg=policy>
- xxxix Such as the Europeana Impact Assessment Playbook <https://pro.europeana.eu/post/europeana-impact-assessment-playbook>
- xl Council of Europe Strategy 21 <https://www.coe.int/en/web/culture-and-heritage/strategy-21-k>