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Aspects of Informatics in Cultural Heritage Management

Irini Stamatoudi¹ and Konstantinos Roussos²

Abstract

Cultural Heritage Management (CHM) is a specialization, which helps museums, and Heritage institutions to face challenges, secure sustainable competitiveness, be resilient to climate change, natural hazards and pandemic risks, and redefine themselves in a constantly changing world. This paper explains how a state-of-the-art management model can be established for museums and heritage institutions, taking into account the latest developments especially application of information technology. The authors discuss the main issues and principles to be considered while drafting procedure of a cultural heritage management plan, describes current status and practice in the cultural heritage sector, presents information on the current needs of the sector and the challenges and hindrances. Based on their study authors put forward some recommendations to support communication between Cultural Heritage Professionals and their various audiences. The study also stresses the need for use of tools and techniques provided by Informatics in cultural heritage management.

Keywords: Heritage Informatics, Cultural Heritage Management, CHM Plan, Museums, Artificial Intelligence (AI), Conservation Monitoring and Visitor Engagement. Augmented Reality (AR), Virtual Reality (VR), Workflow Streamlining.

Introduction

Cultural Heritage Management (CHM) is a complex process meant to manage the diverse aspects of heritage, using a wide set of tools and practices meant for identification, excavation, recording, documentation, protection, conservation, restoration, interpretation, enhancement, promotion, presentation, dissemination, education, monitoring, marketing, evaluation, strategic management, application of heritage Informatics, risk management, law, etc. (Roussos and Stamatoudi, 2022; OSCE, 2020; Stamatoudi and Roussos, 2023b). The need to safeguard and manage cultural heritage resources is become essential to ensure its transmission and revitalization, which ensures its feasibility, viability, and sustainability.

Small museums and heritage institutions, suffer from inefficient management everywhere. It is important for all museums to frame realistic, sustainable CHM and use of current technologies offered by Informatics. This study tries to present a management model for museums which can be cost effectively done using the power provided by information and communication technologies. The study has the following objectives:

- To discuss the main aspects to be considered while drafting a CHM plan
- To understand the current status of CHM in European countries.
- To identify the requirements of the cultural heritage scenario as well as the exiting challenges

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- To put forward some recommendations to improve heritage management systems.

This is one of the few studies authors undertook under the research project 'Redefining the future of cultural heritage, through a disruptive model of sustainability' (ReInHerit, 2023), funded by European Union's Horizon 2020 research and innovation program.

Cultural Heritage Management Plan

Management planning is presently gaining more recognition now in heritage conservation scenario (Wróblewski, 2019). It is a crucial process and all museums and heritage institutions need to set up a CHM plan which specify who makes the decisions, what the mission and aims are, what actions need to be taken and what is the timeframe (Stamatoudi and Roussos, 2023a).

The main objectives of the CHM plan will be a) to conserve the CH for present and future generations, and b) to promote sustainable methods.

Cultural Heritage (CH) is a broad concept, and as the CHM involves various disciplines and approaches, the CHM plan must adapt to changes in the economic, political, social and physical environment (Hall and McArthur, 1998). Based on type and property there will be many variations in the context and character the CHM plan. A common CHM plan for archaeological sites and museums will be very complex. But drafting a CHM plan for a single historic building will

be easy. Nevertheless, both needs to follow some principles and processes regardless of the type of property.

Current Requirements, Challenges and Opportunities

Existing challenges and opportunities need to be understood first which can become the basis of an effective CHM plan. This will provide a vision, set aims and help actions to address the needs. Hence, the first step a museum must take in order to prepare a successful and implementable CHM plan is to look outside the organization and understand how the external environment is changing. In other words, understanding current needs, challenges and opportunities is the basis for an effective CHM plan. An in-depth understanding of the current situation in the CH sector will facilitate museums and CH institutions to stay relevant, to deliver their mission more effectively, to identify important threats that need to be addressed and to act as a major resource for resilience, connection, recovery, and positive change, contributing to the creation of inclusive, peaceful, and sustainable societies in this ever-changing environment. The authors have done this in the context of the ReInHerit project (<https://www.reinherit.eu/>) (Stamatoudi and Roussos, 2023b). In following section, the challenges and needs identified by the authors in the CH sector through this project has been discussed:

Interdisciplinary Collaboration

As CH is to be dealt with an inclusive and extensive concept it becomes very broad and of an interdisciplinary character, since it spreads to many disciplines and fields like social sciences, humanities, architecture, law, management, marketing, finance, restoration, conservation, curatorship, ICT, museology, etc. This necessitates communication and collaboration between different professionals like CH professionals, Information and Communication Technology experts, Intellectual Property Rights experts, etc.

Sustainable Business Models

Funding is decreasing for the CH sector. Financial sustainability is crucial for museums



Figure 1: The ReInHerit Mission

and CH institutions to pursue their aims and goals. Sustainable business models resilient to changes and crises are essential.

Redefining the Relationship between Museums and their Various Audiences

Redefine the relationship between museums and their various audiences will become essential. Museums and CH institutions are facing adversities in sustaining and inspiring actual audiences as well as in attracting potential audiences. Museums attract a broad range of visitors of different age and intellectual groups. Different museums have different tendencies to attract its audiences. They are of different types with major diversities in motivation, interests, barriers, experiences, and needs. Audiences whose primary motivation is to learn something from museums move further to effectively use it. Strategies for effective audience development have to be adopted for engaging the audiences for a long term. Technology and the recent pandemic have changed audience behavior, which necessitates new policies to meet the requirements. A combination of marketing efforts and word of mouth will be an innovative step to nurture the museum audiences. Hence, social and learning based motivations will be more effective which can also attract the future-focused audiences too. CH professionals are also facing difficulties in serving young people, locals, tourists based on their needs. It is also highly challenging task for them to manage the tangible and intangible CH, fulfilling the needs of the different audiences.

Redefining the Management of Collections

The process and methods of data acquisition, tools for CHM, and the techniques, devices, and applications are advancing in the CH domain (Kumar, 2021). Museums and CH institutions have to redefine the management of collections based on evolving ethical standards and current trends. Collecting, preserving and disseminating tangible and intangible CH has become difficult due to lack of resources, the use of institutional gaps

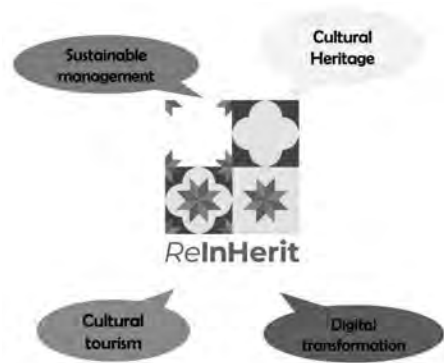


Figure 2: Some of the Pillars on which the ReInHerit Project is Based.

and political will or difficulties arising from illicit trafficking of heritage property. (Stamatoudi and Roussos, 2023c).

Environmental Compatibility

The museums and CH institutions will need to be made environmentally friendly. Climate change and environmental issues play a key role on how museums and CH institutions should be engaged with society as part of the sector's commitment towards it. CH professionals have to find sustainable ways to reduce energy consumption, to improve sustainability of their buildings, and to find alternative energy sources.

Digital Services

The challenges put forward by recent pandemic, the wars, declining revenues and the energy cost increases, provided an opportunity to turn to digital services. Museums and CH institutions are extremely vulnerable to unprecedented cost increases following a period of during the pandemic (Stamatoudi and Roussos, 2023b).

Sustainable CHM Plan

Having fully understood the needs and challenges, as well as the potential opportunities, museums and CH institutions should take the second step, which is to design a CHM plan.

With a thorough understanding of the character of the CH to be managed, an

awareness of concerned for safeguarding CH, knowledge of human and financial resources available and key stakeholders involved CH institutions should start to design a CHM plan.

CHM plan should have:

- people centered and environmentally friendly approach capable to respond to the challenges and requirements
- clear orientation towards the ideas of sustainability and resilience as a framework for the development of long-term strategic cultural policies
- commitment to the concepts of inclusivity, relevance, innovation, accessibility, democratisation, ethics, diversity, professionalism, cooperation, and community participation
- flexibility and adaptability
- a clear vision on the application of tools and techniques of Informatics relevant to CH

CHM plan should also include clear strategies as listed below related to the current needs, challenges and opportunities:

Communication Strategy

CHM plan should have a communication strategy, specifically social media policies. Young people get information about the CH services from friends via social media channels (Ådahl, 2023).

Audience Development Strategy

Setting an audience development strategy will help museums to engage more people with CH. CHM should try to understand young people, local communities etc and reach them and provide enjoyable and meaningful experiences in addition to refreshing the existing audiences (Ayala et.al, 2019, Stamatoudi, and Roussos, K, 2023d and e).

Intellectual Property Rights

There should be clear Intellectual Property strategy to establish the ownership of CH assets and prevent violation by third-

parties (WIPO, 2008, Stamatoudi and Roussos, 2023f).

Environmental Strategy

CHM plan should clearly define Environmental and Energy strategy to reduce energy consumption, to improve sustainability of buildings, and to find alternative energy sources (EC, 2023, Stamatoudi and Roussos, 2023g).

Adopting Digital Business Models

CH plan should have clear business strategies to help CH professionals to create new value and deliver it to visitors and turn this value into economic, social, and cultural outcomes (Li, 2020).

Tools and Actions

Numerous tools and action plans are available to ensure effective implementation of CHM plan

Knowledge and Skills: CH institution should train all employees for successful implementation of the CHM plan. Tools such as marketing plans, project management software etc can help professionals to work more efficiently (ECHS, 2023).

Organograms: Organograms can be set to clarify hierarchical relationships between managers and the people who report to them, as well as departments (UNESCO, 2013).

Evaluation: Self-evaluation and external evaluation should place on a regular basis (HERO, 2010).

Effective Collaboration: CHM must be based upon effective collaboration and communication between professionals from various disciplines. It also requires the involvement of government authorities, academic researchers, universities, research institutions and the general public (UNESCO, 2013).

Digital Technologies: Digital technologies offer solutions to successfully implement the CHM plan. The use of innovative tools can facilitate the targeting of audiences and the understanding of their needs (Stamatoudi Roussos, 2023h).

Codes of Conduct: Implementing codes of conduct can ensure ethics and deontology are considered at all stages.

Engaging Young and Local People

Communication between museums/CH institutions and their various audiences has been identified as a strategic issue for a sustainable CHM. Two categories of audiences we concentrated are young people and local communities who are crucial.

Collaboration with Local Communities

CHM plan should take into account their local communities (UNESCO, 2013) who are considered as a key stakeholder in the CH sector. The ICOM (International Council of Museums) Code of Ethics gives stress to the collaboration between the museums and the communities from which the collections originates (ICM, 2017). The community support is of vital importance for the sustainable management of CH and its development.

Methods to Associate with Local Community

Listed below are a few of the activities, programs, strategies and ways to deepen the relation with the community (Stamatoudi and Roussos, 2023i):

- Adopting a perspective of the understanding and participatory museum with a horizontal interaction.
- Promoting membership schemes in order to foster loyalty of local community.
- Making services relevant to local community and including locally significant themes.
- Connecting CH institutions to local schools, and community organizations.
- Collaborating with local authorities and policy makers.
- Permitting local community to create and exhibit/perform productions on locally significant themes- dance, art, music etc.
- Conducting special events for local community.

- Setting museum timings considering the convenience of local population also.
- Use of social media and mobile applications.
- Making use of marketing methods.
- Engaging volunteers from local community to publicize services.
- Providing a communal reflection space for the local communities

Reaching Younger Audience

CH needs to make more relevant and attractive to young people (Tranta, 2021). They are considered digital natives and they use computers, social networking services, and text messaging as their main means of communication and learning. Understanding the young audience is important in order to determine their specific needs as well as to better understand how they perceive CH, how they experience it, how they want to engage with it, and what is important to them. Promoting real-time dialogue between young people and the CH professional is essential. For this chat rooms for discussions between young people and CH professionals can be created on the organizations' websites or interact with them on social media. Museums and heritage sites can use online seminars, games, and programmes developed with Augmented Reality/Virtual Reality/Mixed reality, Gesture Technology/Non-touch Interactive, Haptic technologies, Mobile Technologies, Virtual touring, etc. which can



Figure 3: The ReInHerit's Official Website

help to attract younger audiences in large scale. Outreach work/activities to schools, universities, and youth organizations can be conducted.

Informatics for CHM

Automating CHM in museums involves leveraging technology to streamline various aspects of preservation, documentation, exhibition, and accessibility of artefacts and artworks. Informatics can play a pivotal role in extending the services of museums and heritage collections, allowing them to reach broader audiences, enhance visitor experiences, and ensure safety of cultural artefacts. We discuss below a few aspects of CHM in museums etc in which technologies provided by Informatics can be used (Stamatoudi and Roussos, 2023h, ReInHerit, 2023c).

Automating CHM in museums involves leveraging technology to streamline various aspects of preservation, documentation, exhibition, and accessibility of artefacts and artworks. Here are several ways museums can use automation in cultural heritage management

Artificial Intelligence (AI): AI can be used to analyze, categorize, and annotate images, documents, and historical texts. This can help automate the tagging, description, and sorting of artefacts within the museum collection.

Automated Preservation Techniques: Robotics or automated systems can be used for delicate tasks such as cleaning, handling, and minor restoration. This will reduce the risk of human error and ensures consistency in preservation practices.

Conservation Monitoring: Sensors and IoT devices can be installed to monitor environmental conditions like temperature, humidity, and light exposure. Automated alerts can signal curators if conditions fluctuate beyond acceptable ranges, aiding in preventive conservation efforts.

Digital Cataloguing and Database Management: Database Management Systems and cataloguing software that use metadata and standardized terminology for

efficient searching, categorizing, and managing collections can be used in museums. This will allow curators, researchers, and the public to access information easily.

Digital Preservation and Archiving: Automation tools can be used in museums for digital archiving, ensuring the long-term preservation and accessibility of digital materials and collections.

Digitization of Collections: High-resolution imaging, 3D scanning, and digital modelling can be used to create virtual copies of artefacts like photographs, paintings, sculptures etc. 3D imaging and 3D printing allows the scanning, 3D modeling, and printing of accurate copies of artifacts, offering visitors the opportunity to study and interact with them more closely than ever before. Therefore, museums do not have to keep controversial CH artifacts; whilst at the same time they need not empty their collections, opening a new path for the return and restitution of such objects to their communities of origin (For detailed discussion refer Stamatoudi and Roussos, 2023c). This process will help to preserve items, make them accessible online, and reduces the need for physical handling.

Online Accessibility and Education: Online portals, educational platforms, and virtual tours can be developed to make CH accessible to a wider audience beyond physical museum walls especially to students and the young. Public forums like the one launched by the ReInHerit community (<https://reinherit-hub.eu/forum>) can be taken as model (ReInHerit 2023a).

Visitor Analytics and Experience Enhancement: ICT based solutions can be employed to gather data on visitor behaviour, preferences, demographics and flow within the museum. This information can be used to optimise exhibit layouts, improve engagement, and tailor experiences. It will make possible marketing efforts to better meet visitor needs.

Visitor Engagement: Solutions provided by Informatics can be used to develop

interactive exhibits using augmented reality (AR) or virtual reality (VR) technologies. These can provide visitors with immersive experiences and additional information about artefacts. (ReInHerit, 2023d)

Augmented Reality (AR) Interpretation:

AR applications that overlay additional information or digital content onto physical artefacts or spaces within the museum can be implemented providing a richer and more interactive experience for visitors.

Workflow Streamlining: ICT solutions can be used implement workflow automation for administrative tasks like inventory management, loan processing, and exhibition planning. This can free up staff time for more specialized tasks. It is important to note that while automation can greatly enhance efficiency and accessibility in CHM, it should complement human expertise and not replace it entirely. Human oversight, interpretation, and decision-making remain crucial in preserving and understanding cultural heritage. Additionally, considerations of ethical implications, data security, and preservation standards should guide the implementation of automated systems in museums.

Online Collections and Archives: Tools provided Informatics can be used to create digital repositories where museums can showcase their collections online (ReInHerit, 2023c). High-resolution images, 3D models, videos, and detailed descriptions can be made accessible to a global audience, facilitating research and education.

Virtual Tours and Digital Exhibitions:

Virtual tour platforms or applications using VR or AR technologies can be developed. They can enable users to explore museum spaces and exhibitions remotely, providing an immersive experience (ReInHerit, 2023f).

Mobile Apps and Audio Guides: Mobile applications that serve as guides for visitors within the museum can be developed. They can provide information, interactive maps, audio guides, and additional multimedia content, enhancing the visitor experience (ReInHerit, 2023e).



Figure 4: Bowl with Fish Motifs in the Free-Field style 600-480 BCE Cyprus Ashmolean Museum

Educational Resources: In ICT based platforms online educational resources such as interactive learning modules, lesson plans, and educational games related to museum collections can be prepared (ReInHerit, 2023c). These resources can serve students, educators, and lifelong learners, which will extend the educational reach of the museum.

Social Media Engagement: Various social media platforms can be used to engage with a wider audience. Live streaming, behind-the-scenes content, interactive Q&A sessions, and storytelling on platforms like Instagram, Twitter, Facebook, and TikTok etc can attract and retain audience interest.

Online Events and Workshops: Virtual events, workshops, lectures, and webinars related to the museum's collections or themes can be organized. (ReInHerit, 2023c and d). These events will allow participation from a global audience and encourage interaction and learning.

E-commerce and Digital Merchandise:

Online shops selling replicas, books, or merchandise related to the museum's collections can be established (ReInHerit, 2023d). This will enable visitors to support the institution and take a piece of it home. The museum can be in long run made self-sustainable using such methods.

Accessibility and Inclusivity: ICT solutions can be used to ensure accessibility for diverse audiences, including features for individuals with disabilities such as audio descriptions, closed captioning, and adaptive technologies.

By using Informatics for CHM museums and heritage collections can, not only extend their reach but also preserve cultural heritage while adapting to the evolving needs and expectations of modern audiences. It is essential to continually innovate and adapt these technologies provided by Informatics to remain relevant and engaging in the digital age.

Conclusions

The COVID-19 pandemic and the energy crisis, which is a transformative and tough period for mankind, has paved the way for innovation and new ways of managing CH. The CH sector in Europe does not need to waste this opportunity by going back to the traditional ways of operating. Instead, it needs to build on the good practices of pre-pandemic situation and the lessons learned over the last years to develop a more sustainable CHM, while taking advantage of technological developments and digital innovation. CH professionals need to go beyond existing practices of digitizing collections and use the numerous tools and techniques like those described above to make visiting a museum or heritage site an interactive and immersive experience that engages the audience in the context of the fourth Industrial Revolution.

In the coming years, any museum and CH institution, especially smaller ones with fewer resources, should draft efficient and implementable CHM plans to successfully address challenges arising and to respond to their social role and responsibilities. In this respect, it is crucial to take into account changes in the economic, political, social and physical environment as well as to understand the needs, challenges and bottlenecks of the CH sector. Any CHM project should be based on a people centered approach to what CH really is, how it can be used, protected and interpreted, by whom and for whom. Any CHM plan should be based on interlocking strategies related to the current needs, challenges and opportunities of the CH sector, and should be a result of a broad set of tools and actions that will ensure their effective implementation.

In this context, it is of immense importance for museums and CH institutions to re-approach their relationship with the various audiences, especial young people and local communities, by offering them a truly meaningful experience and by making themselves open and accessible to all. They should turn their attention to promote connections between people and heritage as well as to foster intercultural dialogue and understanding, sustainability and well-being. In this way, they can better harness the full potential of CH to support sustainable development. Innovations and technologies can be the main vehicle for museums and CH institutions to make CH accessible to a broader audience.

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