A Tailored Framework for the Impact Assessment of Virtual Exhibitions in Glam Sector: a Case Study from Spain

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Abstract

This article presents the development and initial pilot implementation of a methodological framework adapted to assess the impact of the virtual exhibition 'The Library of the Lady of Elche' [La Biblioteca de la Dama de Elche]. By combining a virtual exhibition creation model with the guidelines of the Europeana Impact Playbook, the proposed framework structures the definition of objectives, stakeholders, impact types and value lenses with specific evaluation indicators. The proposal addresses three dimensions of impact while prioritising the assessment of online reach through data from the exhibition's digital dissemination strategies. The measurement process is based on web traffic, social media activity, academic citations and participation in both scholarly and public outreach events, demonstrating the effectiveness of designing digital cultural projects with an impact-oriented approach within the GLAM (Galleries, Libraries, Archives, Museums) sector.

1. Introduction

The digitisation and dissemination of documentary and bibliographic heritage is a fundamental aspect of the cultural sector. GLAM institutions (Galleries, Libraries, Archives, and Museums) have actively worked on digitising their materials and are making their collections available to the public. This digitisation is being promoted by the strategic actions and policies developed at the international level, and Member States have actively supported digitisation and digital preservation of cultural heritage, providing access to the corresponding digitised resources for study, use and re-use (Siso-Calvo y Arquero-Avilés, 2023). The origin of this concern lies in the growing interest in democratizing access to cultural and bibliographic heritage, leveraging the possibilities offered by digital technology to overcome physical, geographical and economic barriers.

With a focus on collection digitisation, collaboration and user orientation, the term GLAM refers to a movement, trend or professional sector that fosters the convergence of libraries, archives and museums. Its goal is to develop common solutions and undertake joint projects aimed at the digitisation, management and dissemination of their collections and digital heritage (Siso-Calvo y Arquero-Avilés, 2023). Some authors have highlighted the importance of technologies in the documentation, preservation, research, exhibition, education and dissemination of cultural heritage (Munilla, García, & Solanilla, 2003). In the digital age, cultural experiences are increasingly re-created thanks to creative applications of new technologies (Bellini, Bergamasco, Brehonnet, Carrozzino, & Lagier, 2018) and specifically, after the outbreak of Covid-19, cultural institutions have been experimenting with new ways to engage a potential audience remotely (Resta, Dicuonzo, Karacan, & Pastore, 2021). The application of multimedia technology in GLAM context is practically usable for visitors to connect with collections in personal meaningful ways and increases their interest in the objects (Fisher, Twiss-Garrity, & Sastre, 2008), so the users can learn about the context of the displayed objects and be motivated to explore them through entertainment (Rosli, Kamaruddin, & Shamsarini, 2022).

GLAM institutions, driven by regulatory frameworks and their social mission, are leveraging digital technologies to develop new services and products that improve public access, use and engagement with their collections.

However, this phase of promoting digital projects to disseminate the collections and

holdings of GLAM institutions has led to a growing interest in justifying and assessing the reach and effectiveness of these initiatives. As a result, impact measurement in the dissemination of cultural and bibliographic heritage, particularly in the digital environment, has emerged as a developing field that seeks not only to optimize resource use but also to provide evidence of its real impact and contribution to the objectives of accessibility, sustainability and heritage valorisation.

Virtual exhibitions, as key agents in the reuse and dissemination of this heritage, represent a unique opportunity to reach diverse audiences, foster knowledge and generate various types of impact, particularly social and cultural impact. However, their intangible nature presents challenges in understanding how and to what extent they achieve these objectives. Measuring their impact not only helps quantify their reach in terms of visits or interactions but also assesses their ability to generate meaningful learning experiences, stimulate interest in the use and consumption of heritage and promote social engagement.

Given this reality, developing appropriate tools and methodologies for impact measurement has become essential to ensuring the sustainability and relevance of these projects in an increasingly competitive digital environment.

In this context, this work is a result of the research project titled 'Cultural and Bibliographic Heritage in the GLAM Context (Galleries, Libraries, Archives, and Museums): Virtual Exhibitions as Agents of Dissemination and Reuse [El patrimonio cultural y bibliográfico en el contexto GLAM (Galleries, Libraries, Archives and Museums): las exposiciones virtuales como agentes de difusión y reutilización]. To promote dissemination strategies to make the bibliographic heritage of museums visible, the collaborative research project between the IDEA Lab Research Group (Complutense University of Madrid, Spain) and the Library of the National Archaeological Museum (Spain) is focused on generating virtual exhibitions as dissemination and reuse tools by connecting the National Archaeological Museum collections with the bibliographic holdings of its Library. The research project aims to develop virtual exhibitions linking the physical collections of the National Archaeological Museum with its library holdings, create standardized datasets, as well as explore and define impact measurement

tools for assessing their educational, cultural and social influence.

1.1 Virtual exhibitions as agents of dissemination of cultural heritage

Virtual exhibitions have become one of the most prominent initiatives within GLAM institutions, representing creative and innovative projects that enhance public engagement. Through an educational approach, these exhibitions facilitate the dissemination of new knowledge about the exhibited objects, thereby capturing societal interest. Beyond their role in outreach, virtual exhibitions serve multiple purposes, including fostering learning, entertainment, cultural and artistic heritage preservation, research advancement and reading promotion (Arquero-Avilés, Marco-Cuenca, & Cobo-Serrano, 2023).

Exhibitions play a crucial role in the promotion and dissemination of cultural and artistic heritage. Following the lead of well-established museums, libraries and archives are increasingly adopting tailored virtual spaces and exhibitions to showcase their collections. In this regard, institutions are developing navigable spaces with distinct identities that function as thematic or specialized microsites (Arquero-Avilés, Marco-Cuenca, & Cobo-Serrano, 2023). These microsites aim to serve as definitive showcases for their respective themes, effectively acting as high-impact digital exhibitions (Munilla, García, & Solanilla, 2003).

The objectives behind organizing exhibitions in these institutions may vary depending on the type of archive or library. However, in general, they align with regulatory frameworks on digitization and online access to collections while offering significant institutional and social benefits. Institutionally, virtual exhibitions enhance visibility and promotion of the organizations, attract new users and foster professional networks. As noted by Chen, Pickle, and Waldroup (2015), exhibition creation is widely recognized as an integral part of the work carried out by specialized centres and institutions with special collections. These exhibitions generate positive publicity, increase institutional recognition and encourage more researchers to engage with the collections. According to Karacan and Resta (2020), virtual exhibitions can help promote physical sites by providing information

about their exhibits and enhancing the display of cultural artifacts through emerging technologies.

Beyond promoting cultural institutions and their holdings, virtual exhibitions also serve an important social function by educating the public in a quite attractive way (Franco, Matthews, & Matlock, 2016). According to Munilla, García, and Solanilla (2003), the technology employed in virtual exhibitions allows users to access and interact with the displayed materials in ways that are often not possible during physical visits. The integration of various educational resources, such as specialized texts, graphic illustrations and extended content, enhances the exhibition experience beyond the constraints of traditional museum displays. Furthermore, virtual access enables the continuous expansion of cultural activities, ensuring that the educational and cultural functions of these institutions extend beyond physical and temporal limitations. As a result, the pedagogical potential of the Internet strengthens the communicative and interactive dimensions of exhibitions (Herrera Morillas, 2005) and creating specific virtual exhibition experiences may offer educational benefits to the visitors (Sylaiou, Dafiotis, Koukopoulos, Koukoulis, Vital, Antoniou, & Fidas, 2024). This innovative infrastructure, prominently involving GLAM institutions, aims at generating a new environment where narrative and educational tools are developed to submerge users in a new experience with which they can learn more about a particular topic (Olmedo-Pagés, & Arquero-Avilés, 2024).

Virtual exhibitions have the potential to effectively disseminate cultural information at a low cost through innovative methods and tools that address the learning and entertainment needs of diverse end-user groups (Karacan & Resta, 2020). On this matter, three key factors must be considered: the content to be exhibited, the exhibition space or platform and the exhibition techniques employed (Arquero-Avilés, Marco-Cuenca, & Cobo-Serrano, 2023). Regarding content, accessibility in cultural heritage initiatives has gained increasing attention and numerous GLAM institutions are now incorporating easy-to-read materials into their exhibitions to establish effective communication (Olmedo-Pagés, & Arquero-Avilés, 2024). Dyson and Moran (2000) highlighted the importance of designing accessible and usable information resources for online exhibitions, emphasizing the

need to cater to diverse audiences. At a European level, organizations such as Inclusion Europe have played a crucial role in promoting accessibility, particularly for individuals with intellectual disabilities. This institution defines the concept of easy-to-read information as the content that is structured and presented in a way that ensures clarity and comprehension for all users, including those with cognitive impairments (Inclusion Europe, 2017). Similarly, IFLA (2010) provides a framework for creating accessible textual content, reinforcing the importance of readability in cultural and educational contexts to enhance user engagement and inclusivity.

Another important element is the exhibition technique. According to the International Network for a Digital Cultural Heritage e-Infrastructure (INDICATE, 2012) a digital collection alone does not make a virtual exhibition. Only when the items are thoughtfully curated to illustrate a specific theme and connected through a cohesive narrative or logical path do they truly form an exhibition. The narrative strategy known as storytelling is characterized by its effectiveness in conveying the message, aiming to create an emotional impact. Digital storytelling effectively delivers engaging information on specific topics in combination with multimedia components like graphics, text, audio, video, narration and music (Porter, 2004). Transmediality and crossmedia storytelling allow for the creation of a multifaceted experience, where multiple narratives can be conveyed through various media. This approach not only delivers a comprehensive story but also enhances our understanding of a broader subject within a story world. The use of storytelling can deepen our relationship with cultural heritage and plays an essential role in drawing the attention of audiences to cultural heritage institutions (Fisher et al., 2008). Also, the diversity of media ensures that the varied preferences and needs of the diverse heritage audience are addressed (Sylaiou et al., 2024).

The importance of digital storytelling has led to the development of tools that facilitate the creation of narratives based on sensory and emotional aspects. For example, the EMOTIVE project offered tools and applications for generating immersive and personalized digital narrative experiences for visitors. It has also been demonstrated the affective potential of virtual humans (avatars) as storytellers in virtual museum environments (Sylaiou, Kasapakis,

Gavalas, & Djardanova, 2020). In summary, the ways in which information is communicated or content is offered for engaging users are exceptionally important (Sylaiou et al., 2024).

Regarding the platforms and the technological options for implementing exhibitions, one crucial technological challenge within cultural organisations is the increasing need to digitize and present their collections using eXtended Reality (XR) experiences. From a technological perspective, eXtended Reality is an umbrella term that encompasses Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) (Sylaiou et al., 2024). The power of Virtual Environments (VE) technology is due to its unique characteristics of immersion and interaction. Immersion is defined as the physical sensation of being inside a virtual space, where sensory interfaces guide the user throughout the experience. Interaction is related to the user's ability to interact with the virtual environment in an active and reciprocal way.

Also, these new tools have an incredible inclusive potential as they make it possible to fully adapt and customise the space in which they are submerged with audio descriptions, subtitles and accessible navigation options. The foundational principles of universality and democratization in this new environment make it an ideal space for fostering connections between GLAM institutions and diverse audiences that were previously difficult to reach. This advancement allows for greater inclusion, enabling people with disabilities, individuals from different cultural backgrounds and those with varying language proficiency levels to be better represented among GLAM visitors (Olmedo-Pagés & Arquero-Avilés, 2024).

The three factors previously mentioned (immersion, interaction and storytelling) contribute to developing several reactions and emotions in experiences related to hedonism and pleasure, such as those related to art and culture. This is why virtual technologies arouse a great interest in the field of cultural heritage (Bellini et al., 2018) and in the Library and Information Science area (Williams, Dumas, Chow, Hofman, & MacLeod, 2024). Specifically, Virtual Reality (VR) is one of the technologies that is increasingly to get adopted in libraries and librarians highlight that the immersive and interactive nature of VR distinguishes it from other digital media, presenting unique opportunities as well as specific challenges when implemented in library settings.

While VR holds significant potential for enhancing learning experiences and fostering social engagement, its effectiveness is largely influenced by the quality of the content available and the strategies librarians employ for outreach and promotion (Lee, King, Dahya, & Lee, 2020).

Arquero-Avilés, Marco-Cuenca, and Cobo-Serrano (2023) designed a methodology for the creation of virtual exhibitions based on a series of sequential stages, which may vary depending on the specific characteristics and needs of the project: (1) initial concept formulation; (2) planning; (3) content processing and development; (4) organization; (5) launch and dissemination; (6) exhibition evaluation and impact assessment; and (7) closure or maintenance. Following this methodology, and considering the perspective of subsequent impact assessment, the planning phase requires the definition of three fundamental elements: the objectives, the stakeholders and the expected impact, ensuring that it can be effectively evaluated at a later stage.

Stakeholders, defined by Europeana (2022) as "a person, group, community, or organization expected to experience a change, that is, to benefit in some way from a certain activity", must be prioritized in a cultural project with an impact-oriented approach. Consequently, both activities and impact assessments should be designed around stakeholders.

1.2 Impact of digital projects for cultural heritage dissemination

In recent years, there has been a growing demand for nonprofit organizations to provide evidence of their value to individuals, their governing organizations and society at large. In the case of libraries, they have responded to this demand by developing methods aimed at identifying and demonstrating their impact and the benefits they offer to users and the broader community (ISO, 2014). According to Europeana (2022) some high-level reasons to think about impact include trying to be more strategic and impactful in GLAM institutions work, doing more reporting or accounting, demonstrating the value created for the heritage sector, progressing the understanding of the digital transformation of the heritage sector and getting better at the things cultural centers do every day. However, the implementation of these drivers can be an important challenge. Cultural institutions often

lack sufficient tools to evaluate the true impact of their initiatives. While they meticulously track immediate data such as visitor numbers, social media engagement and ticket sales, they rarely explore the deeper, long-term effects of their work, such as shifts in attitudes, the formation of new social connections or the development of ideas and values (Europeana, 2022).

Impact is defined as "changes that occur for stakeholders or in society as a result of activities (for which the organisation is accountable)" (Europeana, 2022) or "the measurable outcomes arising from the existence of a digital resource that demonstrate a change in the life or life opportunities of the community for which the resource is intended" (Tanner, 2012). When using these definitions, measuring impact is about identifying and evaluating changes (outcomes), which can be positive or negative, intended or unintended, short-term or long-term (Global Libraries, 2015). However, in most cases, what is defined as impact does not refer to simple skills but rather to broader changes occurring in an individual, group or community, such as increased knowledge, shifts in attitudes, values and/or behaviors, the generation of emotions, among others. These outcomes are largely indirect and intangible, making them difficult to identify and quantify. Moreover, these changes can span multiple areas or dimensions (value lenses) depending on the type of impact intended (social, institutional, economic, etc.). The type of impact or strategic perspective provides a framework for understanding the specific problem a project seeks to address. While some initiatives are explicitly designed to generate positive societal outcomes, others may focus on producing economic benefits. In practice, most projects involve a combination of impacts, and this multifaceted nature of impact highlights the importance of adopting a holistic and adaptable evaluation approach. The value lenses offer a focused approach to understanding specific types of value that may emerge from the experience provided through a digital cultural heritage project. Each lens allows for a more detailed examination of perceived value, helping to isolate and analyze its impact without being overshadowed by broader considerations (Europeana, 2022). For instance, social impact can be assessed in terms of education and experiential learning, cultural engagement or the degree of entertainment and satisfaction derived from the generation of emotions. The type of impact and its

associated variables require the definition of specific metrics and indicators, as well as the design and application of appropriate evaluation methods aligned with the intended objectives and stakeholders.

The development of projects or products with an impact-driven approach must adhere to a precise framework. To advance the measurement of the impact of cultural projects in the digital domain, recent years have seen the development of various tools designed as frameworks, methodologies and/or practical guidelines aimed at guiding project development with a clear focus on impact generation and/or evaluation. Some of these tools adopt a general approach, making them adaptable to any type of project by aligning them with their specific characteristics and objectives. Examples of this category include the INDICES project, the Europeana Impact Playbook (Europeana, 2022) and the Better Evaluation knowledge platform (Global Evaluation Initiative, 2022). Other tools have a sector-specific application within certain institutions or fields. In the case of museums, the MOI Framework (NEMO) and the ME-MIND project have been developed, whereas for libraries, key reference materials include the Impact Planning and Assessment Guide by Global Libraries (2015) and the international standard methods and procedures for assessing the impact of libraries (ISO, 2014).

A final area of application relates specifically to digital platforms and collections, with tools such as the Balanced Value Impact Model (Tanner, 2012, 2020a, 2020b), which was adopted by a range of projects, the Digital Content Reuse Assessment Framework Toolkit (D-CRAFT), developed by the Content Reuse Working Group and the DLF Assessment Interest Group (2023), the report Best Practices for Google Analytics in Digital Libraries (Digital Library Federation, 2015), the guide Altmetrics and Analytics for Digital Special Collections and Institutional Repositories (Konkiel, Dalmau & Scherer, 2015), the guide Standardized Statistical Measures and Metrics for Public Services in Archival Repositories and Special Collections Libraries (SAA-ACRL/RBMS, 2018) and the Impactomatrix tool (DARIAH).

A review of key reference methodologies, such as the Europeana Impact Playbook, highlights several fundamental aspects for the development of impact-oriented projects. The first module of that framework, referred to as Impact Design, consists of the identification and definition of

stakeholders, strategic perspectives, value lenses and intended outcomes. As previously mentioned, these elements must be addressed during the planning phase of the project to ensure that it is developed in line with predefined impact requirements, thus enabling a structured and meaningful evaluation process.

Also, it is important to note that while the tools provide varying degrees of guidance and practical resources, the design and assessment of impact must be tailored to the specific characteristics, needs and objectives of each digital project or product (outputs).

A defining feature of virtual exhibitions is their accessibility to a diverse audience, encompassing users with widely varying backgrounds and levels of expertise. Consequently, evaluation and impact measurement become essential phases within their lifecycle, serving as key mechanisms to ensure visitor engagement and, more broadly, the fulfillment of the exhibition's intended objectives.

2. Literature review

The review of recent literature identifies studies that address, on the one hand, the assessment of the impact of digital heritage and resources, and on the other, the analysis of specific characteristics of virtual exhibitions.

2.1 Impact assessment of digital heritage collections

From a bibliometric perspective, Borrego (2020) analysed the impact of digital heritage collections through the citations they receive in scholarly outputs. Google Scholar was used to retrieve the scholarly outputs citing Memòria Digital de Catalunya (MDC), a cooperative, open-access repository containing digitized collections related to Catalonia and its heritage. The study shows that Google Scholar is a suitable tool for providing evidence of the scholarly impact of digital heritage collections. In contrast, Marsh (2023) explored the uses and impacts of digitized collections within diverse communities through semi-structured interviews, offering a qualitative perspective on their social and cultural value. The results help to document the grounded impacts, positive and negative, as well as the digital and physical return of archival records is having in native and indigenous communities.

Other studies emphasize the importance of storytelling in impact assessment. Marsh,

Punzalan, Leopold, Butler, and Petrozzi (2016) highlighted the crucial role of narrative in articulating the value of digitized ethnographic collections held by GLAM institutions. Through semi-structured interviews, focus group discussions, site visits and workshops involving two communities engaged in cultural heritage digitization projects (both audiences and institutional stakeholders), the authors identify and discuss the various ways in which stories and storytelling are strategically mobilized in conversations about the impact of digitization. Similarly, Frandsen, Sorensen, and Anne Merete (2021) conducted a systematic review of library studies employing narrative approaches in their evaluations, concluding that the collection and presentation of stories of change will become a key trend as evidence in impact assessments.

From a combined methodological perspective, Tanner (2016) addressed how to effectively measure the impact of a digital library using the Balanced Value Impact Model (BVI Model), a framework that combines an organization's internal perspective with the external view of the community, considering both social and economic dimensions. In this context, Fukuyama and Tanner (2022) developed a set of 13 potential impact assessment indicators for the UK Web Archive, drawing on the Balanced Value Impact Model as their conceptual framework. Punzalan, Marsh, and Cools (2017) identified six key areas of significant impact (knowledge, professional discourse, attitudes, institutional capacity, policy and relationships) and proposed specific indicators for each to assess the outcomes of ethnographic archives digitization. Their approach demonstrates the value of such initiatives beyond conventional quantitative metrics such as clicks, likes or downloads. Meyer (2011) examined the use of digitized collections for research, teaching and learning through a mixed-methods approach that combined qualitative and quantitative techniques. His study drew on Google Analytics and media data, bibliometric indicators from Scopus and Google Scholar, as well as surveys and interviews. The results confirmed that employing multiple methods offers a more comprehensive and nuanced understanding of the various types of impact generated by digitized collections.

These studies reflect diverse approaches to assessing the impact of digital collections, highlighting the need for hybrid methodologies that combine quantitative indicators with

qualitative methods, such as testimonial gathering and narrative analysis. This combination allows for a more holistic understanding of the value of digital heritage initiatives.

2.2 Assessment of virtual exhibitions

Research typically focuses on the analysis of specific variables (such as user satisfaction, usability, navigability, etc.), using different methods or a combination thereof. Several studies have examined how virtual technologies influence the perception and evaluation of cultural experiences. Bellini et al. (2018) investigated the impact of immersion, emotions and social interaction on user satisfaction in 'edutainment' applications built on immersive virtual environments, employing measurement items from Fornerino, Helme-Guizon, and Gotteland (2008). Their findings highlight these factors are key to the lived experience. Complementarily, Barbieri, Bruno, and Muzzupappa (2017) proposed a methodology based on user interaction and satisfaction in virtual museums, validated in the Museo dei Brettii e del Mare (Italy). Their approach combined traditional metrics with cognitive studies to assess usability, perceived enjoyment through emotional responses and knowledge transmission.

Polys, Roshan, Newton, Narula, and Thai (2022), through an empirical approach combining observation and questionnaires, analysed various usability metrics in digital exhibitions, highlighting elements such as navigation and interaction. They also examined the interface and its functionalities using Nielsen's heuristic indicators (1994a, 1994b). From a more technical perspective, Kabassi, Amelio, Komianos, and Oikonomou (2019) designed and implemented a usability evaluation model for virtual museum tours in Italy. Their approach combined two multi-criteria decision-making methods (AHP and fuzzy TOPSIS) with heuristic indicators proposed by Sutcliffe and Gault (2004) based on criteria such as virtual reality experience, sense of presence, navigation and learning. The results demonstrated the usefulness of the framework in evaluating different alternatives for virtual tours. Angeloni (2022) proposed a methodological framework for the digitization of museum collections and the evaluation for their virtual experience. This framework was applied to the virtual tour of the Civic Art Gallery of Ancona using a questionnaire

and a concluding interview aimed at assessing the overall perception of the experience. The evaluation of the virtual tour user experience (UX) demonstrated effectiveness in enhancing learning and broadening audience reach.

Munilla, García, and Solanilla (2003) evaluated several virtual exhibitions in museums in Catalonia (Spain) using an approach that combined usage data analysis (such as time spent and number of visits) with visitor surveys, addressing content, aesthetics, educational value and functionality.

Resta et al. (2021) focused their study on visitor engagement in virtual tours of the Troy Archaeological Museum (Turkey). Their evaluation was based on online surveys and interviews that assessed spatial representation, interaction with artifacts and ease of use of the platform. The virtual tour tested was a digital twin of the museum, navigated through a traditional online interface that included ground-level hotspots and object tags for interaction. The findings indicated that the shift of museums to digital environments has fostered new forms of cultural communication and participation. However, the authors noted that there is still no robust metric for evaluating online visits, underscoring the need to develop specific indicators in this field.

Finally, Sylaiou et al. (2024) conducted an extensive analysis of evaluation methods and metrics for virtual exhibitions in User-Centered Design as per two major categories identified by Kabassi (2017): empirical methods (based on user experience) and inspection methods (conducted by experts), that are often combined. Among the most used techniques, Nielsen's heuristics were prominent within the inspection category, while in the empirical category, the most widely applied tool for assessing user experience was the User Experience Questionnaire (UEQ) developed by Laugwitz, Held, and Schrepp (2008). In terms of metrics, the selection depends on technologies employed (virtual environments, as opposed to websites) or evaluation methods. However, authors identified key factors affecting the virtual experience, such as navigability, interactivity, usability, perceived immersion, and entertainment. Moreover, they highlighted a lack of evaluation regarding the educational impact of digital resources, emphasizing the need to design specific metrics to assess their contribution to learning.

3. Objectives

The general objective is to determine the online reach of the virtual exhibition 'The Library of the Lady of Elche' [La Biblioteca de la Dama de Elche], based on the bibliographic collection of the Library of the National Archaeological Museum of Spain. This will be achieved through the proposal of a methodological framework adapted to the specific characteristics and goals of the exhibition for the purpose of impact measurement.

The following specific objectives have been established:
- To set the context for the virtual exhibition project 'The Library of the Lady of Elche' [La Biblioteca de la Dama de Elche].
- To develop a methodological framework for comprehensive impact assessment of the exhibition, through the definition of value lenses and indicators.
- To measure the online impact of the exhibition based on the digital dissemination strategies implemented.

4. Methodology

The methodology developed to achieve the objectives was structured in a series of phases aligned with the specific characteristics and implementation process of the virtual exhibition. Drawing on the background literature and existing theoretical models for cultural impact assessment, recommendations were adapted to a specific context by combining the framework for developing virtual exhibitions proposed by Arquero-Avilés, Marco-Cuenca, and Cobo-Serrano (2023) with the guidelines of the Europeana Impact Playbook, particularly the modules on Impact Design and Impact Measurement (Figure 1).

In the first phase, in accordance with the Impact Design module, the exhibition planning process involved the definition of objectives, stakeholders, expected impact types and their associated value lenses. This impact design phase is critical to ensure that the planned actions are aligned both with the project's objectives and with the needs and expectations of the identified stakeholders. This alignment supports the development of effective impact strategies and ensures that the outcomes are meaningful and measurable. Accordingly, the specific objectives of the virtual exhibition were clearly defined,

establishing what the initiative aimed to achieve in terms of accessibility, heritage dissemination, knowledge generation and audience engagement. At the same time, the main stakeholders (the groups that would benefit from the virtual exhibition) were identified. Understanding their interests and needs made it possible to design targeted actions and communication strategies. This phase also required a clear definition of the intended types of impact and the specific value lenses to be assessed, in line with the overall goals of the project. These elements (objectives, stakeholders, impact types and value lenses) laid the groundwork for the subsequent definition of indicators and evaluation methods, as guided by the Impact Measurement module. In this way, the impact planning process not only focuses on assessing results but also enables a structured strategy from the outset to maximise the effectiveness and reach of the virtual exhibition across different sectors.

After the exhibition was officially launched in September 2022, the project entered its dissemination phase. The dissemination plan was designed around strategies aimed at enhancing the visibility of the exhibition, in line with the previously defined elements (objectives, stakeholders, impact types and value lenses). These strategies primarily involved the production of content related to the exhibition and participation in both academic and public engagement events, as well as the use of digital platforms (web pages, the general social media platform X and the academic platform ResearchGate). The specific dissemination tasks, especially those related to digital environments, were selected to facilitate the collection of metrics and data relevant to online impact. The implementation of the dissemination plan began in early 2023 and, as the project is ongoing, remains active at the time of writing.

The impact measurement phase is intended to ensure that evaluation is based on reliable evidence and verifiable data, allowing well-founded conclusions about the success of the initiative and identifying areas for improvement. A fundamental aspect of this phase is the creation of indicators that allow the effective measurement of the expected outcomes. In line with the Impact Measurement module, metrics were defined to capture the changes or benefits generated for stakeholders, ensuring that these were measurable and relevant to the project's goals. The

selection of metrics was informed by a review of existing value lenses and indicators in the reference models and other related studies cited in the background of this paper. Based on that review, we selected, adapted or developed specific impact assessment indicators for the exhibition 'The Library of the Lady of Elche' [La Biblioteca de la Dama de Elche]. Additionally, the most appropriate methods for data collection were identified, selecting tools and techniques to support the evaluation process. These methods include surveys, interviews, web analytics, usage statistics, focus groups and other qualitative or quantitative approaches, depending on the nature of the impact being assessed.

The integration and direct alignment of the elements defined across these phases (objectives, stakeholders, impact types, value lenses, indicators, and methods) constitute the foundation for the development of a robust methodological framework. This framework supports the design and application of specific methods and strategies that enable effective and context-sensitive impact evaluation.

It is important to note that it is not feasible to measure all possible outcomes for every stakeholder, or at least not simultaneously. Therefore, one of the goals of this phase is to determine which perspectives and value lenses are most relevant to evaluate, prioritising those stakeholders or aspects for which assessment is more significant or informative. In accordance with this principle and the specific aims of the project behind the development of the virtual exhibition, the decision was made to prioritise online impact, drawing on the data generated through the dissemination strategies implemented.
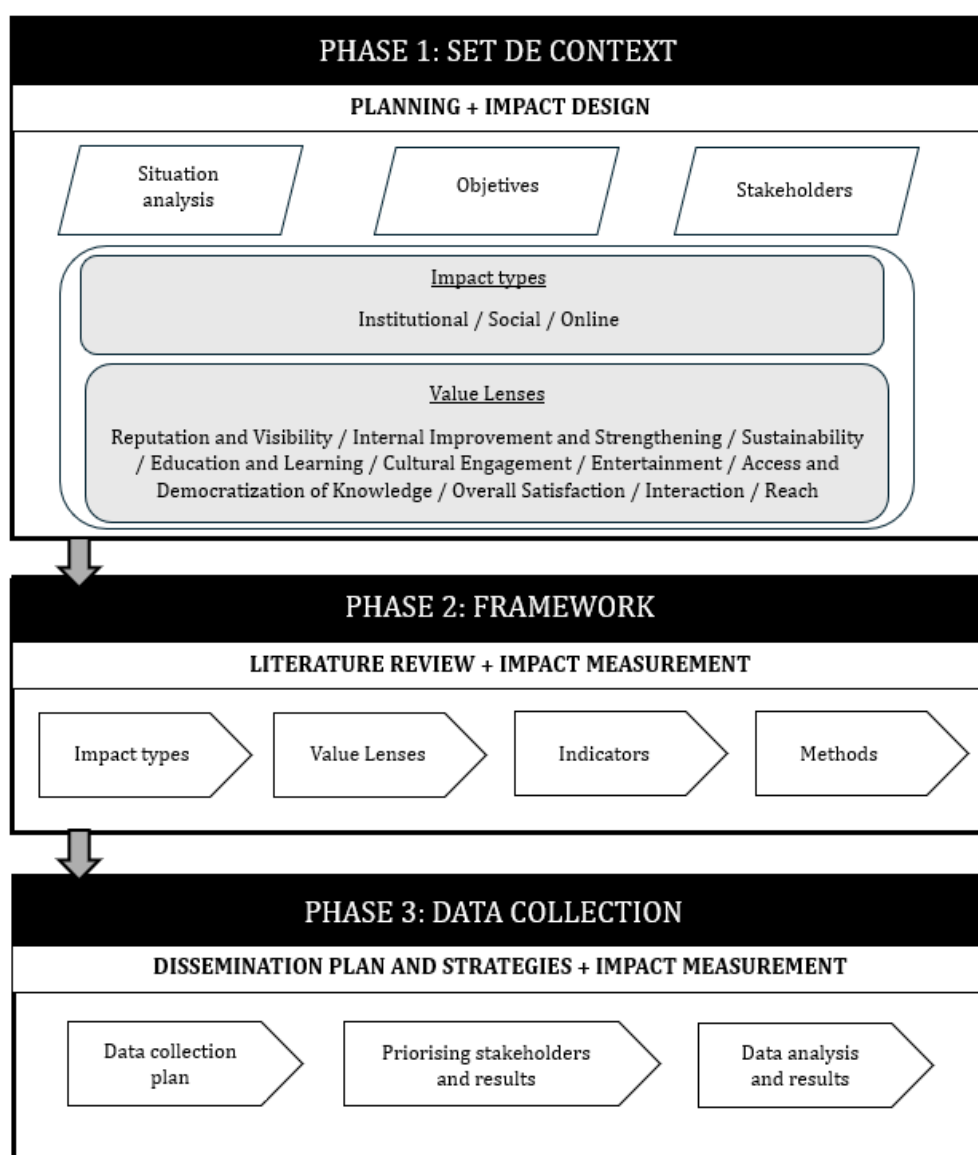

Fig. 1: Approach to develop exhibition impact assessment

5. Results

5.1 Context setting of the exhibition 'The Library of the Lady of Elche': objectives, stakeholders and value lenses

The initial concept and purpose of the virtual exhibition[1] was the commemoration of the 125th anniversary of the discovery of the Lady of Elche, using as its core the specialised collection held by the Library of the National Archaeological Museum of Spain (MAN) and the Network of Museum Libraries (BIMUS).

The curation and development of the exhibition were based on the identification, collection, systematisation and documentary analysis of bibliographic and archival materials from the MAN Library related to the Lady of Elche, on this anniversary. The exhibition content was organised into five thematic sections around the narrative thread (Lady of Elche, Iberians, Other Iberian Pieces, Materials and Reuse).

The Reuse section presents a set of materials including a series of interpretive panels arranged in chronological order, reflecting key stages and milestones in the historical trajectory of the Lady of Elche.

In terms of technological infrastructure, this project promotes the use of open-source software and low-code/no-code platforms, encouraging the reuse of resources under Creative Commons licences. Initially, the exhibition was implemented through a web-based interface (Figure 2) using Omeka, an open-source publishing platform designed for building digital exhibitions and sharing digital collections.

Fig. 2: Web interface and main page of the exhibition

Subsequently, a virtual environment was created (Figure 3) using Spatial.io[2], a platform designed to create unique and customized spaces through virtual reality. This software offers immersive environments that users can access via their avatars and interact with both objects and other users from around the world in real time, enhancing the sense of presence and engagement. Additionally, the platform supports access from a variety of devices, which broadens its usability and makes it more accessible to diverse audiences. The conceptual foundation underlying the creation of this virtual exhibition is the ambition to provide an inclusive space within the metaverse, promoting inclusive dissemination of the institution's bibliographic heritage by exploring innovative and accessible means of communication. This objective is pursued by adapting the content into easy-to-read formats. The new virtual exhibition has been conceived as a parallel, complementary space in which the materials placed at the disposal of the whole public are employed to invite users to learn about this centre of interest in a didactic and inclusive manner (Olmedo-Pagés, & Arquero-Avilés, 2024)[3].

The aim of developing a virtual exhibition on this thematic focus area was to promote the dissemination and visibility of the bibliographic and documentary collection through the Internet, thereby connecting the Library of the National Archaeological Museum of Spain (MAN) with broader audiences. The exhibition is thus conceived as a showcase to promote and highlight this thematic focus and its associated collection, with the intention of increasing its visibility and impact both in society at large and within the educational domain. Accordingly, the following specific objectives were defined:

- To raise awareness of the bibliographic heritage held by the Library of the National Archaeological Museum.
- To promote the library itself as an institution.
- To facilitate access to the bibliographic resources related to the Lady of Elche.
- To enhance public knowledge and education on the subject matter.
- To inspire other communities to develop dissemination projects related to bibliographic and cultural heritage.

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[1] Available online: https://expoidealab.es/s/biblioteca-dama-de-elche

[2] Available online: http://bit.ly/4n8NoEI

[3] A more comprehensive description of the exhibition's features can be found in previously cited studies: Olmedo-Pagés, & Arquero-Avilés, 2024 and Arquero-Avilés, Marco-Cuenca, & Cobo-Serrano, 2023

Fig. 3: Virtual space of the exhibition

Based on these objectives, the main stakeholder groups and target audiences were identified:

- The GLAM institution involved (MAN Library).
- The academic and scientific community.
- GLAM sector professionals.
- University students.
- Teachers.
- Schoolchildren.
- General public and citizens.

Based on the stakeholder analysis, we identified key areas of focus using the strategic perspectives and value lenses framework proposed in the Europeana Impact Playbook. Mapping the relationships between impact types, value lenses and user segments allowed for a deeper understanding of the stakeholders and their surrounding interrelationships. As a result, user segments were linked to the specific values they receive.

The impact types (social, institutional and online) were matched with ten value lenses, which guided the definition of specific assessment activities aligned with the core changes and benefits intended to be measured. These ten value lenses are defined as follows:

a) Reputation and Visibility: the public recognition and positive perception achieved by the GLAM institution because of the virtual exhibition. This lens assesses how the initiative helps position the institution as a cultural reference and enhances its presence in both digital and traditional media.

b) Internal Improvement and Strengthening: the internal changes that improve efficiency, services or staff satisfaction, thereby contributing to the institution's core mission and objectives.

c) Sustainability: the institution's ability to attract funding, qualified human resources or strategic partnerships, ensuring long-term viability and social contribution.

d) Education and Learning: the capacity of the project to facilitate learning processes and the value generated through knowledge transfer, skill development and critical thinking stimulation.

e) Cultural Engagement: the extent to which the exhibition fosters interest, participation and connection with cultural heritage. This lens encompasses the stimulation of curiosity, a strengthened sense of cultural belonging and active public involvement as observers, creators or mediators.

f) Entertainment: the exhibition's ability to provide an enjoyable, playful or emotionally engaging experience. It explores how entertainment enhances interest in content, aids message retention and fosters connection with diverse audiences.

g) Access and Democratization of Knowledge: the contribution to reducing geographic, economic, cognitive or technological barriers to cultural heritage. This lens assesses how the project promotes equity and openness, encouraging a more inclusive and participatory cultural landscape.

h) Overall Satisfaction: the user's general perception of the exhibition experience, including the fulfilment of expectations and the perceived value. It provides a holistic view of both the emotional and functional impact of the project from the visitor's perspective.

i) Interaction: the degree of user engagement and interaction with the exhibition and its content.

j) Reach: the number of individuals exposed to the exhibition's informational and promotional content.

Table 1 shows the intersections between user segments and the associated values or benefits.

This visual representation enables the construction of a clear benefit narrative from the outset, facilitating a more structured understanding of impact based on user profiles and expected value outcomes.

Tab. 1: Stakeholders and related outcomes

VALUE LENSES	STAKEHOLDERS						
	GLAM institution	Scientific and academic community	GLAM sector professionals	University students	Teachers	Schoolchildren	General public and citizens
Reputation and visibility	x						
Internal improvement and strengthening	x						
Sustainability	x						
Education and learning		x	x	x	x	x	x
Cultural engagement				x		x	x
Entertainment				x		x	x
Access and democratization of knowledge				x		x	x
Overall satisfaction		x	x	x	x	x	x
Interaction		x	x	x	x	x	x
Reach		x	x	x	x	x	x

5.2 Developing indicators

Following the approach of Fukuyama and Tanner (2022), an indicator is defined as a piece of information that conveys something useful, specifically, a measure of a state or trend under certain conditions, rather than an absolute value. Based on the identified context, we determined which elements should be considered indicators of success. In this regard, indicators should be understood as guiding tools for designing the most appropriate methods, questions and metrics to evaluate the values being measured. They serve, therefore, as evidence that demonstrates the extent to which success criteria are being met.

Table 2 links the different impact types with the ten value lenses in order to guide the

evaluation towards specific tasks that reflect the core values intended to be measured. This framework enables a more accurate analysis of how, and to what extent, those benefits are realised in the context of the exhibition.

5.3 Online Reach of the exhibition 'The Library of Lady of Elche'

The measurement of online reach is directly related to the dissemination phase of the virtual exhibition itself, as the appropriate selection of strategies linked to the digital context enables the collection of data on the number of people exposed to the exhibition's informational and promotional content.

Tab. 2: Impact assessment indicators list

VALUE LENSES	INDICATORS	METHODS
INSTITUTIONAL IMPACT		
Reputation and visibility of the GLAM institution	Increase in website traffic.	Web analytics.
	Growth in mentions of the institution across social media platforms, blogs, news outlets and specialized media.	Traceability of traditional and alternative metrics to track mentions (e.g., altmetrics aggregators such as Altmetric). Monitoring of interactions and external feedback on social media.
	Increase in the number of academic citations or references related to the exhibition/materials.	
	Influence on public perception.	Surveys.
Internal improvement and strengthening	Skills developed by staff during the creation of the exhibition (e.g., training in digital tools).	Internal staff surveys. Evaluations of learning processes and project development.
	Enhanced institutional capacity to develop similar projects in the future.	
	Impact on staff well-being and engagement.	
	Contribution to the achievement of institutional goals and objectives.	Mixed-methods data analysis supported by management and monitoring reports.
	Increase in digitized and openly accessible materials.	
Sustainability	Contribution to the Sustainable Development Goals (SDGs).	
	Capacity to attract funding.	
	Collaborations or partnerships generated because of the exhibition.	
SOCIAL IMPACT		
Education and learning	Learning about the exhibition's subject matter.	Combination of methods to obtain quantitative and qualitative feedback: Surveys Interviews Focus groups Observation User logs
	Comprehension and clarity of the materials and narrative.	
	Inspiration and usefulness for diverse audiences (e.g., cultural professionals and institutions, university students, etc.).	
	Reuse as an educational tool.	
Cultural engagement	Curiosity or interest in cultural heritage.	
	Participation in other related cultural activities.	
	Intention to seek more information on the subject or related exhibitions.	
	Intention to access additional materials in the catalogue.	
Entertainment	Enjoyment of the experience.	
	Emotional engagement.	
	Interactions with multimedia elements.	
	Participation in gamified tasks.	
	Sense of immersion.	
Overall satisfaction	General and specific evaluation of the experience (e.g., usability, accessibility).	
	Perceived most and least valuable aspects.	
	Unmet needs or suggestions for improvement.	
	Intention to recommend (Net Promoter Score - NPS).	
	Success stories (e.g., users who reused the exhibition for research, professional, or personal projects).	
Access and democratization of knowledge	Diversity of demographic groups.	Web analytics.
	Geographical reach.	
	Downloads of materials.	

	Requests to use or reuse content in courses, workshops or conferences.	User logs, access and usage statistics.
ONLINE IMPACT		
Interaction	Number of unique visitors to the exhibition.	Web analytics. User logs, access and usage statistics.
	Time spent and interaction with the exhibition.	
	Number of digital accesses per year/month.	
	Total page views by users.	
	Unique page views.	
	Downloads.	
	Likes on social media.	Data analysis from social media and platform services.
	Shares and mentions on digital platforms.	
Reach	Views of informational pages	Web analytics. User logs, access and usage statistics.
	Traffic channel/source	
	Social media views.	Citation analysis. Data analysis from social media and platform services.
	Downloads of publications related to the exhibition.	
	Citations.	
	Number of participants in events.	

Within the framework of the research project, the dissemination plan was designed by selecting strategies to promote the exhibition according to its objectives and stakeholders. These strategies focused primarily on generating publications about the exhibition and participating in both academic and public-facing events and activities, as well as using digital platforms (websites, the general social network X and the academic social network ResearchGate). The use of digital communication and publishing channels enables the collection of specific metrics and data on the online reach of the exhibition's content.

First, information about the exhibition was published on the institutional website of the Library of the National Archaeological Museum (Spain) and, following outreach to various intermediaries, the exhibition was disseminated by relevant institutions through posts on their websites. These included the Office for the Transfer of Research Results at the Complutense University of Madrid (OTRI-UCM), the Council for Library Cooperation (Spain), the Dama Chair at the Miguel Hernández University (Spain) and Europeana Pro. This initial dissemination strategy facilitates the collection of data related to the number of views of the exhibition's informational pages using web analytics tools.

The exhibition was also promoted via the social network X, initially through the two corporate accounts directly related to the MAN Library: the profile of the National Archaeological Museum and the Museums Libraries Network (BIMUS). Other relevant institutions also shared and reposted the content through their institutional profiles, including the Directorate-General for Books, Comics and Reading at the Ministry of Culture (Spain), and the Council for Library Cooperation (Figure 4). This social media reposting enables the collection of certain metrics, such as views (the number of times a post was seen), based on data provided by the platforms.

Fig. 4: Example of exhibition dissemination via the social network X

In line with the project requirements and with the aim of increasing the visibility of the exhibition, various publications related to different aspects of the exhibition were generated. Priority was given to open access publication, whether through journal platforms or institutional

repositories. These were also shared through the academic social network ResearchGate. The combined use of these digital platforms expands the reach of the publications and facilitates the collection of data, including both traditional metrics, such as citations and downloads provided by the platforms themselves, and alternative metrics that track mentions and impact across social networks and other digital media, through tools such as Altmetrics.com.

The final strategy involved participation in academic and public outreach events and activities. The exhibition was presented at various academic conferences, both nationally and internationally, including those focused on Library and Information Science as well as other education-related fields. Examples include the iConference, the Qualitative and Quantitative Methods in Libraries International Conference (QQML), the International Conference on Lifelong Education and Leadership for All (ICLEL), the International Meetings on Information and Documentation Systems (IBERSID), and the II Bibliographic Heritage Conference of the Community of Madrid. On the outreach side, various activities related to the exhibition were organised within the framework of the Madrid Science and Innovation Week, an annual event dedicated to science communication and citizen engagement. Finally, the exhibition participated in the 'Built with Bits' programme, part of the Europeana Initiative mentoring programme and educational challenge to design beautiful and sustainable digital spaces. This participatory strategy facilitates the exhibition's reach to diverse user segments across both digital and physical environments and supports the systematic collection of quantitative data on the audiences exposed to the various contents, thereby contributing to a more precise evaluation of the impact generated.

6. Conclusions

This work demonstrates that virtual exhibitions, when designed with a structured impact strategy, can become effective tools for the dissemination and valorisation of bibliographic and documentary heritage. It confirms the importance of incorporating an impact-oriented perspective from the early stages of designing digital cultural projects.

The implementation of methodological frameworks, such as the Europeana Impact Playbook, helps guide the evaluation process towards relevant impact dimensions such as education, access, sustainability or institutional reputation, ensuring a more comprehensive and meaningful analysis. Accordingly, the adapted use of the Europeana Impact Playbook proves to be a solid methodological tool for guiding both the design and the evaluation of impact, particularly in cultural heritage dissemination projects in digital environments.

The systematic definition of objectives, target audiences, types of impact and value lenses allow for more effective strategy structuring and the selection of specific indicators that support a rigorous and contextualised evaluation of results. The definition of these elements made it possible to establish clear indicators for collecting specific online impact metrics. In the case analysed, the combination of websites, social media platforms, academic repositories and in-person events significantly expanded the virtual exhibition's reach, demonstrating the effectiveness of a planned and diversified dissemination approach.

The results obtained reinforce the need to plan projects strategically, linking actions to expected outcomes and providing clear evidence of their social, institutional and educational contributions, among others.

Finally, the experience confirms that impact measurement should not be an isolated process at the end of the project, but rather a practice integrated throughout all phases of planning, implementation and dissemination.

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