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Transforming museum management through ICT adoption: an analysis of the Portuguese context during the COVID-19 pandemic

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ABSTRACT

This study aims at analysing the development of digital co-creative strategies adopted by museums during the COVID-19 pandemic and the transformative potential of co-creative experiences with the help of digital tools to redefine the relationship between the museum and its audiences. This is exploratory research using online qualitative surveys applied to Portuguese museums during the COVID-19 pandemic for participation of virtual audiences for data collection and analysis. Results from this study contribute to managers' awareness of museum digital transformation around the world sharing similar contexts and that may want to develop the participatory approach with the support of digital technologies. Results show new avenues for the adoption and implementation of digital strategies in museum management. To the authors' knowledge, this is one of the first studies to explore the participatory museum framework combined with the development of digital strategies applied to museums following COVID-19.

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Participatory museum; co-creation; museum experience; digital technologies; COVID-19 pandemic

Highlights

- New museology demands a participatory approach to museum management.
- A participatory approach to museum management involves ICT adoption and co-creation.
- Museums' level of digital transformation is low for Portuguese museums.
- Opportunities for digital transformation were not fully taken by Portuguese museums.

Introduction

The concept of a 'participatory museum' (Simon, 2010) emerged from the transition from an object-centred to a subject-centred museology in which co-creation and ICT play a key role in reshaping museological practices. Concurrently, current museum audiences are no longer

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considered an undifferentiated mass of consumers. Instead, they are viewed as engaged interpreters and active participants in the construction of the museological discourse, as well as in the design of immersive and creative experiences (Beevor et al., 2022; Hooper-Greenhill, 2011). By focusing on audiences, museums adopt a more participatory and co-creative model of management that brings them closer to audiences.

Precisely when the first reports on the pandemic emerged internationally, the International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM) announced the theme *Digital Transformation in Heritage Institutions* for the annual conference to be held in 2020. The conference website claimed that ‘the use of digital technology, though marginal at first, has gradually reshaped documentation practices and transformed almost all aspects of museum work, sometimes even pushing institutions to deviate from traditional conceptions of what their roles should be’ (CIDOC, 2019). Hence, adoption of digital technologies is seen as a critical factor in the broader context of the changes that museums have been conceptualising and carrying out over the last few decades.

Due to its unprecedented nature, the COVID-19 pandemic has disrupted current management practices in museums, leading to new approaches to management, funding, and communication with audiences (Cadavez, 2020; Crooke, 2020; Roque, 2021). In many countries around the world, facing central governments’ decision to go into strict lockdown (UNESCO, 2020), museums had to close their doors overnight and turn towards the digital (Noehrer et al., 2021). Constraints caused by the pandemic aggravated museums’ weaknesses in this area, highlighting the urgent need of digital transformation in cultural mediation and communication.

Concerning cultural institutions, museums reacted first to the constraints imposed by lockdown measures, creating alternative channels of communication with their usual audiences, such as institutional websites (ICOM, 2020a, 2020b, 2021). Also, social media, video sharing, virtual guided tours, courses, conferences, workshops, podcasts, streaming activities, and gaming developed as alternative means of learning and entertainment which provide additional cognitive and emotional stimuli, ultimately contributing to breaking the generalised climate of anxiety and isolation caused by the pandemic (UNESCO, 2020).

This study discusses the participatory museum framework subsequent to the COVID-19 pandemic, applied to the Portuguese context. The framework builds on two critical dimensions for its successful implementation, namely the co-creation paradigm shift and ICT adoption. There are still scarce studies on ICT adoption by museums under the participatory museum framework and co-creation theory following the COVID-19 pandemic. Insights from this study may contribute to broaden awareness and discussion on the paradigm shift of the participatory museum and the role played by ICT in the process. Thus, this study’s objectives are to: (i) identify the museum’s level of digital transformation, (ii) uncover the digitally based co-creative strategies adopted by museums during the COVID-19 pandemic, (iii) analyse the use of ICT to promote visitor co-creation of the museum experience, and (iv) examine managers’ perceptions of ICT as threat or opportunity in museum management. To achieve these objectives, the structure of this article is as follows: the first section presents the literature review on new trends in museum management and experience, the co-creation paradigm, and museum digital transformation; the next section describes the study’s methodology, including description of data collection and analysis methods; the following section discusses the findings, and the last presents the conclusion, including theoretical contributions and managerial recommendations, the study’s limitations and suggestions for future research.

Literature Review

Museum digital transformation

Research on the application of ICT in museums evolved to a growing discussion about the phenomenon (Antos et al., 2017; Giaccardi, 2012) and its impact on museum discourse and communication

with audiences (Parry, 2013). ICT contributed to the reshaping of the societal role of museums, by transforming cultural offerings, attracting new audiences, and facilitating inclusiveness (Akker & Legêne, 2016; Alexander et al., 2017; Bautista, 2014; Giannini & Bowen, 2019; Wang & Lin, 2018). Although ICT are not seen as substitutes for the visit to the physical museum, they are considered beneficial to the museum experience, as they enhance interpretation of objects and provide a new range of mediation and interaction (Pujol-Tost, 2011). Some advantages of ICT adoption in museums which enhance visitor engagement are compactness, flexibility, mobility, interaction, experience immersion, spatialisation and scenarisation. In turn, investment and maintenance costs, intrusiveness, problems with exhibition design (e.g. interruption of visit path or difficult usability), leading to visitor isolation and distraction and trivialisation, spectacularisation and *Disneyfication* of the museum experience have been identified as critical disadvantages of ICT in this context (Cerquetti, 2018, p. 155).

The museum's digital strategy is a 'complex challenge that requires a complete mobilisation of all parts of the organisation, starting from the very top' (Minoska-Pavlovska, 2019, p. 158). Lack of resources, covering both human and financial, and competent leadership in managing the process are threats to effective digital transformation (Minoska-Pavlovska, 2019). In general, museums are still unable to equally benefit from cutting-edge digital technology and specialist expertise (Kamariotou et al., 2021).

Although ICT use is not homogeneous, as profound asymmetries in access to digital products are observed (Karol & Navarrete, 2017), COVID-19 contingencies caused museums to embrace digital culture as 'intrinsic to a new sense of identity and purpose' (Giannini & Bowen, 2021, p. 55).

Museums' reactions to the pandemic impacted immediately scientific production. Most studies focused on how museums responded to it through ICT (Agostino et al., 2020a, 2020b; Giannini & Bowen, 2021; Houston, 2020; Hussain, 2021; King et al., 2020; Massi & Turrini, 2020b; Noehrer et al., 2021). Much research was concentrated in Italy, as this country owns a vast cultural heritage and a high number of museums, which were, as many others around the world, severely affected by the health crisis, especially between February and May 2020 (Agostino et al., 2020a, 2020b; Cipullo, 2021; Clini & Quattrini, 2021; Fissi et al., 2021).

The use of ICT aligned with the evolution in museology. Simone et al. (2021) propose an evolutionary model of digital transformation in three stages: (1) the 'social-sleeper museum' describes museums that do not invest in technology, using it only as a substitute for traditional forms of communication and enjoyment of cultural heritage, without developing new relationships with users in a virtual environment; (2) the 'socially-oriented museum' characterises museums that invest in web services and social media to communicate daily with their followers and create an integrated audience, directing technology to the pre- or post-visit phases, but without impacting the experience of the visit itself; and (3) the 'digital museum' stage, in addition to ensuring its presence on the web and social media, explores interactive digital technologies to enhance the visit with multisensory experiences and using the *Internet of Things* (IoT) to create new interconnections and virtual environments (Simone et al., 2021, p. 326).

The *digital museum* reshapes the interaction between individuals and objects, creating a more dematerialised and easy access to museums' collections. Digital technologies allow museums to apply active methodologies, acting as mediators between heritage and audience, while the visitor is actively engaged in searching for information and interpreting the contents autonomously. It has been said that 'personalisation of learning will finally facilitate an escape from the deficit models so prevalent in educational institutions and release untold potential. And the key to personalisation lies with the sensitive use of digital technologies by museum educators' (Hawkey, 2016, p. 116). Therefore, personalisation through ICT is the crucial dimension of the learning experience of the visitor.

The processes of digitisation, representation, and reproduction of objects, as well as the storage and digital processing of data and information retrieval, are facets of the museological performance concerning preservation, interpretation and dissemination of collections. Over the past two decades, 'museums ushered in the virtual museum while establishing the digital life of the physical

museum encompassing all museum work, activities, and functions' (Giannini & Bowen, 2019, p. 10). However, the most complex applications in the field of digital technology, such as image rendering, 3D visualisation and printing, the creation of virtual reality (VR) and augmented reality (AR), holographic models, gamification, and artificial intelligence (AI) have been accepted essentially as random, piecemeal initiatives, and their generalisation is seen as a threat to the museum's identity: 'Many museum professionals and the visiting public remain sceptical, even hostile to digital applications in the museum, concerned about issues of authenticity, authority, ownership, and truthfulness of representation' (Meecham, 2013, p. 35). Resistance to digital technologies' adoption prevented museums from following the changes in society and responding to post-modern changes, breaking with established conventionalisms. While institutional struggles and constraints are related to investment costs and maintenance of hardware and software that is adequate to improve the museum experience and enhance visitor engagement and co-creation, as well as to recruiting specialised and highly skilled human resources, the main factors of resistance to change are internal. They mostly relate to staff fears of crucial changes in their habitual tasks and organisational roles, concerns towards the need of learning new digital skills, difficulties in dealing with distrust of being up to the job, and feelings of uncertainty about the future (Prudencienne et al., 2023). Despite these barriers, the digital transformation of museums is inevitable. The COVID-19 pandemic demonstrated this by forcing upon managers the use of digital resources as the only way to communicate with audiences.

The co-creation orientation in the museum experience

According to Prahalad and Ramaswamy (2004), co-creation refers to the joint process of creating value by a company and the customer during an experience, which is personalised and contextualised. Sanders and Stappers (2008) discuss co-creation as evolving into an act of collective creativity leading to innovative designs and participated solutions. This represents a change in the perspective of consumers' role in the value creating process. Consumers are now viewed as resource integrators and active participants in this process by engaging in interactive and personalised experiences with providers, using their own resources (e.g. knowledge, past experience, expertise, creativity) in the design, development and consumption of products, services, and experiences (Brodie et al., 2013; Vargo & Lusch, 2008).

A growing body of research is focusing on the relation between co-creation and the contribution of ICT in facilitating co-creative processes (Garrigos-Simon et al., 2012; Kalaiganam & Varadarajan, 2006; Zwass, 2010). The importance of ICT to consumer co-creation is increasingly being recognised, as they are seen to impact interaction in the digital sphere and augmenting the reach of community engagement. Access to information and social interaction through ICT are expanding co-creation activities and practices as never before. ICT, in addition to providing access to a deeper understanding of consumers' needs and wants, are stimulating consumer collaborative engagement by facilitating greater interaction among consumers and bi-directional communication with providers (Veeckman et al., 2013).

Digital tools provide the technological basis that enables consumers to co-create value by boosting their active participation with organisations (Kalaiganam & Varadarajan, 2006; Martínez-Cañas et al., 2016). ICT also increase experience value through personalisation of products, brands, and services, according to their own needs (Garrigos-Simon et al., 2012). Such technological advances offer new tools that consumers can use to interact, as well as incentives for creating new experiences, products, and services. The ubiquity of the Internet and ICT also help consumers to interact widely and easily with other consumers. More skilled and powerful consumers require support for new idea generation and evaluation, experience and product improvement, prototype selection and personalisation, new product feature experimentation, new product development, and information sharing (Füller, 2006).

Within the heritage and museum sector, the co-creation orientation is critical in the face of fierce competition observed in heritage, entertainment, and attraction offerings (Minkiewicz et al., 2014). Moreover, current visitors demand more than an authoritative discourse about heritage (Barron &

Leask, 2017; Beevor et al., 2022). Evidence shows they are expecting participative and immersive memorable experiences and events (Lam et al., 2013; Mijnheer & Gamble, 2019; Minkiewicz et al., 2014). Museum management is now committed to designing richer experiences that combine sensory, aesthetic, recreational, social, educational and entertainment elements, and simultaneously expanding the on-site visit to up-stream and downstream interactions and co-creative activities (Antón et al., 2017). The visitor experience at the museum has moved to the centre-stage of museum management concerns (Antón et al., 2017; Beevor et al., 2022) under a participatory perspective (Simon, 2010). Despite evidence of growing change and adaptation, museums and similar organisations are placed at different points on the co-creative experience continuum and deal with visitor active participation in different degrees. Simultaneously, visitors vary in their level of willingness to co-create with museums and even in the type of co-creative activity they are willing to participate in (Lam et al., 2013).

Reshaping museums during and after COVID-19

The COVID-19 pandemic induced a process of digital acceleration and changed the attitudes of museum managers and professionals concerning ICT (Barrutia & Echebarria, 2021). It stimulated museums to use ICT and social media, using new communication formats to maintain the connection with regular users and attract new audiences through remote access (Agostino et al., 2020a; Clini & Quattrini, 2021).

According to the UNESCO report (2020), in the first half of 2020, approximately 90% of museums worldwide were forced to close their doors. Many museums started to offer online exhibitions, virtual tours, webinars, and online learning programmes (UNESCO, 2020). ICOM (2020b, 2020c, 2021) and NEMO (2020, 2021) reported that most of the strategies developed by museums during the crisis involved digitally-based activities. The institutions that invested most heavily in digital activities before the pandemic were the most successful with virtual audiences (NEMO, 2020); those that had not been able to make the same type of investment faced a 'creative and technological gap' (UNESCO, 2020, p. 18), i.e. faced the risk of digital exclusion.

Until 2020, museums were characterised by the 'experience of distancing' (Ebbrecht-Hartmann, 2020, p. 1096). However, their immediate reaction to lockdown was to increase communication through social media to get closer to audiences (Clini & Quattrini, 2021) and 'The success of the digital communication of museums in time of lockdown has confirmed that museums have credibility and reputation. They may be a driving social reference for citizens in time of uncertainty, fake news, and information overload' (Garlandini, 2021, p. 13). Furthermore, the pandemic demonstrated the fundamental importance of digitisation, although in most cases it has simply accelerated a transition that was already in process.

Before the global health crisis, communication was mainly unidirectional due to the museum's weak involvement in dialogue with visitors (Camarero et al., 2018). During lockdowns, museum staff became more available to respond to users, and interacted more with them by reinforcing virtual communication: 'The strengthening of communication through SM [social media] has led to an increase in both strategic and organisational investment that will make it possible to support digital communication when the pandemic ends' (Fissi et al., 2021, p. 13).

In addition to managerial and procedural implications, the pandemic crisis led to a revised definition of 'museum,' according to which museums are no longer considered the guardians of heritage but hybrid platforms, both physical and virtual, where audiences and cultural actors interact and perform new roles (Massi & Turrini, 2020a).

The pandemic acted as a trigger for the rise of interactions that were hitherto unlikely or even unfeasible due to physical, social, or cultural distance, confirming the need for critical reflection about the new and complex systems of relationships built between the museum, the community, and the dispersed and fluctuating audiences. Thus, the new museum paradigm necessarily includes digital technologies, new models of management, and heritage curation and mediation.

Methods

To thoroughly understand the inside perspective on ICT transformation and co-creation in museums, this study develops exploratory research under a constructivist paradigm. Qualitative methods are adequate for this study, as it concerns understanding of social phenomena through participants' voices, perspectives and meanings (O'Brien et al., 2014). Online surveys can be designed and used as a qualitative research tool (Braun et al., 2020; Regmi et al., 2016). They are a rather new method for data collection for which there is still scarce literature, however, that promise new understandings of social issues by being open and flexible (Braun et al., 2020). Online qualitative surveys combine (1) digital tools and platforms, (2) the capturing of broad and diverse data, (3) the depth of data analysis, and (4) questionnaire structure with benefits for both researchers and participants, including unobtrusiveness and participant control. In this study, online qualitative surveys were conducted to museum managers and used for the analysis of co-creative strategies implemented by Portuguese museums during the COVID-19 pandemic for participation of virtual audiences.

Participants

This study used a purposive sample, considered an adequate option to analyse a population with characteristics that contribute to achieve the research's objectives, and which may deliver in-depth information on the researched topic (Palinkas et al., 2015). Museum managers were considered in the best position to provide rich information on museums' digital transformation and change during the pandemic. A balanced combination of criteria included heterogeneous variables in order to capture the diversity of Portuguese museums, as well as the various perspectives of managers (Braun et al., 2020). The combination considered the following characteristics: ownership (public *versus* private), collection type (art, history, science, and religion), and type of ownership administration (national, municipal, foundation, association, ecclesiastical). Based on the criteria selected, six museums were selected for this exploratory study (Table 1). The sample mirrors the wider picture of existing Portuguese museums, and included three public and three private museums, three Art museums, and one History museum, one Science museum and one religious collection museum, two museums with local (or municipal) administration and one of another type of administration, including national, private association, foundation and ecclesiastical administration. The sample was recruited from the museums which had accomplished a relevant and continuous virtual activity during the lockdowns. Contact with the managers of the selected museums took place through email correspondence exchanged with the researchers. From these contacts, acceptance to participate in the study ensued. Additionally, the emails included a brief description and definition of the three stages of the evolutionary model of digital transformation, as proposed by Simone et al. (2021).

Data collection methods and analysis

Data collection aimed at uncovering how museums communicated with audiences during the two lockdowns in Portugal. The first lockdown occurred from March 15th to May 17th, 2020. The

Table 1. Participant museums main characteristics.

Museum code	Ownership	Collection types	Type of ownership administration
1NMCA	Public	Art	National
2LM	Public	History	Municipal
3PM	Private	Science	Association
4CGM	Private	Art	Foundation
5NRM	Public	Art	Municipal
6MRAF	Private	Religion	Ecclesiastical

Source: Authors' own.

second lockdown took place from January 15th to March 5th, 2021. During those two periods, museums were closed and communication with audiences continued through museums' websites and diverse social media.

Qualitative online surveys were conducted to museum directors during April 2022. Firstly, participants were directly and personally invited by one of the researchers to participate in the study and after communication of informed consent, questions were sent via email. The survey is composed of three open-ended questions and one close-ended question. Open-ended questions were used to allow deep probing into the participants' answers, gaining rich information about topics under discussion (Braun et al., 2020). These included (1) perception of the museum stage in the evolutionary model of digital transformation (the 'social sleeper museum,' the 'socially oriented museum' and the 'digital museum'), as proposed by Simone et al. (2021), (2) clarification of digital activities developed by the museum during the two lockdowns to attract and to retain visitors, and (3) perception of digital technologies benefits and threats concerning museum management. The close-ended question asked managers to identify the digital technologies currently in use and expected developments in the next 2 years. Table 2 shows literature sources for the questions used in the surveys, crossing each question with authors from the literature.

Analysis of open-ended questions was conducted according to several procedures in order to meet research reliability and validity criteria (Golden-Biddle & Locke, 1993; Morse et al., 2002). Thus, the six surveys collected were first assigned a code and subsequently inspected separately. Analysis progressed deductively and reflexively taking into consideration the study's themes (level of digital transformation; activities; digital tools and opportunities/threats of digital transformation to museums) and was supported by 'vivid and compelling excerpts from participants' responses' (Braun et al., 2020, p. 10). Analysis was conducted manually, i.e. no use of software was employed in this process. Subsequently, researchers jointly checked, analysed and discussed the data. *Verbatim* quotes are included in the report to emphasise the most relevant findings. Results obtained from the close-ended question are shown below in Table 4. Additional data collected from museums' websites were considered and included in this analysis.

Results

Museums' level of digital transformation

Despite tentative digitally-based tools and initiatives, managers perceive museums as socially-oriented museums, if not social-sleeper museums [INMCA]. For most of them, prior to the pandemic, organisational websites were already in use to disseminate activities (Table 3). Some claim

Table 2. Questions and literature sources.

Questions	Authors
1. Simone et al.'s (2021) evolutionary model of digital transformation argues the existence of three levels: the 'social sleeper museum,' the 'socially oriented museum' and the 'digital museum.' Which of these levels do you believe your museum is on and why? If possible, give a practical example to justify your answer.	Simone et al. (2021)
2. What digital activities have your museum developed during the two lockdowns to attract and to retain visitors?	Holcombe-James (2021) ICOM (2020b, 2020c, 2021) NEMO (2020, 2021) UNESCO, 2020
3. There are currently a number of new digital technologies that promote the co-creation of experiences with your visitors. From the list presented, indicate which ICT your museum currently uses, on the one hand, and, on the other hand, those you plan to use within 2 years (mark with an X)	Lam et al. (2013) Simon (2010) Marzano and Castellini (2022)
4. Do you believe that the aforementioned tools are an opportunity or a threat for museums? Why?	Akker and Legêne (2016) Cobley et al. (2020) Meecham (2013)

Source: Authors' own.

Table 3. Museum digital platforms.

Museum	Website URL	YouTube	Facebook	Twitter	TripAdvisor	Instagram	Linkedln
1NMCA	http://www.museuartecontemporanea.gov.pt	×	×	×			
2LM	https://museudelisboa.pt/pt	×	×	×	×	×	
3PM	https://www.museudafarmacia.pt	×	×	×		×	×
4CGM	https://gulbenkian.pt/museu/	×	×	×		×	×
5NRM	http://www.museudoneorealismo.pt	×	×				
6MRAF	http://www.masf.pt/homepage.html		×				

Source: Museums’ websites.

that the digital paradigm extended to adoption and implementation of catalogue and collection inventory.

The director of the 4CGM challenges the proposed model of museum technological evolution, however, s(he) considers that the museum falls into the stage of the socially-oriented museum because it adopts

a steady strategy of capture of digital audiences without compromising visitors’ physical experience at the museum which will always emphasise the direct contact with the art pieces in display; thus digital mediation is made available with parsimony and using portable hardware. [4CGM]

Furthermore, they goes on to say that

neither VR nor the multi-sensory experience are an aim *per se*. Their use, currently under analysis, will always be closely linked to the knowledge the museum aspires to disseminate about the work of art, the collection, or the art collector. [4CGM]

The 2LM uses, since 2011, a digital interpretive tool linked to the permanent collection about Lisbon prior to the 1755 earthquake. From 2017 on, this museum created its *Facebook* and *Instagram* pages, regularly creating content to disseminate activities concerning the different areas of interest. The 2LM websites comprise audio-visual materials and digital interpretive tools available to visitors and some of this museum’s collections are supported by 3D animation, which highlight

Table 4. ICT currently in use by museums and expected development in the near future.

Digital tools	Utilisation	1NMCA	2LM	3PM	4CGM	5NRM	6MRAF
Online Exhibitions	Now	×	×	×	×		×
	In 2 years	***					***
Virtual Tours	Now		×	×			
	In 2 years		×				
Webinars	Now						×
	In 2 years						
Online Learning Programmes	Now						
	In 2 years						×
3D Visualisation and Printing	Now		×	*			
	In 2 years		×	*			
Augmented Reality	Now						
	In 2 years		×	**			
Virtual Reality	Now						
	In 2 years		×	**			×
Holographic Models	Now						
	In 2 years						
Artificial Intelligence	Now						
	In 2 years						

Source: Authors’ own adapted from Marzano and Castellini (2022).

* The use of 3D printing has only been used in the presence of objects for exhibition and mediation activities, but without a co-creation component with the audience.

** Functionalities foreseen in the plan to create digital mobile ‘audio guides’ for all spaces in the museum, as soon as this is achievable.

*** Through the Google Art Project.

the importance of their geographical and historical context. Also, some areas of the museum use QR codes that connect *in-loco* visitors to the museum's website, providing easy access to additional information on location, collections, and items. Despite this, the director claims that the socially-oriented museum level fits the 2LM, because

the digital elements that can be seen and used in our permanent exhibitions, even though contributing to enhancing the visitor experience, are sporadic. [2LM]

The 3PM director considers that the museum currently falls between the 'social sleeper museum' and the 'socially oriented museum' stages but 'definitely not in stage 3' [the digital museum]. The director states that digital technologies have changed the traditional way of communicating with audiences, by allowing museums to emancipate from mass media control, as communication between parties (organisations and visitors) may run freely in both directions, overcoming time and space constraints. Moreover, by relying on digital tools, the 3PM has been able to enhance the visitor experience by developing content with surprising and appealing design and elements. According to the 3PM director, this has been done with e.g. exhibitions starring the famous mystery murder writer Agatha Christie.

Social media pages, such as *Facebook* and *Instagram*, are considered important channels to strengthen museums' interaction with visitors because they too are used to disseminate collections and activities, provide visitors access to virtual exhibitions, and collect visitor information before and after the visit. However, the digital divide is a reality, as not all museums adapt at the same pace to the digital paradigm, and imbalances and deficiencies are still found in many areas that are critical to fully engage with visitors. This may explain why the 6MRAF director said the museum is 'socially-oriented,' highlighting that

the website is under revision so that more interactive tools can be added to it that facilitate closer contact with users and prospective visitors, to communicate both the history and heritage of collections and temporary events occurring in physical and digital space. [6MRAF]

The 1NMCA director reported that the museum faces many different types of difficulties, ranging from financial to technological. This has been linked to the museum's poor performance in terms of adherence to the digital paradigm. Up to now, the 1NMCA does not provide wireless network service, preventing many activities to occur, such as online events, and not being digitally connected is believed a barrier to effective database building and knowledge creation on visitor profile. Although social media activity mitigates these limitations, the website's lack of interactivity prevents dynamic utilisation by current and potential visitors. Social media 'are used to share information about collections and educational services events.' For this reason, this director perceives the museum as lying in between the stages of 'social sleeper museum' and the 'socially oriented museum.'

The COVID-19 pandemic accelerated the digital transformation of museums. Directors generally recognise that digital content production increased and diversified during the lockdowns, and social media (mainly *Facebook* and *Instagram*), digital channels and sites (*Youtube* and *LinkedIn*) were critical to facilitate access to collections and synchronous activities. *Facebook* is the social media platform common to these museums, although digital presence on *Youtube* is equally relevant (Table 3).

Digitally-based co-creative strategies adopted by museums during the COVID-19 pandemic

Most common digitally-based activities carried out during the lockdowns were guided tours and exhibitions, live and recorded, webinars, conferences, talks, interviews and educational workshops, documentaries, and text and video production. The digital space was seen to stimulate and incorporate visitor participation through the sharing of 'micro-narratives and personal meaningful items,' as stated by the 6MRAF director. The 2LM director reported that the museum

recreated itself digitally since the first lockdown, since March 2020. The urgency in communicating with its audiences, connecting with people of different ages, means of living and places of residence through content related to the history of Lisbon led to production of diverse digital content on a daily basis during the first lockdown. [2LM]

This director said that in addition to talks and discussion on exhibition content, the museum conducted interviews to staff members for sharing behind-the-scenes activity and stories on museum-related professions. As the 2LM spreads throughout the city, video production emphasised the many areas of Lisbon closely related to key events and local heritage. *Facebook* and *Instagram* were used to share video content with different degrees of interactivity and visitor participation, as well as recurrence. Some activities were one-off, while others took place regularly. Of all museums analysed, the 2LM provided the longest list of digitally-based activities.

Soon after the start of the first lockdown, the 1NMCA created the 'Small Stuff Diary,' an activity inspired in the exhibition on the Portuguese painter Sarah Afonso, that collected on a daily basis a variety of content using different media formats, to communicate information on the museum, the neighbourhood, but also the museum's team, research projects, movies and art collections. This was done

still in a daze with a distance we had never experienced before, thus our activities' program was designed to keep our visitors in contact with the museum, providing them all the comfort and inspiration we could.

For 1NMCA, the second lockdown brought great changes in the team's mindset and attitude, this time having faced lockdown positively. In fact, this time, activities revolved around another diary, called 'the Diary of Daily Dilemmas,' based on the exhibition 'The Dilemma of Being and Appearing' which was centred on painting, photography and sculpture of the late 1800s. Content varied between text production on personal stories on art pieces, art history, and the museum's history, but also talks on portrait painting, movies, jigsaw puzzles and quizzes.

The 4CGM director said that the activities proposed during the lockdowns were 'highly participated' and included

digital contents accessible on the website (Creative tutorials, animation, storytelling), online events (*Facebook*), social media content (*Facebook*, *Instagram*, *YouTube*), and a 360° tour. [4CGM]

Current and expected future development of ICT to promote visitor co-creation of the museum experience

Table 4 shows museums' current use of digital technologies and expected use in the future as a result of adaptation to closures during the pandemic. The directors of museums 4CGM and 5NRM reported that no ICT are in use nor that they will be included in a future strategy to stimulate visitor co-creation of the museum experience. Despite that, online exhibitions are the activity most used by museums. The 2LM leads ICT adoption, assumedly because management is aware of the technological options for the future. Virtual tours are recognised as digitally-based activities to be further developed.

ICT tools: an opportunity or a threat to museums?

Participants were unanimous in the idea that digital tools are not an end but a means to

serve the museum's operations and functionalities, such as research, archives, exhibitions, collection dissemination, as well as design of creative and diversified cultural mediation programs [2LM].

A cautionary attitude towards ICT was expressed by some participants. To them, 'all that is invented can be used to do good or harm' [1NMCA], thus digital tools can be a threat 'if museologists don't incorporate them to their benefit' [3PM]. As such, they are seen as an opportunity as long as they contribute to improve communication efficiency and capture audience attention,

allowing a deeper understanding and interpretation of heritage and the stories behind them. A participant emphasised the important role of ICT in eliciting visitors' emotions through enhancement of 'the soul' of the items displayed in exhibitions [3PM]. And another one said that

they support interactive ways of connecting with collections and narratives, satisfying varied objectives and demands, both in the museum's perspective (by aiding in the performance of its functions of researching, curating and communicating), and in the audiences' point of view, whether researchers, students or tourists. [6MRAF]

However, museums will not be able to extract the full potential from ICT if adoption and digital content is not aligned with a global strategy which harmonises the museum's mission, values, and objectives. Virtual collections and activities do not replace the physical dimension of the museum experience, something that has been emphasised by one participant that said:

after the pandemic, we could see how eager people were to come to the museum and personally get in touch with the physical original items [3PM].

Discussion

Museums in Portugal have taken slight advantage of COVID-19 and lockdowns to develop a relationship with visitors through ICT (Cadavez, 2020; Roque, 2021), corresponding to the general trend pinpointed in the literature published during lockdowns or immediately after (Agostino et al., 2020a, 2020b; Crooke, 2020; Giannini & Bowen, 2021; Houston, 2020; Hussain, 2021; King et al., 2020; Massi & Turrini, 2020b; Noehrer et al., 2021). Whilst the pandemic accelerated the digital transformation of heritage institutions in the short-term during lockdowns, as experienced, for instance, by Italian museums which faced a harder pandemic context (Agostino et al., 2020a, 2020b; Cipullo, 2021; Fissi et al., 2021), these exceptional circumstances have not significantly changed Portuguese museums when they reopened their doors as they had not previously set ICT policies nor implemented digital strategies.

Portuguese museums are described as 'social-sleeper' or 'socially-oriented,' according to Simone et al.'s (2021) model, which places them behind European and American museums in the digital transformation process, while Noehrer et al. (2021) consider that this is crucial 'to ensure the sustainability of museums and their capacity to deliver social mission and public benefit on-site and online in the future' (p. 9). In response to objective (i), Portuguese museums present a low level of digital transformation compared to similar institutions in Europe and the United States, as informed by the literature review.

During the lockdowns, museums were compelled to use ICT and social media (Agostino et al., 2020a; Clini & Quattrini, 2021) to maintain communication with audiences (Barrutia & Echebarria, 2021). This phenomenon was confirmed by UNESCO (2020), ICOM (2020b, 2020c, 2021), and NEMO (2020, 2021) reports. Likewise, Portuguese museums created digital content to sustain communication with their audiences through social media, in line with most museums worldwide. However, despite some innovative experiments calling for audience participation, Portuguese museums were seen to use ICT in a minor role, limited to the conversion of analogue information to digital. In correspondence to objective (ii), imbalances in the digital activities developed during the lockdowns have been observed, ranging from rudimentary to creative and complex, in some cases showing museums' lack of technical expertise and skilled human resources, in other cases, a preceding consolidated digital infrastructure. Studies focusing on the Portuguese museum landscape (e.g. Carvalho, 2022) have uncovered asymmetries in other critical dimensions of museum management, such as government policies and leadership. Taken together, these asymmetries compromise museums' swift adoption of ICT in the long term.

Despite this, ICT are generally recognised as an appropriate instrument to promote visitors' co-creation (Antón et al., 2017; Beevor et al., 2022; Minkiewicz et al., 2014) in a participatory environment, seen to enhance the visitor experience in museological contexts (Simon, 2010). In alignment

with digital transformation processes (Lam et al., 2013), it was expected that there would be a change in museum managers' and professionals' vision and attitudes towards ICT, especially when facing the global health crisis. Choi and Junic (2021) observed that 'museums should focus on managing the co-creation of value in the first place, because it is one of the most effective solutions for their sustainable development amidst the challenges in the COVID-19 epoch and thereafter' (p. 14). These considerations inspired this study's objective (iii), but results obtained from this research somehow contradict them, since ICT use and implementation of co-creative activities after COVID-19 are similar to those offered to audiences during the pandemic. In fact, ICT strategies are incipient in Portuguese museums and mostly limited to virtual visits to the physical environments of exhibitions and collections. Moreover, no significant changes are expected in the medium term. Assumedly, lack of innovation links to scarce financial resources, which in turn impacts on shortage of human resources, expertise, and digital skills, as observed in central and local administration museums. This accounts for the relative digital acceleration of privately managed museums, which are financed by their own resources. In addition, the preference for low-cost strategies concerning external communication (e.g. social media) limits investment in intra-organisational digital tools, including the interactive and collaborative platforms that should be in place for enhancing the visitor experience. Seemingly, beyond shortage of financial, human, and technological resources (Carvalho, 2022), a different management mindset may be at play here, that requires managerial skills and vision to understand the strong connection that currently exists between innovation and consumers' capacity and willingness to co-create. In line with this study's findings, greater efforts should be made to facilitate visitor co-creation. As ICT are effective drivers of consumer co-creation, managers need to fully grasp their potential to boost visitor participation in the process of creating their own experiences.

The *aura* of the object as contrasted with its reproducible representations (Benjamin, 2008) underlies the tensions between the physicality of the object exhibited in the museum and its digital versions and, ultimately, between the experience as lived in the museum environment and in the virtual environment. Luís Raposo, a former Portuguese Museum director and president of ICOM Europe (2015–2022), wrote on a *Facebook* post that 'humans are analog [*sic*] creatures, not digital,' claiming that museums must be 'spaces where each one [of us] can be confronted with real original materialities' post-pandemic' (Raposo, 2020). The recognition of traditional analogue strategies over the digital strategies is indicative of the gap between the current reality of Portuguese museums and the full potential involved in the digital transformation. Even as a medium-term strategy, museum directors do not foresee using ICT to strengthen the relationship with current visitors or attract new ones. ICT are perceived as tools to enhance museum mediation between the object and the audience but not as substitutes for the lived experience of the original object's materiality. Fulfilling objective (iv), museum managers' perceptions about ICT are ambiguous, as ICT are accepted as an opportunity to improve the museum experience and the museological discourse and interpretation, however never as a replacement of the physical object.

Although the selected cases are limited to museums that somehow stand out for using ICT, results reveal difficulties in adapting to the digital environment, allowing concern regarding the development and investment in a digital culture leading to sustainable museum management and co-creation in models of public participation. The relative mismatch between Portuguese museums and the general trends in museum management identified by the UNESCO, ICOM, and NEMO reports is thus concluded.

Conclusion

Digital transformation has become a top priority for museums and similar heritage institutions following the COVID-19 pandemic (Marzano & Castellini, 2022). International organisations in charge of policies for heritage assets, curation, and management institutions are pressing museum

managers to adhere to digital transformation processes and provide tools for visitors to engage in co-creation and thus enhance their museum experience.

This study has found that Portuguese museums have not fully taken advantage of the opportunities brought by the COVID-19 pandemic to redesign management strategies and restructure their processes to accommodate and accelerate the digital paradigm. A major conclusion of this study is then that Portuguese museums lag behind similar institutions in Europe and the United States, and have not yet reached the digital museum stage (Simone et al., 2021). Asymmetries found in the digital activities developed by these museums during lockdown and shortly after are due to the different investment in digital infrastructures made previous to the pandemic. Financial capacity seems to play a role here as privately managed museums were seen to perform better subsequently to the pandemic and thus to better sustain digital transformation in the long run.

Theoretically, this study contributes to museum management literature in two distinctive ways. Firstly, this study contributed to the discussion and further understanding of the participatory museum framework in light of the digital transformation of museums following a major global crisis. According to Marzano and Castellini (2022), such a discussion is still lacking. Previous studies have investigated museum management and digital acceleration in the context of the COVID-19 pandemic crisis (Agostino et al., 2020b) or the role played by ICT in the management of this crisis. This study however combined the discussion of museum digital transformation during the pandemic within the participatory museum framework which considers an approach through co-creation, and more specifically co-creation by the visitor. The participatory museum framework is aligned with current international policies for museum and heritage organisations management and encapsulates a whole new way of looking at old-aged heritage and cultural institutions through the lenses of contemporary life, societies, and values. Additionally, it also requires examination of its adequacy concerning museums' response to and recovery from crises with the help of ICT *and* visitor participation. As the participatory museum framework argues for visitor co-creation in the creation of cultural value, participatory techniques that facilitate co-creation, including ICT, play a critical role in the process of connecting heritage to contemporary societies and people, especially during major crises. However, as this study has shown, adaptation to and investment in technological change varies across museums, which impacts their ability to rehearse strategies and solutions for times of crisis and beyond that include their visitors. In sum, this study discussed the participatory museum framework subsequent to the COVID-19 pandemic applied to the Portuguese context. The framework builds on two critical dimensions for its successful implementation, namely the co-creation paradigm shift and ICT adoption. To the authors' knowledge, there are still scarce studies on ICT adoption by museums under the participatory museum framework as a consequence of the COVID-19 pandemic. Insights from this study contribute to broaden awareness and discussion on the paradigm shift of the participatory museum and the role played by ICT in the process beyond the context of a global health crisis.

Second, in this study, authors have collected primary data using a qualitative online survey, 'a relatively novel and often invisible or side-lined method' (Braun et al., 2020, p. 1). This methodology requires the combination of open-ended questions with a structure provided by the questionnaire that facilitates data reduction, analysis (Seixas et al., 2018) and comparability (Braun et al., 2020). It is considered new to most research fields and thus also to the museum management literature. Previous investigation shows application in health and related public policy issues (Braun et al., 2020; Regmi et al., 2016; Seixas et al., 2018). Museum management under the participatory framework and the challenges of digital transformation and acceleration faces complex issues and different landscapes, allowing for a broad range of perspectives to emerge; thus as qualitative surveys conducted online 'can produce the rich and complex accounts of the type of sense-making typically of interest to qualitative researchers' (Braun et al., 2020, p. 1), they are argued a viable methodological approach to uncover inherent complexities and asymmetries.

Managerially, this study supports some general recommendations and some specific to Portuguese museum managers. In general, it is recommended that directors and curators regularly perform benchmarking activities in search of innovative and creative ideas that adapt to existing

collections. This work is increasingly necessary, given the speed of technological change and its multifaceted applications. Second, to promote co-creation in museums, the authors suggest that managers invest in calls to stimulate audience participation with ideas for exhibitions and other activities, to involve them in the idea and design of the collections, as well as of the exhibition venue or else in the creation of related objects to the collections. This strategy allows a balanced integration of cultural groups of origin of exogenous collections in the curatorial teams, promoting cultural inclusion by decolonising the museum's authoritarian and Eurocentric discourse.

Additionally, a recommendation is made to guide the transfer of scientific knowledge to the museological universe, which is to increase higher academic training in museology, providing museum managers and curators with expertise in management and communication with increasingly tech-savvy audiences and online communities. A more specific recommendation addressed to Portuguese museum managers is to increase the number of teams working in museums on an interdisciplinary basis, combining collections' scientific areas and ICT, but also to develop training on co-creation both as a new mindset in museum management and as a strategic methodological approach to boost visitor participation in the creation of their own museum experiences.

This study presents two limitations that future research may overcome. The first one concerns sample size. Despite the diversity of museums captured in the sample, it remains small, and inclusion of more museums in the study would contribute to generalizability of results. In this case, results point to a lack of a strategic plan for digital transformation and innovation, which is consistent with findings from other studies (Marzano & Castellini, 2022). Only two of the analysed museums consider medium-term (two-year) plans concerning virtual tours, online learning programmes, 3D visualisation and printing and augmented and virtual reality. Findings confirm the lack of financial and human resources, also at different levels, specialised skills, and ability to execute a global and articulated digital transformation policy programme. Therefore, subsequent studies should widen the research field and consider greater sample diversity, particularly incorporating small museums, which are highly dependent on local government, to clarify the observed trends and integrate museum digital strategies into their discourses' interpretation and mediation with audiences.

Another limitation relates to the time when the current study was conducted, i.e. shortly after the pandemic and the reopening of museums to the public. Given the importance of time in the process of museum management in the participatory framework and digital transformation and acceleration, a long-term perspective is needed to assess its effectiveness. This said, a future research avenue could adopt a longitudinal design able to capture perspectives of change and evolution.

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