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Academic Research Paper

Technology-Driven Innovation in Cultural Heritage: A Museum Experience Perspective

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Abstract: This study explores the evolving impact of technology on cultural heritage encounters, specifically within museum settings. It introduces a comprehensive conceptual framework that encompasses various aspects of the museum experience influenced by technology and assesses its effects on visitor satisfaction and loyalty intentions. Through an empirical investigation involving 300 individuals visiting archaeological sites in Rome (Italy), including both permanent and temporary exhibitions with varying levels of technological integration, this research employs a self-administered questionnaire to validate its hypotheses. The results underscore the significance of technology in shaping diverse facets of the visitor experience, such as education-entertainment fusion, engagement, and ambience, with substantial implications for enhancing customer satisfaction and fostering visitor loyalty. This research adopts a mixed-methods approach to investigate the evolving role of technology in cultural heritage encounters within museums. In a first phase, a comprehensive conceptual model that captures various dimensions of the museum experience influenced by technology was designed. Subsequently, data was collected from a purposive sample of 300 individuals visiting archaeological sites in Rome, encompassing both permanent and temporary exhibitions. This sample is intentionally diverse in terms of technology integration, allowing for a nuanced analysis. Data is gathered through the administration of a self-administered questionnaire designed to empirically test the hypotheses formulated in the conceptual model. Statistical analyses, including regression analysis and structural equation modeling, are employed to assess the impact of technology on visitor satisfaction and loyalty intentions. This research contributes to the field by introducing a comprehensive conceptual framework that holistically examines the multifaceted influence of technology on the museum experience, including dimensions such as edutainment, engagement, and ambience. Furthermore, it provides empirical evidence of these effects through a diverse sample of museum visitors. This study offers valuable insights into the evolving role of technology in cultural heritage contexts, filling a gap in the existing literature and providing actionable guidance for cultural institutions seeking to enhance visitor engagement and loyalty. The findings of this research hold practical significance for cultural institutions, particularly museums, aiming to leverage technology to enrich visitor experiences. By

understanding how technology influences dimensions such as edutainment, engagement, and ambience, museums can strategically integrate technology to enhance customer satisfaction and foster visitor loyalty. This research encourages museums to adopt innovative technological solutions that cater to diverse visitor preferences, ultimately ensuring a more immersive and satisfying cultural heritage encounter.

Keywords: *Technology-enhanced experiences, Cultural heritage, Museums, Visitor satisfaction, Loyalty intentions*

JEL Codes: O33; O35; L83; Z32; O14

1. Introduction

Cultural institutions are currently undergoing a significant transformation in response to the rising expectations of visitors seeking enhanced tourism experiences (McIntyre, 2008). Museums are compelled to redefine their communication strategies, incorporating innovative language to pursue commercial objectives (Camarero & Garrido, 2012) while accommodating evolving user expectations in the realm of customer experiences (Evans et al., 2012). In this evolving landscape, the role of technology has gained prominence before, during, and after cultural visits (Pallud, 2017). It is crucial to comprehend the influence of technology on the overall customer experience and develop methods for its assessment. Technology's integration into museum experiences has garnered substantial interest in recent years (King et al., 2016). Nevertheless, a gap persists in understanding how visitors' interactions with museums have evolved in response to technology. While various studies have explored the impact of specific technologies, such as social media (e.g., Lazzeretti et al., 2015) or emerging technologies (Jung & tom Dieck, 2017), a comprehensive perspective for measuring museum experiences and technology's impact remains inadequately established.

Similar considerations are relevant in the tourism sector, where Neuhofer et al. (2012) underscored the role of technology in shaping tourism experiences and devised a conceptual model to integrate experiential developments by amalgamating experience elements, co-creation, and technology. Technological advancements, such as augmented reality (AR), virtual reality (VR), mobile applications, and big data analytics, have seamlessly integrated into the tourism ecosystem, profoundly influencing how tourists perceive, plan, and engage with destinations. These technologies have enabled tourists to access a plethora of information, personalized recommendations, and immersive experiences, thereby enhancing their overall travel experience (Buhalis & Foerste, 2015; Xiang & Gretzel, 2010). Furthermore, digital platforms, encompassing social media and online review platforms, have empowered tourists to actively contribute to destination marketing and decision-making processes, thus ushering in a paradigm shift in tourism marketing dynamics (Gretzel et al., 2015; Neuhofer et al., 2015). Consequently, technology's indelible footprint on the tourism landscape is indicative of its pivotal role in engendering a more informed, interconnected, and customized travel milieu, fundamentally altering the contours of contemporary tourism experiences.

While there is a growing body of research that acknowledges the increasing role of technology in enhancing museum experiences, there remains a notable deficiency in comprehensively understanding how visitors' interactions with museums have evolved in response to technology. Previous studies have

primarily focused on the impact of specific technologies or aspects, such as social media or emerging technologies, without providing a holistic perspective on measuring museum experiences and technology's overall influence (Zollo et al., 2022; Buonincontri & Marasco, 2017).

Based on these considerations, our study pursued two primary objectives: (i) the formulation and validation of a conceptual model encompassing dimensions of the museum experience related to technology, and (ii) the assessment of technology's influence on visitor satisfaction and loyalty intentions.

2. Theoretical framework

2.1 The Cultural Heritage Experience from a Service Perspective

Historically, cultural heritage consumption has primarily centered around physical sites and monuments, which have been regarded as significant cultural attractions for tourism (McKercher & Du Cros, 2002). However, contemporary cultural heritage destinations have transitioned towards adopting a visitor-centric approach, blurring the distinction between tourists and other visitors (Vecco, 2010; Geissler et al., 2006). This shift has been driven by visitors ascribing personalized meanings to their visits, which may not necessarily align with the intentions of cultural organizations (Smith, 2015). Consequently, visitor experiences are dynamically evolving, actively engaging users (Holbrook, 2006) and fostering the cognitive co-creation of content and meaning within an ecosystem (Ruiz-Alba et al., 2019).

Within the framework of a service ecosystem, defined as a self-contained and self-regulating system of actors integrating resources through shared institutional arrangements and mutual value creation via service exchange (Vargo & Lusch, 2016), multiple interaction levels operate as drivers of value creation (Vargo et al., 2017). Cultural heritage is conceptualized as a service ecosystem where visitors' overall experiences hinge upon their relationships within the cultural heritage context.

Customer experience, as posited by Schmitt (2010), results from the interplay of diverse dimensions with varying significance, contingent on individual and situational factors. Traditional measures of customer experience, rooted in four realms (Education, Entertainment, Engagement, Ambience) (Pine & Gilmore, 1998), are now being challenged due to their insufficient incorporation of technology interaction as a central component of contemporary museum experiences (Buonincontri & Marasco, 2017; Neuhofer et al., 2015).

2.2 The Transformation of Museums Through Technology

Digital transformation refers to the integration of digital technologies across various facets of an organization, including service and product offerings, business models, core operations, and organizational structures (Chanias & Hess, 2016). Experiential marketing, as advocated by Schmitt (2006), positions consumers as individuals actively seeking enjoyable experiences rather than merely rational decision-makers. The goal is to evoke sensory, emotional, creative, and cognitive responses, linked to lifestyles and physical experiences, thereby offering consumers holistic experiences (Rialti et al., 2015). Museums and cultural sites, once predominantly object-focused, have shifted towards experiential marketing strategies to compete for visitors' leisure time alongside theaters, cinemas, and shopping malls. Recent research demonstrates that museum visits are increasingly perceived as

experiences, rather than informational cultural outings (Dirsehan et al., 2012). Museums can be characterized as experiential places offering both cognitive and emotional stimulation (Del Chiappa et al., 2014). Fostering positive experiences among cultural heritage visitors enhances the value of cultural assets and the likelihood of return visits (Burton et al., 2009). Technology applications in cultural heritage aim to enhance access and emotionally engage users for effective information absorption (Falk & Dierking, 2016).

3 Conceptual Model and Hypothesis Development

The conceptual model (Fig. 1) derives from a comprehensive review of relevant literature on experience (Yuan & Wu, 2008; Poulsson & Kale, 2004; Arnould, Price, & Zinkhan, 2002; Tynan and McKechnie, 2009) and the role of technology in cultural heritage (Bakhshi & Throsby, 2012; Hume, 2015; tom Dieck & Jung, 2017; Bec et al., 2019).

3.1 Technology Adoption

The implementation of technology in cultural contexts hinges, among other factors, on people's willingness to embrace unfamiliar technologies (Hume, 2015). Technology's role has evolved significantly, revolutionizing how consumers engage with museums (Falk & Dierking, 2016). Technology integration in cultural heritage settings has particularly enhanced the facilitation of experiences, resulting in emerging museum experiences like immersive virtual reality, 3D printing, 4D presentations, augmented reality, and technologies such as iBeacon (Chen et al., 2017). The Technology Acceptance Model (TAM) (Davis et al., 1989) is a prominent framework for explaining technology adoption, emphasizing perceived usefulness, perceived ease of use, and attitude toward use. Accordingly, we propose the following hypothesis:

H1 Visitors' inclination to adopt technology significantly and positively influences their experiences in cultural contexts where technology is integrated.

3.2 Visitor experience in museums employing technology

The visitor experience in museums, when augmented by technology, undergoes a transformation characterized by enhanced engagement and interaction. Technology integration within museum contexts facilitates dynamic and personalized encounters, where visitors actively co-create content and meaning (Ruiz-Alba et al., 2019). This transformation aligns with the paradigm shift towards a visitor-centric approach, blurring the traditional boundaries between tourists and other visitors (Vecco, 2010; Geissler et al., 2006). Upon reviewing the literature, the predominant dimensions that characterize the utilization of technology in shaping the visitor experience encompass edutainment, engagement, and ambience.

In the context of this study, an adaptation of Pine and Gilmore's (1998) four realms of experience is proposed. This adjustment stems from a comprehensive analysis of contemporary tourism dynamics, emphasizing the shifting expectations and preferences of today's visitors. The consolidation of "Edutainment" reflects the increasing demand for experiences that seamlessly blend education and entertainment. Modern tourists are seeking not only informative encounters but also engaging and

interactive learning opportunities during their travels (Ponsignon & Derbaix, 2020). This adaptation ensures the framework accurately captures the essence of educational yet entertaining experiences that resonate with the evolving mindset of travelers.

Furthermore, the introduction of "Ambience" as a distinct dimension acknowledges the critical role that atmospheric and environmental elements play in shaping the overall tourist experience. Beyond the traditional aesthetic considerations, tourists today are highly attuned to the ambiance of their surroundings, including the sensory aspects such as lighting, sounds, and spatial design (Heide et al., 2007). This modification responds to the heightened importance placed on creating immersive environments that evoke specific moods or emotions, contributing significantly to the overall satisfaction of visitors.

3.2.1 Edutainment

Edutainment combines education and entertainment, enhancing the learning environment's engagement and enjoyment (Song et al., 2004). Contemporary museums offer diverse learning opportunities, including historical recreations, art exhibitions, guided tours, and audio guides (Pallud, 2017; Raajpoot, Koh & Jackson, 2010). Learning can contribute to meaningful experiences, aligning with visitors' needs and interests (Packer & Ballantyne, 2002). The overlap between informative, fun, and social aspects during museum visits is termed edutainment (Pine & Gilmore, 1999). On the basis of these considerations, we can state that:

H2a: In museums leveraging technology, the visitor experience is notably enriched through Edutainment

3.2.2 Engagement of Visitors

Museums' ability to engage visitors, coupled with factors like learning and social interaction, plays a pivotal role in visitors' preference for cultural experiences (Falk & Dierking, 2016). Visitors may choose to visit museums for various reasons, including the desire to explore different environments (Timothy & Nyaupane, 2009). Technology actively engages visitors, influencing their perceptions through sensory, cognitive, and emotional stimuli (Grinter et al., 2002). Thus, it is possible to assume that:

H2b: Within the technology-empowered museum context, the visitor experience encompasses a distinct dimension of Engagement

3.2.3 Ambience

Ambience encompasses the physical environment, its atmospherics, and overall mood (Hicks, 2015). Cultural heritage contexts may feature intangible elements stimulating visitors through sensory cues (Suarez et al., 2015; Crozier, 2012). These elements may encompass physical space, color, lighting, visitor guidance, and methods to pique interest (Rentschler & Gilmore, 2002). Museums invest in renovating their ambience to impact visitors' attitudes, future patronage intentions, and their likelihood to recommend the experience (Bonn, Joseph-Mathews, Dai, Hayes & Cave, 2007).

In line with these considerations, we propose the following hypothesis:

H2c: Visitor experience in museums employing technology has an impact on the Ambience

3.3 Customer Satisfaction

In addition to exploring experience dimensions, researchers examine how these dimensions relate to specific outcomes (Schmitt, 2010). Our conceptual model also addresses two outcomes—customer satisfaction and word-of-mouth—while assessing their relationships with experience dimensions. Customer satisfaction can be categorized into attribute satisfaction and overall satisfaction (Oliver, 1993). Attribute satisfaction affects overall satisfaction (Chi & Qu, 2008). Considering our study's focus, we measure visitor satisfaction with the museum experience at an overall level (Harrison & Shaw, 2004; Huo & Miller, 2007). Consequently, it is possible to conclude that:

H3: Visitor experience significantly and positively impacts customer satisfaction.

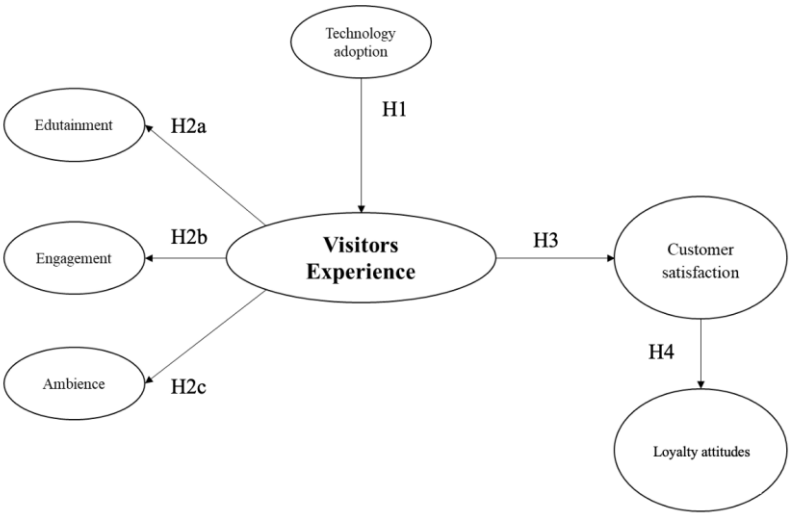
3.4 Loyalty attitudes

Considering the significance of behavioral attitudes in understanding consumer actions, it is essential to recognize that loyalty attitudes encompass not only the inclination towards revisitation but also encompass word-of-mouth behavior. Behavioral attitudes, as defined by Lam and Hsu (2006), pertain to consumers' expectations regarding their likelihood to engage in specific actions.

In the context of museums, positive behavioral intentions, including the intention to revisit and engage in word-of-mouth behavior, have been identified as relevant factors (Harrison & Shaw, 2004; Hume, 2011; Huo & Miller, 2007). Given this background, we posit the following hypothesis:

H4: Customer satisfaction significantly and positively influences loyalty attitudes

Figure 1. Conceptual Model. *Source: Author elaboration*



4. Method

In order to empirically validate our hypotheses, a designed research study was undertaken. The selection of archaeological sites in Rome as the research setting was conducted considering the significance of these sites in the context of cultural heritage, encompassing both permanent and temporary exhibitions, and taking into account the extent to which technology had been integrated into these sites. Subsequently, two specific sites were chosen to serve as the focal points of our investigation. The first site, the Ara Pacis, was selected due to its incorporation of augmented and virtual reality experiences, offering an intriguing blend of historical artifacts and immersive technological elements. The second site, the Baths of Caracalla, was chosen for its utilization of virtual reality to vividly showcase historical settings, providing an innovative and technology-enriched perspective on ancient Roman culture.

Our data collection methodology adhered to established best practices in survey research (De Leeuw et al., 2008), wherein a self-administered questionnaire was employed. To establish the questionnaire, we began by conducting an extensive review of existing literature on technology-enhanced museum experiences (Bakhshi & Throsby, 2012; Hume, 2015; tom Dieck & Jung, 2017; Bec et al., 2019).

Drawing from this theoretical foundation, we crafted items and questions that were conceptually aligned with our research model. Additionally, we incorporated well-established scales and measurements from previous research where applicable to ensure the questionnaire's validity and reliability. Moreover, the questionnaire underwent a rigorous pre-testing phase to refine its clarity, comprehensibility, and appropriateness for our target audience. This process involved soliciting feedback from experts in the field and conducting pilot tests with a small sample of potential respondents. Subsequent revisions were made based on the insights gained from this pre-testing phase, ultimately resulting in a robust and comprehensive questionnaire tailored to the research's specific objectives (De Leeuw, 2008).

The final version of the questionnaire was thoughtfully structured into two distinct sections, each thoughtfully tailored to align with the specific objectives of our study. The initial section of the questionnaire was designed to capture an array of variables related to technology knowledge and evaluation, delving deep into the respondents' perceptions and interactions with technology within the context of cultural heritage experiences. Meanwhile, the second section of the questionnaire was dedicated to the collection of socio-demographic data, including variables such as gender, age, educational background, and employment status.

To ensure the robustness and representativeness of our data, a sample of 300 individuals was thoughtfully selected for participation in the study. The composition of this sample was meticulously balanced to encompass both Italian and foreign visitors to the selected archaeological sites.

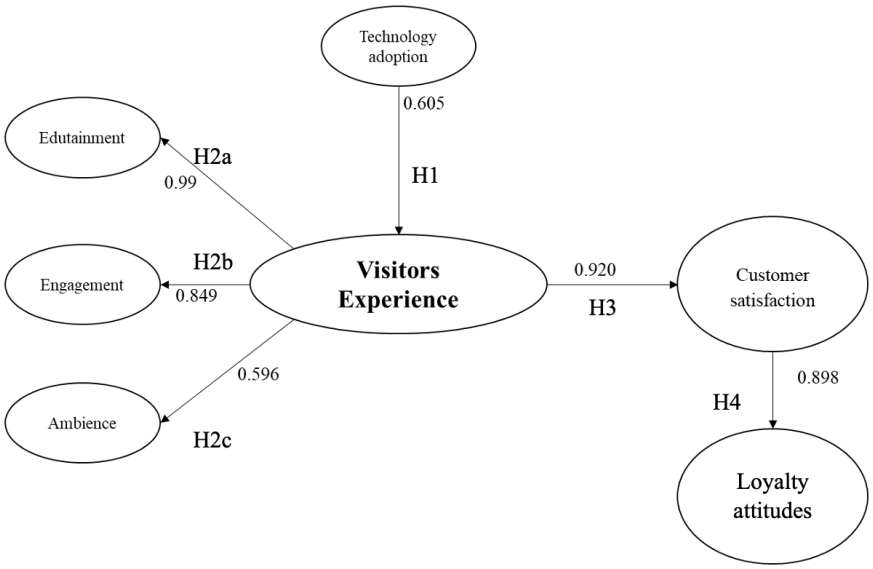
5. Results and Discussion

The initial phase of our data analysis involved the application of descriptive statistical techniques (Babbie, 2015). To rigorously evaluate our proposed hypotheses, we employed advanced statistical methodologies. Specifically, an Exploratory Factorial Analysis (EFA) was conducted, a robust

statistical technique commonly utilized in research to explore the underlying structure and interrelationships among variables (Fabrigar et al., 1999). EFA facilitated the identification of latent factors that explained the observed patterns of variation within our data, a crucial step in confirming the dimensions of the conceptual model (fig. 1).

Then, structural equation modeling (SEM) was applied to scrutinize the relationships posited in our theoretical framework (Kline, 2023). To ascertain the goodness of fit of our structural model with the empirical data, we employed a suite of fit indices (West et al., 2012). This analytical approach, involving both EFA and SEM, was undertaken to ensure a comprehensive and rigorous assessment of our theoretical framework. The integration of these advanced statistical techniques strengthens the robustness of our data analysis and enhances the validity of the conclusions drawn from our study.

Figure 2. Structural model: Standardized regression weights (Error terms are not shown)



Source: Author elaboration

Findings underscore the transformative impact of technology on cultural heritage experiences, highlighting the positive correlation between technology and various experience dimensions, particularly edutainment.

The research findings validate the proposed hypotheses, highlighting a positive and significant correlation between technology adoption and various dimensions of the visitor experience, with a particularly strong impact observed in the dimension of edutainment. This underscores that visitors' propensity to use technology significantly and positively affects their experiences in cultural contexts where technology is employed.

Customer satisfaction emerges as a central driving force behind both visitor loyalty intentions and word-of-mouth behavior. This revelation underscores the fundamental significance of elevating visitor satisfaction levels within the museum context, particularly in environments enriched with technological integrations. Such enhancements hold the potential to yield amplified levels of visitor loyalty and generate positive word-of-mouth recommendations, which are undeniably instrumental for cultural institutions as they endeavor to allure and sustain their visitor base.

6. Conclusion

The findings of this research carry substantial managerial implications for cultural institutions, with a specific focus on museums. The study underscores the transformative potential of technology in elevating visitor engagement and satisfaction, thereby fostering increased loyalty and positive word-of-mouth behavior. Cultural organizations stand to benefit significantly by leveraging these insights to strategically enhance their offerings and create high-value experiences through effective integration of technology.

The identified potential of technology suggests that cultural institutions, particularly museums, can strategically deploy technological tools to not only meet but exceed visitor expectations. Key technologies such as augmented and virtual reality, 3D printing, or augmented reality emerge as viable means to provide visitors with immersive and educational experiences. This is in line with other research in similar contexts (Fan et al., 2022). By incorporating these technologies thoughtfully, cultural institutions can create dynamic and interactive encounters that captivate visitors, enhancing their overall satisfaction and fostering a deeper connection with the institution.

For museum managers and decision-makers, the research underscores the importance of adopting a forward-thinking approach to technology integration. It suggests that investments in technologies that facilitate edutainment, engagement, and an enriched ambience can yield substantial returns in terms of visitor loyalty and positive word-of-mouth promotion. This, in turn, can contribute to the sustained success and relevance of cultural institutions in an ever-evolving landscape.

Additionally, the managerial implications extend to the need for ongoing evaluation and adaptation. Given the rapid pace of technological advancement, cultural institutions should remain attuned to emerging technologies and continually assess their relevance and applicability. A proactive stance in adopting and adapting to technological innovations ensures that museums stay at the forefront of providing compelling and contemporary cultural heritage experiences.

6.1 Theoretical Implications

From a theoretical point of view, this study makes a significant contribution to the existing literature by providing empirical data and introducing a comprehensive conceptual model that enhances our understanding of the intricate relationship between technology and cultural heritage experiences. The research adds to the existing body of knowledge by corroborating the substantial impact of technology on visitor experiences, specifically focusing on the dimensions of edutainment, engagement and ambience within the museum environment.

By empirically validating the role of technology in shaping cultural heritage encounters, the study adds depth and specificity to the ongoing discourse on the changing nature of cultural heritage consumption. The identified dimensions of edutainment, engagement and environment serve as key components in elucidating the nuanced ways in which technology influences and enriches the overall visitor experience in cultural institutions.

6.2 Managerial Implications

The findings of this research have important management implications for cultural institutions, especially museums. The study highlights the transformative potential of technology to increase visitor engagement and satisfaction, thereby fostering greater loyalty and positive word-of-mouth behaviour. Cultural organisations can benefit significantly by leveraging these insights to strategically enhance their offerings and create high-value experiences through the effective integration of technology. The identified potential of technology suggests that cultural institutions, especially museums, can strategically deploy technological tools to not only meet but exceed visitor expectations. Key technologies such as augmented and virtual reality, 3D printing or augmented reality emerge as viable means to offer visitors immersive and educational experiences. This is consistent with other research in similar contexts (Fan et al., 2022). By carefully incorporating these technologies, cultural institutions can create dynamic and interactive encounters that engage visitors, improving their overall satisfaction and fostering a deeper connection with the institution. For museum curators and managers, the research emphasises the importance of taking a forward-looking approach to technology integration that facilitate edutainment, engagement and enrichment of the environment. This can help sustain the success and relevance of cultural heritage institutions in a changing landscape. Furthermore, the potential for museum management extends to the need for museums to remain at the forefront of providing engaging and up-to-date heritage-related experiences.

6.3 Future Research Directions

While this study provides valuable insights, there are avenues for future research that should be explored. Firstly, the study should consider extending its research to a more diverse visitor population, encompassing different demographics and cultural backgrounds, to validate and generalize the findings. Additionally, investigating the role of specific technologies and their impact on different dimensions of the visitor experience could offer more nuanced insights. Furthermore, exploring how cultural institutions can effectively manage and implement technology to maximize visitor engagement and satisfaction remains a pertinent area for future research. Finally, longitudinal studies can assess the sustainability of technology-enhanced experiences over time and their long-term impact on visitor loyalty.

Acknowledgments

Nothing to declare

Conflict of interest

Nothing to declare

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Appendix 1. Questionnaire items

Dimensions	Var.	Item
Edutainment	V1	The visit stimulated my curiosity
	V2	The visit increased my knowledge
	V3	Without the use of technology, I couldn't imagine the original place
	V4	Thanks to technology, I learned more about the history of the museum
	V5	During the visit I felt stimulated
	V6	During the visit I had fun
	V7	The technology used in the museum definitely improves the show
Engagement	V8	During the visit I imagined living in another age and in another place
	V9	Thanks to technology, the visit represented an escape from reality
	V10	The visit allowed me to get away from a stressful social environment
	V11	During the visit I totally forgot about the daily routine
Ambience	V12	During the visit I felt a sense of harmony with my surroundings
	V13	During the visit I found a pleasant atmosphere
	V14	Thanks to technology, the visit stimulated my senses
Technology acceptance	V15	I had no difficulty in approaching augmented and virtual reality
	V16	My basic knowledge was sufficient for using augmented and virtual reality
Customer satisfaction	V17	My opinion in the visit is very positive
	V18	I feel good about the idea of having visited the museum
	V19	Overall, I am satisfied with the visit
Loyalty intentions	V20	I would like to visit the museum again in the future
Word-of-mouth behaviour	V21	I would like recommend visiting the museum to my family members and personal friends
	V22	I would recommend visiting the museum to my acquaintances

Source: Author elaboration