



## Original Research

# How Immersive and Interactive Technologies Affect the User Experience and Cultural Exchange in the Museum and Gallery Sector

Hyejin Kwon, Brunel University London, United Kingdom

Youngok Choi, Brunel University London, United Kingdom

Xiaoyang Zhao, Imperial College London, United Kingdom

Hua Min, Shanghai Jiaotong University, China

Wei Wang, Shanghai Jiaotong University, China

Vanja Garaj, Brunel University London, United Kingdom

Busayawan Lam, Brunel University London, United Kingdom

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**Abstract:** Recently, immersive and interactive technologies have brought about significant changes and developments in the museum and gallery sector. These technologies can transport their audiences to specific places, times, and points in history without the need for physical travel and provide them with valuable intellectual and emotional experiences. Through these experiences, museum and gallery audiences have the opportunity to better understand diverse cultures. Accordingly, museums and galleries in the UK and China are increasingly investing in immersive and interactive technologies to promote cultural exchange between the two countries. However, there is limited information about stakeholder awareness of the immersive and interactive technologies used in museum and gallery experiences for cultural exchange and the mechanisms for developing museum and gallery experiences utilizing such technologies. This study employs a mixed-methods approach, combining qualitative methods, such as questionnaire surveys, with qualitative methods involving case studies and interviews. This integrated approach allows for an exploration of mechanisms for leveraging and developing immersive and interactive experiences in museums and galleries while also providing an in-depth understanding of key stakeholders' perspectives in both the UK and China. The research highlights the need to improve the acceptance and accessibility of immersive and interactive technologies for enhanced audience experiences and cultural exchange in the museum and gallery sector and the importance of improving stakeholder roles and relationships. The research outcomes have also resulted in recommendations at the operational (e.g., technology deployment) and strategic levels (e.g., stakeholder roles, relationships, and approaches).

**Keywords:** Museums and Galleries, Immersive and Interactive Technologies, User Experience, Stakeholder Involvement, Cultural Exchange

## Introduction

Over the past few years, immersive and interactive technologies have affected many aspects of our lives. These technologies give users a sense of being immersed in an experience (Lee, Chung, and Lee 2013) by offering new and enhanced user experiences (Kaur et al. 2022) in a simulated environment without requiring physical travel (Pratisto, Thompson, and Potdar 2022).

For example, immersive and interactive technologies provide (1) a fun, effective, and enjoyable virtual shopping experience (Kim et al. 2023), (2) surrogate experience that can be used to convince potential visitors to travel to a tourism destination (Pratisto, Thompson, and Potdar 2022), and (3) a variety of teaching methods to improve student engagement (Kaur et al. 2022). Recently, museums and galleries have adopted these technologies to embrace technological innovation and adapt to the challenges of the digital era (Shehade and Stylianou-Lambert 2020). Some examples of such developments in recent years are the *Van Gogh Immersive Experiences* at the Van Gogh Museum London (Van Gogh Expo 2021), the *Dinosaurs and Robots Experience* at the Natural History Museum, London (NHM 2019), the virtual reality (VR) experience of *Curious Alice: The VR Experience* at the Victoria & Albert Museum (V&A 2021), London, and the *Mona Lisa in VR* exhibition at the Louvre Museum in Paris (Rea 2019). Immersive and interactive technologies enhance visitor engagement (Ponsignon and Derbaix 2020) and encourage active participation (Allen, Kidd, and McAvoy 2020) by offering powerful experiences through immersive storytelling, transporting visitors to inaccessible places or to particular points in time and history (Shehade and Stylianou-Lambert 2020) and providing opportunities for verbal and physical interactions with other visitors (Ponsignon and Derbaix 2020). This enhanced engagement and participation allow visitors to have emotional rather than merely intellectual experiences.

These new media technologies also allow museum and gallery audiences to better understand different cultures by facilitating cross-cultural experiences. Immersive and interactive technologies are, therefore, considered promising means for enhancing cultural exchange (Colamatteo et al. 2024). They are being applied in the museum and gallery sector in the UK and China (Kwon et al. 2023). The UK creative industry considers China as a crucial export market. Consequently, major UK museums and galleries, including the Natural History Museum and the Science Museum in London, have collaborated with counterparts in China (Charr 2021; Science Museum 2020). Similarly, the Chinese government accelerated the global expansion of major museums and galleries in China by establishing the Belt and Road Association, which promotes networking between Chinese businesses and their UK counterparts (BRA 2019).

Immersive and interactive technologies create economic, social, and cultural value by connecting people from different countries, fostering unity, mutual respect, and appreciation for diversity (Donkor 2023). For example, the *Van Gogh Immersive Experiences* have a great local economic impact, estimated at more than \$40 million USD, generated by ticket buyers, tourism, hotels, dining, and more (Blumenthal Arts 2022). For museums and galleries, the point of using immersive and interactive technologies is not to replace the physical object but to offer another type of encounter. This type of encounter allows precision and completion by adding layers of information to physical and cultural objects. It provides audiences with opportunities to recontextualize different cultures cognitively, perceptually, and emotionally.




Despite the interest in and efforts to use immersive and interactive technologies for cultural exchange in museums and galleries in both the UK and China, there is limited understanding of

(1) the mechanisms for developing immersive and interactive museum and gallery experiences and (2) stakeholders’ and audiences’ perceptions of the immersive and interactive technologies used for museum and gallery experiences and cultural exchange. Therefore, this research explores the mechanisms for utilizing and developing immersive and interactive experiences in museums and galleries and develops an in-depth understanding of the perspectives of key stakeholders, including museums and galleries, creative businesses, academic research communities, policymakers and implementers, and audiences in the UK and China.

**Literature Review**

Immersive and interactive museum and gallery experiences comprise multi-sensory systems that allow users to interact and be immersed in the exhibits (Gao 2022; Shehade and Stylianou-Lambert 2020; Vi et al. 2017). They are commonly developed using the following technologies: (1) 3D screens and projections, (2) self-led augmented reality (AR), and (3) VR. Table 1 offers an example of how the technologies are used, and the details of the technologies follow.

Table 1: Example of Immersive and Interactive Technologies

<i>3D Screens and Projections</i>	<i>Self-Led Augmented Reality (AR)</i>	<i>Virtual Reality (VR)</i>
		
<i>Source: Atkinson 2021</i>	<i>Source: Jam Creative Studios 2018</i>	<i>Source: Coates 2020</i>






- 3D screens and projections create a unique atmosphere. They are inexpensive and easy to use (Yan and Ding 2017) but offer limited viewing angles, which can be a drawback in public or crowded spaces (Hua et al. 2021). They are suitable for individual users and small organizations.
- Self-led AR technology combines the real scene that the user sees with a virtual scene created by smart devices. The devices enhance the real scene with additional information, pictures, videos, and interactive graphics (Al-Duhaiman 2020). AR technologies benefit museums and galleries by allowing them to interact with visitors at a new level and giving visitors the opportunity to look at the world around them from different perspectives. However, self-led AR technology is expensive and requires specific hardware, such as a mobile or tablet, which can limit usage; it can also cause dizziness or nausea in some people (Sáez Martínez 2023).
- VR technology permits virtual tours of museums and galleries and the virtual exploration of collections. The technology is reliable and has advantages for (1) engaging with collections, (2) attracting visitors, (3) increasing the accessibility of museums and galleries and their collections, (4) providing education, and (5)

customizing experiences (Shehade and Stylianou-Lambert 2020). After the outbreak of COVID-19, museums and galleries provided virtual tours to continue to communicate with existing visitors and attract new visitors (Resta et al. 2021). However, the use of VR may minimize social interaction, and some visitors may be reluctant to experiment with the technology (Shehade and Stylianou-Lambert, 2020). It can be costly and require staff training and extra staff to maintain the system and clean components such as headsets (Shehade and Stylianou-Lambert 2020).

Immersive and interactive museum and gallery experiences provide important social experiences, emotional engagement, embodied and spatial interaction, and knowledge (Allen, Kidd, and McAvoy 2020). For example, they provide people with the experience of stepping into another world (Sparks Marketing 2021). They allow storytelling to be conducted through a dialogical approach so audience members can navigate at will through historical content (Allen, Kidd, and McAvoy 2020). They create a privileged means of communication between exhibits and viewers, making culture accessible to a mass audience (Carrozzino and Bergamasco 2010). Art and history can be investigated and understood more comprehensively through immersive and interactive museum and gallery experiences (Pantile et al. 2016). The inclusion of these experiences supports the development, renewal, and competitiveness of cultural organizations (Ponsignon and Derbaix 2020).

The key similarities between immersive and interactive experiences at museums and those at galleries are that both target segments of the public—young people, for example (Future Museum 2010; Ibrahim and Zainin 2021)—who feel confident when trying new technologies (Vogels 2019) and have not seen or experienced many traditional museums or galleries (Dixon 2011; Hürst et al. 2016). Another key similarity is that both museums and galleries create a culture for individuals to perceive and experience for themselves by using immersive and interactive technology (Magnelli et al. 2020). Although museums and galleries may take diverse approaches and have overlapping objectives when utilizing immersive and interactive technologies, the key difference between the two types of venues in implementing new media is that culture is the end goal; museums would rather preserve past cultures, while galleries focus on creating new cultures. For example, immersive and interactive museum experiences may include the reconstruction of artworks or artistic/historical environments destroyed or damaged by time (Carrozzino and Bergamasco 2010) to preserve and safeguard the items for future viewers to see and experience. In contrast, the immersive and interactive gallery experiences (especially those that use VR technologies) allow the visitor to enter the painting and the world created by the artist to experience intensified art appreciation (Shehade and Stylianou-Lambert 2020). In addition, museums prefer to educate through experiences in which the users are taken on a journey, whereas galleries focus on hands-on experiences in which the users become part of the art and key actuators (Magnelli et al. 2020). Table 2 offers examples of immersive and interactive museum and gallery experiences in the UK and China.

Table 2: Case Studies of Immersive and Interactive Museums and Galleries Experiences in the UK and China

Immersive and Interactive Technologies		Audience Engagement	Impact
3D Screens and Projections	UK  <i>Van Gogh Immersive Experiences</i> Source: Van Gogh Expo 2021	Providing immersive and interactive space by using a 20,000-square-foot light and sound spectacular featuring two-story projections which encounter the art in 360 degrees	People of all ages experienced the exhibit with ease, allowing them to relax and feel immersed in the activity. The experience is also becoming widespread news, creating novelty around the immersive experience frontier through social media
	China  <i>Dreaming Buddha Palace</i> Source: Dunhuang Academy 2022	Utilizing 3D screens and projection technology in the exhibition of mural art vividly recreated the original setting of the artworks, aiding the audience in both feeling and understanding the pieces	The permanent preservation of the Dunhuang Grottoes through comprehensive digital capture, processing, and storage of the relics
AR	UK  <i>Curious Alice: The VR Experience</i> Source: V&A 2021	Encouraging audiences to reward their curiosity by navigating a fantastical landscape, interacting with the book's famous characters, and completing a series of curious challenges	Experience the genre from a new perspective, setting the way for the future of academic literature and escapism books from all genres to be experienced and read in a new interactive way
	China  <i>Digital Tour of Ancient Liangzhu City</i> Source: Liangzhu Museum 2021	Providing a unique tour route tailored to the distribution characteristics of various exhibition points via AR glasses	A wide variety of information while viewing exhibits, including insight into the Liangzhu culture and life scenarios from 5,000 years ago
VR	UK  <i>Virtual Veronese VR Experience</i> Source: Creative Innovation 2022	Reconstructing and preserving the artwork in its original form through VR headsets	Artwork lost or damaged through time was reconstructed and preserved for new audiences to view and interact

China		Experience recreating the appearance of the royal palace through VR devices	Promote the dissemination of traditional culture among the younger generation
	<p><i>The Forbidden City</i> Source: <i>The Palace Museum</i> 2017</p>		

Similarities and differences in the use of immersive and interactive museum and gallery experiences in the UK and China were identified by observing cases. Museums and galleries in both countries use immersive and interactive technologies that mainly target younger generations and focus on entertainment (e.g., *Curious Alice: The VR Experience* in the UK and *The Forbidden City* in China). However, immersive and interactive museum and gallery experiences in the UK often provide individuals with environments that allow them to control their experiences and perceptions (e.g., *Van Gogh Immersive Experiences* and *Curious Alice: The VR Experience*). In contrast, museums and galleries in China tend to use technologies to preserve heritage and promote traditional culture (e.g., *Dreaming Buddha Palace*, *Digital Tour of Ancient Liangzhu City*, and *The Forbidden City*). This comparison is significant in exploring how immersive and interactive technologies are used and the preferences of museum and gallery audiences and stakeholders. Museums and galleries must first understand their audiences to choose the best technologies for an exhibit (Kidd and McAvoy 2020).

In particular, the blockage of offline exchange due to the COVID-19 epidemic barrier made overseas tourism and exhibitions difficult, activating the adoption of immersive and interactive technologies as a new route for cultural exchange and education in museums and galleries. Some studies demonstrated current trends and key points in utilizing immersive and interactive technologies for Western and Eastern cultural exchanges via museums and gallery experiences (Ma, Li, and An 2023; Science Museum 2020; StoryFutures 2020). However, these studies had limits in understanding the diverse perspectives on immersive and interactive technologies for cultural exchange among various stakeholders and audiences in the museums and galleries sector. Thus, it is essential to comprehensively and strategically explore how stakeholders and audiences in the museums and galleries sector perceive the immersive and interactive technologies for cultural exchange.

## Methodology

This study consisted of three phases: (1) exploration, (2) investigation, and (3) analysis. The first phase explored current trends in the use of immersive and interactive technologies for museum and gallery experiences by reviewing the literature and case studies. The case studies were notably important in developing a broader understanding of the research context, and special attention was paid to identifying similarities and differences in the use of immersive

and interactive technologies in museums and art galleries, particularly in the UK and China. Six cases (UK,  $n = 3$ ; China,  $n = 3$ ) that applied existing immersive and interactive technologies for museum and gallery experiences were observed and compared. The data collected through the literature review and case studies were investigated using a content analysis approach. The analysis revealed significant topics, such as experience with and perception of immersive and interactive museum and gallery experiences among stakeholders and audiences and interest in cultural exchange that could not be fully explored through the literature review and case studies. In the next stage, the topics were used to design an in-depth interview with stakeholders and an online questionnaire survey.

The second phase concentrated on understanding the audience and eliciting stakeholders' perspectives. The online questionnaire survey was undertaken to understand audience preferences and behavior patterns in accessing museum and gallery experiences onsite and online and audience interest in the transnational cultural exchange. The survey aimed to gather at least one hundred valid responses from participants in different age groups (from 18 years to over 65 years) selected randomly in the UK ( $n = 50$ ) and China ( $n = 50$ ). The survey was promoted via social media platforms in the UK (e.g., LinkedIn and Facebook) and China (e.g. WeChat). In total, 142 responses were obtained from the UK ( $n = 70$ ) and China ( $n = 72$ ), representing six age ranges (18–24, 25–34, 35–44, 45–54, 55–65 and over 65 years) (Figure 1). To elicit stakeholder perspectives, we conducted in-depth, semi-structured interviews with stakeholders from museums and galleries (UK,  $n = 5$ ; China,  $n = 4$ ), creative businesses (UK,  $n = 4$ ; China,  $n = 6$ ), academic research communities (UK,  $n = 8$ ; China,  $n = 5$ ), and policymakers and implementers (UK,  $n = 2$ ; China,  $n = 2$ ).

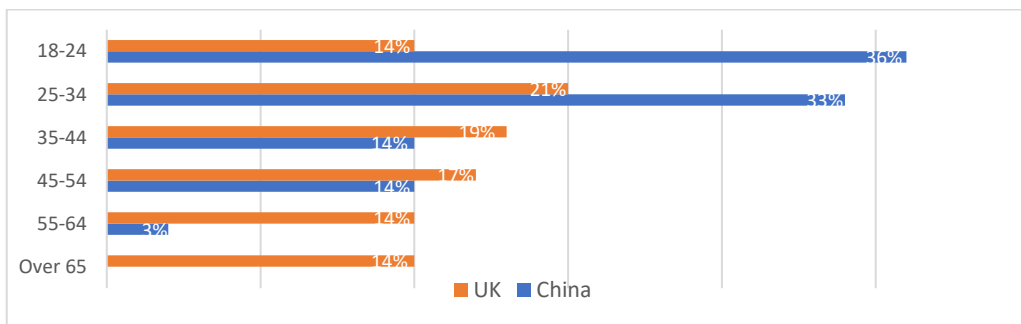


Figure 1: Number of Respondents, According to Age Range in the UK and China

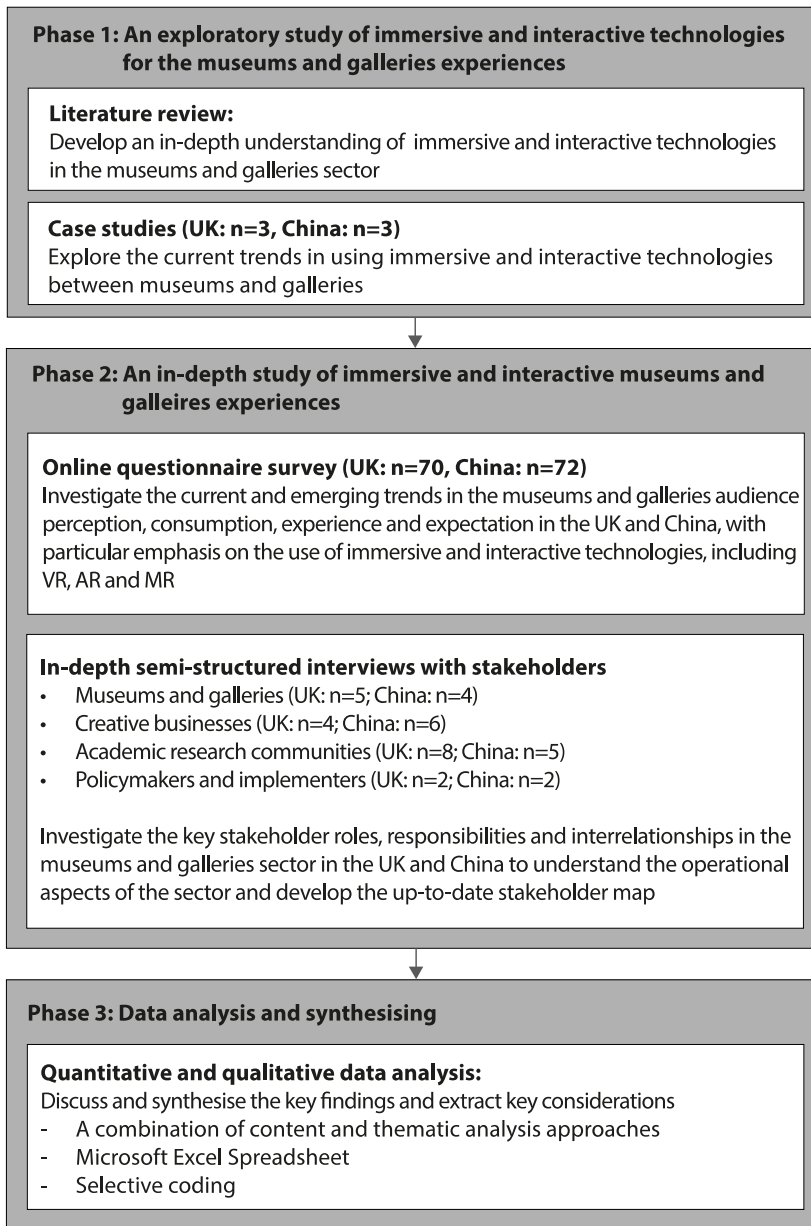


Figure 2: The Research Process

The third phase entailed analyzing and synthesizing the key findings of the previous phases to understand the mechanisms for developing immersive and interactive gallery and museum experiences and identify key considerations for improving the mechanisms. A combination of content analysis and thematic analysis was employed. First, the data collected via the questionnaire survey was analyzed quantitatively and qualitatively. A Microsoft Excel



spreadsheet was used for closed questions with multiple answers, and content and thematic analyses were performed for the open-ended questions to consider the following five key themes: (1) audiences' awareness of museums and galleries, (2) museum and gallery experiences, (3) immersive and interactive museum and gallery experiences, (4) expectations for immersive and interactive museum and gallery experiences, and (5) interests in cultural exchange between the UK and China. The key findings for the UK and China were compared to explore similarities and differences. In addition, some of the results were compared to observe details, taking into account that the samples differed in size and their age and gender ranges. The analysis of the in-depth interviews focused on understanding stakeholders' (a) awareness of immersive and interactive museum and gallery experiences, (b) expectations of immersive and interactive museum and gallery experiences, and (c) interest in cultural exchanges between the UK and China. The analysis and synthesis of the in-depth interview and questionnaire data revealed (1) key drivers of and barriers to immersive and interactive museum and gallery experiences, (2) operating mechanisms for immersive and interactive museum and gallery experiences in the UK and China, and (3) key considerations for improving those mechanisms, including the key stakeholder roles and relationships and the implementation of the mechanisms at the systemic and operational levels. Figure 2 presents an overview of the research process.

## Findings

This research reveals the diverse perspectives on immersive and interactive museum and gallery experiences and cultural exchange among museums and galleries, creative businesses, academic research communities, policymakers, and technology implementers. It also clarifies the stakeholder landscape for immersive and interactive museum and gallery experiences and cultural exchange in the two countries. The following subsections detail the key findings.

### Finding 1: Immersive and Interactive Museum and Gallery Experiences

#### *Audiences' Perspectives*

Exploring the audiences' perception of the immersive and interactive technologies used in museums and galleries was crucial to understanding the key factors influencing the improvement and development of immersive and interactive experiences. This research focused on four themes to understand the audiences' perceptions of immersive and interactive technologies for museum and gallery experiences. The subjects were asked about their awareness of and experiences with immersive and interactive museum and gallery technologies, including the difficulties they faced in using the technologies and improvements that could or should be made.

Similar benefits of immersive and interactive museum and gallery technologies were identified by the UK and Chinese audience members (UK, 47%, China, 68%). The respondents indicated that the technologies allowed them to have innovative, exciting, and engaging experiences and increased their ability to understand exhibition content by making it accessible and promoting interaction with it. Audiences in both countries had high rates of awareness of the immersive and interactive technologies used for museum and gallery experiences, including 3D screens and projections (UK, 81%, China, 90%), self-led AR (UK, 70%, China, 75%) and interactive VR (UK, 80%, China, 82%). In addition, they showed similar preferences for experiencing unique immersive and interactive experiences they had not yet experienced (UK, 44%, China, 49%). The findings demonstrate that audiences in the two countries had similar understandings of the impact and benefits of the technologies. They also indicate the need to develop and utilize immersive and interactive technologies for museum and gallery experiences.

Rates of awareness of the various immersive and interactive technologies among people of different ages differed between the UK and Chinese respondents. For example, the UK participants in the over-65 age group needed to learn about or had never heard of immersive and interactive technologies. Participants in the 55–64 age group in China were only aware of 3D screens and projections. The finding indicates that different levels of awareness of existing immersive and interactive technologies among other age groups can be both an opportunity and a barrier to facilitating the use of technologies for museum and gallery experiences. Moreover, the UK and Chinese audiences experienced different obstacles when using immersive and interactive technologies in museums and galleries. The UK audiences singled out instructions for AR and VR content as the main obstacle. In contrast, Chinese audiences chose to use AR and VR devices (e.g., AR applications or VR headsets). The UK respondents also complained about the long waiting lines to use the technology, equipment that did not work properly, and the fact that the technology had become outdated within three years of being introduced. The Chinese respondents singled out hygiene concerns, the comfort of the devices, and the redundancy of the instructions. Aggregating the obstacles the UK and Chinese respondents experienced when using immersive and interactive technologies in museums and galleries indicates that providing an improved experience would require offering better instructions and access to the technologies and considering the context and environment in which the technologies are utilized (e.g., hygiene, convenience, accessibility, etc.). Although the UK and Chinese audience members identified different obstacles with immersive and interactive technologies, all barriers should be addressed in museums and galleries to improve the user experience. To address the identified obstacles in using immersive and interactive technologies for museum and gallery experiences from the UK and Chinese audiences, the following potential guidance could be considered: firstly, ensuring the smooth operation of immersive and interactive technologies would necessitate a more robust maintenance schedule, including regular equipment checks and timely replacement of outdated or malfunctioning devices. Secondly, enhancing user experience would require ensuring the availability of

professionals trained to assist visitors with using the technologies effectively. This might involve providing on-site technical support or incorporating tutorials to guide users through the functionality of the devices. Furthermore, logistical considerations such as the placement of equipment within the museum or gallery space, ensuring accessibility for all visitors, and maintaining hygiene standards are crucial aspects to address.

### *Stakeholders' Perspectives*

Exploring stakeholders' perspectives on immersive and interactive technologies for museum and gallery experiences was crucial in understanding their perceptions and requirements for facilitating and improving these technologies. Moreover, identifying key drivers of and barriers to utilizing immersive and interactive technologies for museum and gallery experiences guided the extraction of key considerations for improving the mechanisms for developing and using immersive and interactive museum and gallery experiences.

Most stakeholders in the UK and China saw the use of immersive and interactive technology in museums and galleries in a positive light. They viewed the technologies as a powerful medium for storytelling and engaging audiences. In particular, UK stakeholders (especially museums and galleries) stressed that immersive and interactive technologies greatly impacted visitor numbers during the pandemic. They were able to use something novel to engage their audiences in a new way. Similarly, museums and galleries in China highlighted audience engagement in interactive exhibitions and the ability of immersive and interactive technologies to reach audiences emotionally.

Both UK and Chinese stakeholders stressed that immersive and interactive technologies could be used to reach audience segments such as younger children, teenagers, or families by targeting their needs and interests. UK stakeholders emphasized that immersive and interactive technologies deepen the understanding of objects and impart knowledge by telling compelling stories about them and allowing virtual interaction. According to the stakeholders in China, the psychological threshold of consumers is relatively high, so new things are needed to attract them, and what is challenging to achieve physically can be achieved digitally. Museums and galleries can utilize the technologies to increase their audiences' size and global reach by creating connections with them through these new experiences. However, a critical barrier exists: the high cost of producing immersive and interactive content. Although big institutions in the museum and gallery sector often have multiple revenue streams, including charitable donations, most museums and galleries, especially small ones, would require supplementary financial resources to develop and maintain immersive and interactive technologies. Also, knowledge of immersive and interactive technologies is not as extensive in the museum and gallery sector as in the technology sector, so utilization lags behind development. Furthermore, traditional museums may prefer to avoid the use of immersive and interactive technologies because they

prefer visitors to see artifacts directly rather than virtually. It will take time for the value of these technologies to be proven and for the market for them to develop, and institutional awareness will change slowly.

Some of the barriers that were identified differed between the UK and Chinese stakeholders. For instance, the UK stakeholders faced difficulties in striking the right balance between providing highly immersive experiences and staying true to physical objects; they also found it challenging to prevent the novelty of the immersive experience from wearing off. The Chinese stakeholders pointed out the difficulty of matching technologies to content.

Stakeholders in the UK and China stressed the need to create a contextual layer to bring a physical object to life rather than focusing on immersive and interactive technologies. However, such technologies can allow audiences to uncover alternative narratives of an artwork or collection, revealing hidden histories to help drive awareness, serve diversity, and foster inclusivity. The UK stakeholders highlighted some additional requirements: the need to (1) generate future income for museums and galleries based on an understanding of the commercial and social value of the technologies and (2) develop more collaborations related to intellectual property rights, content, and technologies development.

## Finding 2: Immersive and Interactive Technologies for Cultural Exchange

### *Audiences' Perspectives*

This research explored the interest of the UK and Chinese audiences in cultural exchange between their respective countries. We investigated (1) whether UK and Chinese audiences had experienced Chinese or UK cultural content in the museums and galleries in their respective countries, (2) their preferences for using immersive and interactive technologies to improve cultural exchange, and (3) their needs regarding the exploration and experience of different cultures.

The research found that more than half of the UK and Chinese respondents had yet to experience the other country's culture through immersive or interactive content offered by museums and galleries in their own countries (UK: 67%, China: 61%). The responses differed by age group, with a notable difference between respondents less than versus greater than 35 years. For example, a high rate of respondents in the 18–24 and 25–34 groups had experienced museum or gallery exhibitions of other countries' cultures (the culture of China for UK respondents and the culture of the UK for Chinese respondents). In contrast, those in the 35–44, 45–54, 55–64, and over 65 groups had a high rate of not having had such experiences. Exposure to such experiences was related to opinions regarding the use of immersive and interactive technologies for improving cultural exchange, except for those over 45 years of age in the UK and over 55 years in China. For example, UK and Chinese respondents, especially those under 45 years of age, shared positive opinions about the use of immersive

and interactive technologies to foster cultural exchange between the UK and China. Their opinions can be summarized as follows:

1. Immersive and interactive technologies allow audiences to experience different cultures in many ways, lowering cultural barriers and increasing understanding.
2. Such technologies provide entertainment, making the process of understanding and storing information easier and more meaningful than when information is provided through traditional methods.
3. These technologies make it easy to show details and give access to people who cannot physically visit certain locations, broadening their knowledge of the world and improving economic opportunities and tourism.

The UK and Chinese respondents older than 45 years gave lower ratings to the use of immersive and interactive technologies for cultural exchange between the UK and China for the following reasons:

1. Due to their limited experience with immersive and interactive technologies, they had a minimal understanding of how these technologies could influence cultural exchange.
2. They doubted that these technologies could have a significant effect on cultural exchange, unlike politics and commerce.
3. They felt that technology exchange was not a cultural exchange.

Several key issues for cultural exchange between the UK and China were also identified. Most UK and Chinese respondents who had experienced Chinese or UK culture through museums and galleries pointed out that there were only a few ways to experience content relating to different cultures from museums and galleries in the two countries. They indicated that most cultural content was experienced through text information (e.g., labels on art pieces and descriptive panels). Therefore, they often encountered difficulties in exploring detailed information about UK or Chinese culture or artifacts. This finding demonstrates that the practical application of immersive and interactive technologies remains limited despite their benefits. Using them more widely could improve the ability of UK and Chinese museums and galleries to promote cultural exchange.

UK and Chinese audiences viewed the worth of experiencing different cultures similarly. For example, respondents in both countries valued understanding different cultural contexts, followed by understanding the different histories and improving their knowledge of culture and the arts. In contrast, they expressed different opinions about the key aspect of the experience they would like to have with UK or Chinese content in museums and galleries. Although all age groups in China wanted to learn about everyday life, arts, and history from UK content, preferences varied by age group in the UK. For example, half of the UK respondents stated they would like to experience content related to history, and more than a third chose art. Respondents aged 25–34 and 35–44 years showed high interest in

experiencing Chinese content about history. However, respondents aged 18–24, 45–54, and 55–64 years chose art as the Chinese content they wanted to experience most. These findings on preferences associated with various age groups could be used in developing cultural exchanges between the UK and China.

### *Stakeholders' Perspectives*

This research found that some UK and Chinese stakeholders were excited about the potential of immersive and interactive technologies to facilitate cultural exchanges, while others were skeptical. Stakeholders interested in deploying the technologies for cultural exchanges considered that their use was gaining a lot of traction. Many big immersive art exhibitions have successfully attracted audience interest and participation. Some immersive and interactive exhibitions have become news by creating novelty around the immersive experience through social media channels such as Instagram and TikTok. The audiences enjoy the experience, and the experiences allow them to share new content with others. Some stakeholders in the UK and China believe that technologies can cultivate cultural exchanges between the two countries by providing new methods and settings for experiencing other cultures. Although stakeholders in the UK, especially those from the museum and gallery sector, acknowledge that the technologies can help explain complicated aspects of different cultures by providing an accessible means of cultural exchange, they are concerned that audiences might retain more memory of the technologies than the cultural objects. Also, some noted that the process of understanding objects is slow; it may take time to understand and experience objects from different cultures. In addition, some stakeholders stressed the need to understand the different assumptions and preferences of UK and Chinese audiences, considering the cultural differences between the UK and China.

Other stakeholders were unsure about using immersive and interactive technologies as they believed in the classic power of objects in museums and galleries. A few stakeholders from the museum and gallery sector stressed that using immersive and interactive technologies for cultural exchange requires well-balanced partnerships between partners—including tech providers, museums/galleries, and, especially, content developers with specialisms in creating narratives. Building such partnerships is one of the critical barriers that stakeholders in the museum and gallery sector have faced. Contributing to this barrier is the lack of resources and cases that demonstrate the use of immersive and interactive technologies for cultural exchange as well as the passive attitude of stakeholders in the museum and gallery sector in adopting immersive and interactive technologies for cultural exchange. Chinese museum and gallery stakeholders pointed out that utilizing technologies may not be an ideal focus for cultural exchange. According to one of the stakeholders, most museums and galleries are interested in using the technologies. However, some traditional museums and galleries still do not use them much, and traditional audiences may have little interest in experiencing them.

The identifications of drivers of and barriers to the use of immersive and interactive technologies indicate the importance of enhancing their acceptability for cultural exchange. To do this, it is important to (1) provide audiences with continuity and a connection to the subject of the cultural exchange for longer than just that moment of seeing/experiencing the object and (2) develop an in-depth understanding of audiences in the UK and China based on acknowledgement of cultural differences.

### Finding 3: The Stakeholder Landscape

The operating mechanism for immersive and interactive museum and gallery experiences depends on the key stakeholder roles, responsibilities, and interrelationships. Therefore, it was crucial to develop an up-to-date stakeholder map to understand the operational aspects of the sector. We found that the museum and gallery sector stakeholders were diverse; they included government, policymakers and implementers, creative businesses, academic research communities, and audiences. The stakeholders play both direct and indirect roles, steering and aiding development. The roles of stakeholders in the UK and China are largely similar, with some exceptions.

Stakeholders in the UK and China play three similar direct roles: (1) governments, policymakers, and implementers lay the groundwork for the growth of creative industries at the national level, developing and implementing strategies and action plans; and (2) governments allocate budgets, policymakers and implementers provide funds, and universities, museums, galleries, and creative businesses develop funding schemes based on partnerships. Stakeholders also play two types of indirect roles: (1) conducting or being the subjects of market research (museums and galleries, creative businesses, universities, audiences) and (2) coming up with ideas that require implementation by museums and galleries to explore how an audience interacts with the technologies (universities). Some differences in indirect roles were observed between the UK and Chinese stakeholders. Chinese museums and galleries present the pioneering nature of new technologies to the government and incubate and support young artists in universities. Universities in China also provide theoretical support to museums and galleries in the use of immersive and interactive technologies. They forecast technology trends and audience preferences and provide advice after a policy has been developed and before its execution. In contrast, universities in the UK demonstrate the value of research on immersive and interactive experiences.

Figures 4 and 5 illustrate the stakeholder landscape, showing the key stakeholder roles and relationships for immersive and interactive museum and gallery experiences in the UK and China and illustrating the similarities and differences among the stakeholders in the two countries.

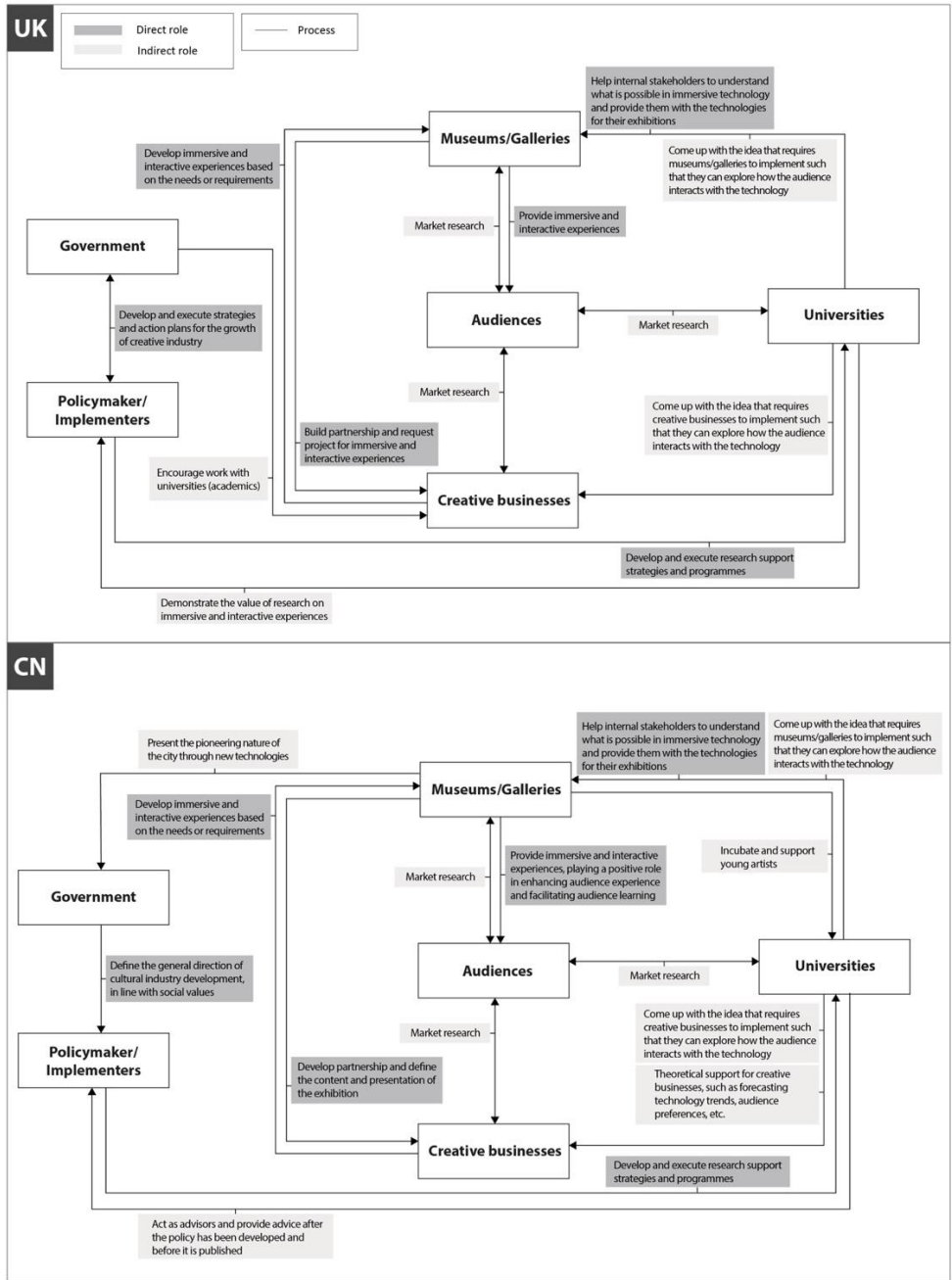


Figure 4: Key Stakeholder Roles for Immersive and Interactive Museums and Galleries Experiences



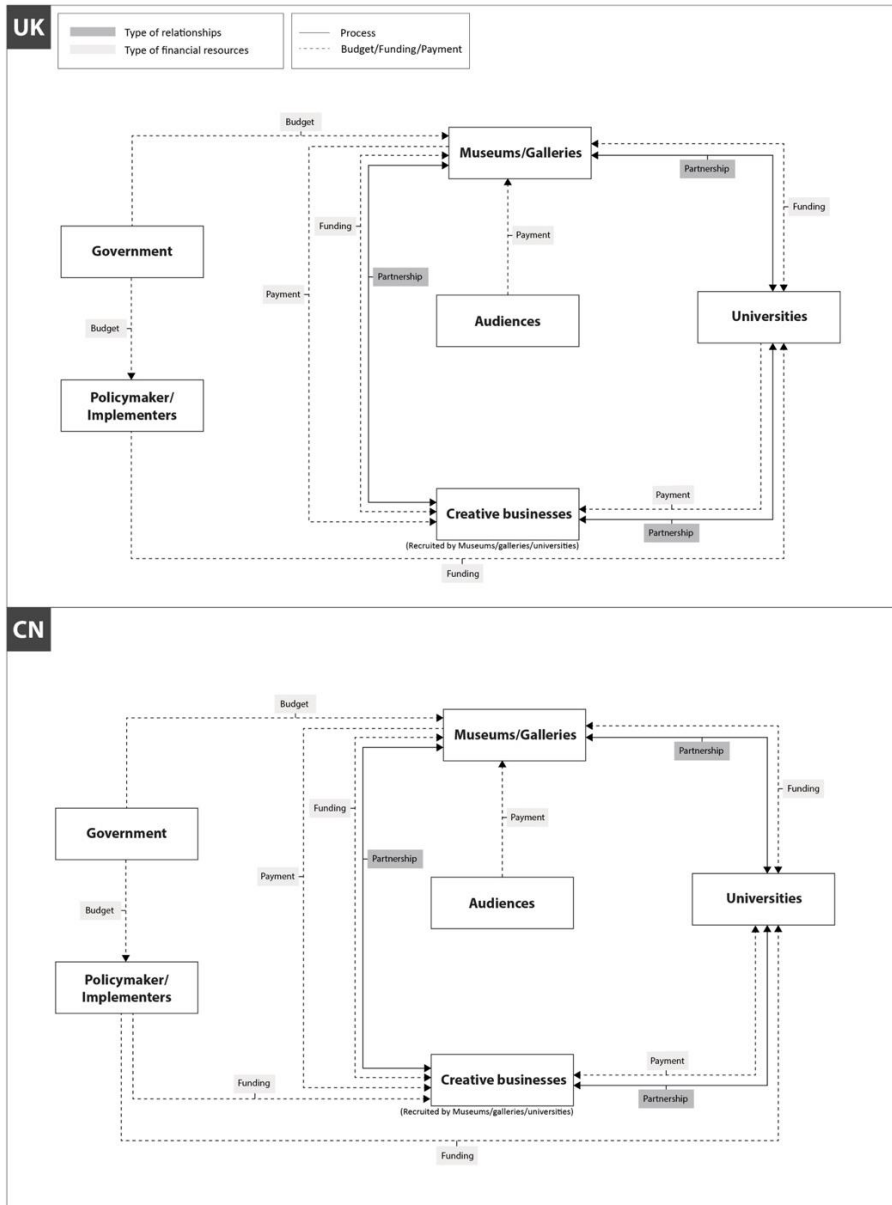


Figure 5: Key Stakeholder Relationships for Immersive and Interactive Museums and Galleries Experiences

By exploring the stakeholder landscape for immersive and interactive museum and gallery experiences in the UK and China, this research identified two critical issues that hinder the optimization of operational mechanisms for immersive and interactive museum and gallery experiences in the UK and China. First, the UK and Chinese stakeholders (museums and galleries, creative businesses, and universities) who develop immersive and

interactive museum and gallery experiences rely heavily on financial resources from the government. Sometimes, stakeholders develop funds with their partners, but in most cases, they depend on budgets and funding from governments, policymakers, and implementers. This issue relates to the cost burden of producing immersive and interactive museum and gallery content, as pointed out by stakeholders (discussed in Finding 1). The lack of financial resources is a critical issue for both content development and content management. To address this issue, it will be crucial for museums and galleries to explore and secure financial support and resources from the private sector as well as develop income generation models that draw on immersive and interactive museum and gallery experiences.

Furthermore, partnerships between stakeholders have tended to be developed on a one-off basis (i.e., project-based), and multilateral partnerships between museums and galleries, creative businesses, and universities are lacking. In the stakeholder landscape, museums and galleries, creative businesses, and universities are considered strategic stakeholders who not only contribute to the development of immersive and interactive museum and gallery experiences but also influence other stakeholders (i.e., government and policymakers) to develop and improve the groundwork for immersive and interactive museum and gallery experiences. Universities play various roles in market research (e.g., they explore trends and audience preferences) and offer theoretical support and technological development. Museums and galleries present opportunities for applying technology developed in response to market research. Considering their respective roles, universities and creative businesses should be more active in building partnerships with museums and galleries; universities could even link museums and galleries and creative businesses. Understanding the role and effects of each stakeholder, as well as those of long-term and multilateral partnerships between museums, galleries, creative businesses, and universities, would make it possible to maximize their impact.

## **Discussion and Recommendation**

This research explored (1) museum and gallery stakeholders' and audiences' experience with and perception of immersive and interactive museum and gallery experiences, (2) their interest in cultural exchange utilizing immersive and interactive technologies, and (3) operating mechanisms for immersive and interactive museum and gallery experiences in the UK and China. We identified great opportunities and needs for the use of immersive and interactive technologies in museums and galleries and cultural exchange by investigating the awareness and expectations of the technologies among audiences and stakeholders of UK and Chinese museums and galleries and preferences related to the use of the technologies. Similarities and differences in critical drivers of their use, as well as barriers, were also observed. Some issues that should be addressed to improve the current stakeholder landscape were also identified; these involved refining the mechanisms for developing and utilizing immersive and interactive technologies for museum and gallery experiences and cultural exchanges. The key findings are summarized in Table 3.

Table 3: Summary of Key Findings

		UK	China	
<i>Similarities</i>	<i>Museums and Galleries Experiences</i>	<i>Drivers</i>	<ul style="list-style-type: none"> <li>Positive lights on the immersive and interactive technologies for museums and galleries experiences among audiences and stakeholders</li> <li>Awareness of the impact and benefits of the technologies they can gain from the experiences among stakeholders</li> <li>Reach a particular new type of audience by targeting the experience specifically toward their needs and interests</li> </ul>	
		<i>Barriers</i>	<ul style="list-style-type: none"> <li>Different rates of awareness of the existing immersive and interactive technologies among different age groups of audiences</li> <li>Different obstacles when using immersive and interactive technologies in museums and galleries among different age groups of audiences</li> <li>High cost of production of immersive and interactive museums and galleries content</li> <li>Different levels of pace between the development (e.g., technology sector) and utilization (e.g., museums and galleries sector) of the technologies</li> <li>Different preferences on the technologies by traditional institutes and audiences</li> </ul>	
		<i>Requirements</i>	<ul style="list-style-type: none"> <li>Content development rather than the technology itself</li> <li>Income generation for the future of museums and galleries</li> </ul>	
	<i>Cultural Exchange</i>	<i>Drivers</i>	<ul style="list-style-type: none"> <li>Positive lights on the immersive and interactive technologies for cultural exchange among audiences and stakeholders</li> </ul>	
	<i>Barriers</i>	<ul style="list-style-type: none"> <li>Minimal understanding of how immersive and interactive technologies can influence cultural exchange due to limited experiences with the technologies</li> <li>Doubts about how these technologies have a significant effect in this area when compared to politics and commerce</li> <li>Concern about the memory of the technologies rather than the objects of the cultural exchange</li> <li>Establishment of well-balanced partnerships between partners</li> <li>Lack of resources and cases of using immersive and interactive technologies for cultural exchange</li> <li>Passive attitude of the museums and galleries sector stakeholders in adopting the technologies for cultural exchanges</li> <li>Different preferences on the technologies among museums, galleries and audiences</li> </ul>		
	<i>Stakeholder Landscape</i>	<i>Issues</i>	<ul style="list-style-type: none"> <li>Heavy reliance on financial resources from the government</li> <li>One-off basis partnerships between stakeholders</li> <li>Lack of multilateral partnerships between museums and galleries, creative businesses, and universities</li> </ul>	
<i>Differences</i>	<i>Museums and Galleries Experiences</i>	<i>Barriers</i>	<ul style="list-style-type: none"> <li>Provide the right balance between the highly immersive experience while staying true to the actual physical objects and not losing out on its importance</li> <li>Secure the novelty of the immersive experience wearing off</li> </ul>	<ul style="list-style-type: none"> <li>Match between the content and technologies</li> </ul>
		<i>Requirements</i>	<ul style="list-style-type: none"> <li>Develop more collaborations for IP (Intellectual Property Rights), content, and technologies development</li> </ul>	N/A

To minimize the barriers and maximize the drivers and potential of immersive and interactive technologies for museum and gallery experiences and cultural exchange, as well as to improve the current stakeholder landscape (e.g., the mechanisms for developing and utilizing immersive and interactive technologies for museum and gallery experiences and cultural exchange between the UK and China), this research recommends the following.

- Creative businesses, museums, and galleries should increase accessibility to immersive and interactive technologies to help audiences become accustomed to them by accompanying initiatives to educate and familiarize audiences with these technologies. They should also focus on the added value of immersive and interactive experiences instead of rushing to add technologies. Also, they should balance physical and digital experiences (i.e., engaging onsite versus online). This consideration is particularly relevant to developing income generation models to ensure the continuity of technology development and the future of immersive and interactive museum and gallery experiences.
- Universities, creative businesses, museums, and galleries should develop an in-depth understanding of the needs of different audience sectors (e.g., age groups) and work together to structure information about those sectors' needs (including their interest in and awareness of the technologies and different cultures) to provide credible information. In particular, they should build strategic partnerships with industries for research projects that would allow knowledge transfer. This consideration may relate to establishing resource platforms between the UK and Chinese museum and gallery sectors. The two countries could share various resources through the platforms, including artifacts, knowledge, experiences, technologies, and human resources. Also, stakeholders could explore opportunities to interact and collaborate.
- Governments, policymakers, implementers, and museums and galleries should consider providing additional long-term funding. In particular, governments, policymakers, and implementers in the UK and China should work together to develop international funding schemes to facilitate cultural exchange using immersive and interactive technologies. The provision of stable funding will influence the quality and continuity of the development of immersive and interactive technologies and cultural exchange between the UK and China.

## Conclusion

This research explored and compared the opinions of audiences and key stakeholders in the museum and gallery sector in the UK and China regarding immersive and interactive technologies and cultural exchange. An exploration of the current stakeholder landscape provided insight into the existing operational mechanisms for developing and utilizing the technologies in museums and galleries for audience experiences and cultural exchange.

The key findings highlighted the need to enhance the acceptability and accessibility of immersive and interactive technologies for audience experiences and cultural exchange in the sector. Additionally, there is a need for improvement in stakeholders' roles and relationships. The recommendations derived from the research encompass both operational considerations (e.g., deploying the technologies) and strategic considerations (e.g., stakeholders' roles and relationships; approaches).

This research makes theoretical and practical contributions. First, it comprehensively explored and compared the awareness, interest, and preferences of audiences, museums, and galleries regarding immersive and interactive technologies and cultural exchanges between the UK and China, which have received only limited coverage in the literature. Consequently, it can serve as a foundation for research on immersive and interactive museum and gallery experiences and cultural exchange between the UK and China. Second, the research identified essential stakeholder roles and relationships by evaluating the current mechanisms for developing and utilizing immersive and interactive technologies in museum and gallery experiences and cultural exchange between the UK and China. Consequently, the findings can guide stakeholders interested in immersive and interactive technologies for museum and gallery experiences and cultural exchange to improve their roles.

However, research findings represent limitations in exploring and evaluating current policies, action plans, and funding landscapes for promoting the interaction and collaboration between the UK and China. Also, it should be noted that the implementation of the recommendations may be limited due to the different cultural contexts.

Considering the limitations, further research is recommended to build a strategic framework that can guide interaction and collaboration between UK and Chinese stakeholders to facilitate immersive and interactive technologies in museum and gallery experiences and cultural exchange. This would enable scholars and practitioners to develop strategies and action plans to promote international collaborations between the UK and China in a larger context beyond the museum and gallery sector.

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The authors declare that generative AI or AI-assisted technologies were not used in any way to prepare, write, or complete essential authoring tasks in this manuscript.

## Informed Consent

The authors have obtained informed consent from all participants.

## Conflict of Interest

The authors declare that there is no conflict of interest.

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## ABOUT THE AUTHORS

**Dr. Hyejin Kwon:** Research Assistant, College of Engineering, Design and Physical Sciences, Brunel University London, Uxbridge, United Kingdom  
Corresponding Author's Email: k.hyejin1407@gmail.com

**Professor Youngok Choi:** Professor, College of Engineering, Design and Physical Sciences, Brunel University London, Uxbridge, United Kingdom  
Email: Youngok.Choi@brunel.ac.uk

**Xiaoyang Zhao:** PhD candidate, Dyson School of Design Engineering, Imperial College London, London, United Kingdom  
Email: x.zhao21@imperial.ac.uk

**Dr. Min Hua:** Assistant Professor, Institute of Cultural and Creative Industry (ICCI), Shanghai Jiatong University (SJTU), Shanghai, China  
Email: huamin@sjtu.edu.cn

**Dr. Wei Wang:** Lecturer, Institute of Cultural and Creative Industry (ICCI), Shanghai Jiatong University (SJTU), Shanghai, China  
Email: wangwei1115@sjtu.edu.cn

**Professor Vanja Garaj:** Professor, College of Engineering, Design and Physical Sciences, Brunel University London, Uxbridge, United Kingdom  
Email: vanja.garaj@brunel.ac.uk

**Dr. Busayawan Lam:** Reader, College of Engineering, Design and Physical Sciences, Brunel University London, Uxbridge, United Kingdom  
Email: busayawan.lam@brunel.ac.uk