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EFFECTIVENESS OF USING INFORMATION AND COMMUNICATION TECHNOLOGY IN DEVELOPING MUSEUM EXHIBITIONS: THE CASE OF THE SHARJAH MUSEUMS

Abstract: Museums are increasingly embracing information and communication technology (ICT) to promote cultural tourism and to keep pace with changes in society. Cultural values, legacies, and customs are transmitted through museums, connecting current generations with their past. ICTs are used in almost all museum operations, both within and outside their walls, and especially for exhibitions and preservation. Prior research indicates that museums utilize a variety of ICTs to further modernize displays and artifacts and improve the visitor experience. Museums also use various digital communication tools to enrich the visitor experience. Many of the functions performed by ICTs used to create interactive processes in museum displays are the subject of ongoing research among museum scholars. This study investigates how experts and museum scholars view the effectiveness of using ICTs in creating a trend in the development of museum exhibitions in the Emirate of Sharjah. It will also discuss which available ICT applications museums can apply to improve technology services for their visitors. The study was conducted at the Sharjah Museum of Islamic Civilization, one of the largest museums in the Emirate of Sharjah. Both qualitative and quantitative data were collected, with questionnaires being the main method of data collection. A questionnaire was distributed to learn the views of experts about the application of ICTs in museum exhibitions. The results of the study indicate that ICTs should be designed with physical surroundings in mind. Physical distance can be bridged using “mixed interfaces” or mobile devices.

Keywords: Information and communication technology (ICT), Sharjah Museum Authority, Sharjah Museum of Islamic Civilization, digital technologies, museum exhibition.

1. Introduction

Information and communication technology (ICT) makes it possible for people to communicate and share information over long distances through telecommunication methods like the internet, wireless networks, and cell phones.[1] The cultural sector has witnessed unprecedented progress over the last few decades due to significant technological development and the evolution of the internet and digital applications. This is especially true for museums.[2] Technology has brought museums into a novel, imaginative world in which museums can play active and appealing roles while breaking down barriers, and particularly that presented by the spatial dimension.[3]

Anderson (2012) identified eight fundamental changes in the museum sector and the two key points for this study. First, museums are increasingly being required to become more acclimatized to the future and to be able to innovate and use ICT in museum exhibitions and interpretations. Second, communication with the audience must be sustained, and internet and digital technology applications should be used to continually attract visitors. An authentic visitor experience must be continually processed.[4]

Current ICTs in museums are defined by three features: computational virtuality, interactivity, and the multiplicity of interfaces. In computational virtuality, the boundaries of the physical dimension vanish, and any sort of exhibition can be built. Interactivity is the ability of systems to receive and react to human input. ICTs shatter the conventional perception of museums as being elitist, authoritative institutions by encouraging visitors to engage in a mutual, conscious environment in which they create their own experiences and identity. The third feature is the multiplicity of interfaces. ICTs come in a variety of forms, and can be used for a variety of purposes. This is closely linked to the museum level of the exhibition. Wearable or mobile devices are essential for exhibitions that place a focus on an object, but augmented reality systems can provide an additional layer of information that can be tailored to suit the needs of different types of visitors.[5]

Thus, many museums today cannot imagine permanent or temporary exhibitions without interactive components that might explain or replace artifacts unavailable in museum galleries, evoke an emotional response, or involve them in the museum's environment.

2. Theoretical Background

This study draws on two distinct bodies of literature: one that investigates the link between ICTs and museums, and another that assesses the effectiveness of ICTs in museum exhibitions.

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1 Perron et al. 2010: 1.
2 Kulesz 2016: 2.
3 Vaz et al. 2018: 31.
4 Liebl 2015: 19.
5 Pujol-Tost 2011: 64.

2.1. Types of ICTs in Museum Exhibitions

ICTs used in museums can be divided into three main categories.[6] These technologies are versatile and exist on various levels within other categories:

- **Informative and display technologies:** technologies that improve exhibition design and artifact/content presentation, primarily during the visit (audio and smart guides, touchscreen kiosks, 3D, virtual and augmented realities, mobile apps, etc.).
- **Communication and marketing technologies:** technologies that facilitate communication and marketing by encouraging additional and deeper audience involvement, mostly prior to and following a visit (digital media, websites, and social media tools).
- **Organizational and managerial operations technologies:** technologies mostly employed in organizational and management operations to offer and integrate the elements required for the display alongside other technologies (database, conservation technologies, and internal network systems).

Museums benefit from innovations supported by ICTs. They are most actively employed in museums for communication and mediation with the audience. There are various devices and applications used for mediation in museums. The main elements that ICTs are used for in the museum communication process are presentations, audience attraction, creating an effective experience, entertainment, and education (Fig. 1).[7]

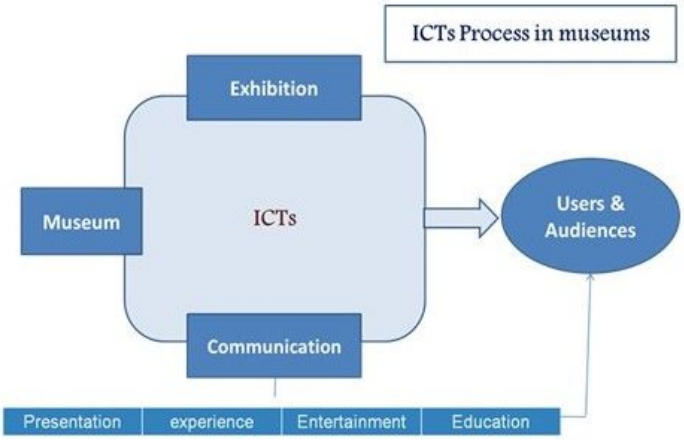

Fig. 1: ICTs and the museum communication process.
Source: (Barbosa, Camila Costa. 2013). Ed. by the authors.

[6] Barbosa 2013: 36.
[7] Navarrete 2019: 202–203.

This paper discusses specific trends regarding ICT applications in the museum. Many ICT applications, such as multimedia kiosks, audio guides, smart guides, holographic displays, and short films, have been specifically developed to aid visitors in understanding exhibits. Virtual reality, augmented reality, and mobile apps may also be utilized on-site over the web.

Virtual reality (VR) enables users to interact in real time with a computer-simulated environment via human sensory channels.[8] A VR system composition mainly includes five components: a virtual environment, a sensor device, other devices, and a generator of human and virtual environments (Fig. 2).[9] Technologies like VR have unquestionably provided museums with tremendous potential for connecting with their visitors in new ways. The use of VR to recreate historical and cultural settings and to interpret and improve visitor experiences in and out of the museum increases audience involvement, improves education, and builds immersive museum environments.[10] In addition, it can be used to create tours of exhibition and help curators contextualize objects and reveal their true scale.[11]

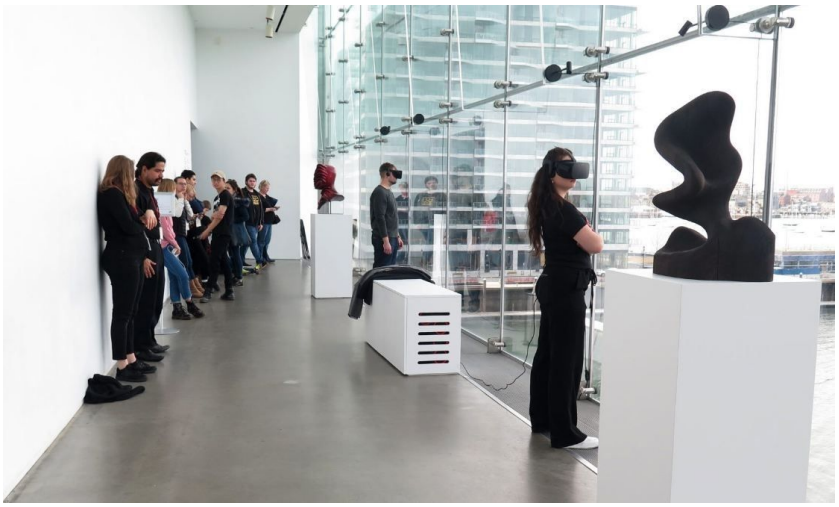

Fig. 2: VR experience at the Utah Museum of Fine Arts.
Source: https://jasoren.com/vr-in-museums/

Augmented reality (AR) is associated with a reactive experience of a real-life environment in which objects in real life are enhanced via perceptual information generated by computer and sometimes via sensory modalities that include the tactile, auditory, and visual.[12] According to Azuma, AR can indeed be described as a system with three

8 Weng et al. 2011: 180.
9 Wang, Yue 2019: 1.
10 Shehade, Stylianou-Lambert 2020: 1.
11 Coates 2020.
12 Zhou et al. 2008: 193.

fundamental characteristics: the real world combined with virtual worlds, interaction in real time, and 3D real and virtual artifact registration.[13] Augmented reality is also linked to two main components: a mixed reality (of which AR is a part) and a computer-mediated reality. AR thus changes one's perception of the real world, while VR fully replaces the user's environment.[14] AR can be installed on various digital devices, including mobile phones, tablets, and mounted displays such as Microsoft HoloLens and Google Glass (Fig. 3).[15]

Fig. 3: Visitor experience (AR). 3D model of a fully animal.
Source: (Marques & Costello, 2018).

In addition to conventional displays at museums, AR technology provides new opportunities for objects to be digitized in several ways and to call up virtual and augmented objects.[16] It also enhances critical thinking and the audience's thinking processes such as curiosity and analysis. It enhances an exhibition's digital content and digital storytelling methodology,[17] and makes it possible for visitors to experience unattainable journeys through time or space. It also allows for targeting larger audiences, and especially technological audiences of both children and adults.[18]

The use of audio "digital" guides at museums dates back to the 1950s. The traditional audio guide service achieved great success as a mobile interpreter at this time.[19] Interactive audio guides are electronic devices with an MP3 memory, a keypad, a few buttons, and a

[13] Azuma 1997: 356.
[14] Azuma et al. 2001: 34.
[15] Ulukuz, Whitworth 2016: 19.
[16] Weng et al. 2011: 180.
[17] Poce et al. 2019: 2.
[18] Loumos et al. 2018: 313.
[19] Sexton 2013: 15–19.

speaker. RFID chips are connected to smart tags using radiofrequency and are analogous to the immersive guide: The reception of information is initiated once the device nears a sensor or, as with some systems, connects to a GPS.[20] Interactive audio guides commonly employ infrared technology to activate audio channels when directed at objects or displays or when suspended in rooms. Photos, pictures, audio, and text may be sent to a specific phone number to assist audiences in comprehending the displays (Fig. 4 and 5).[21] Audio guides often utilized in museums or exhibitions may be classified as follows:

- Devices with number pads.
- Personal Digital Wizards or PDAs.
- Handsets.
- Special scenario devices.[22]

Fig. 4: Visitors experience audio guide with new Nintendo 3DS – Navigation.
Source: https://www.louvre.fr/en/museum-audio-guide

Fig. 5: Visitor experiences traditional audio guide with a headset.
Source: https://umfa.utah.edu/audio-guide

Audio guides allow audiences to immerse themselves in stories that help them create meaningful memories and thus achieve a comprehensive experience.[23] It also enables the blind and visually impaired to visit museums and replaces the customary human guide, thus increasing visitor autonomy.[24]

A mobile app is a software program designed to be run on smartphones, tablets, and other devices.[25] Apps are usually small, limited function, single software units. The use of this software is propagated by the app store and thousands of iPhones, iPads, and iPod Touch applications have been sold.[26] Each app offers limited and isolated features such as games, media, or mobile internet browsing. It generally depends on the computer software and is then transferred to the phone via the app store. The market provides many applications which can be classified according to function (Fig. 6) and include apps for managing, storing, and registering

[20] Gebbensleben et al. 2006: 249.
[21] Martins 2012: 104.
[22] Gebbensleben et al. 2006: 252.
[23] Cesário et al. 2017: 128.
[24] Martins 2012: 104.
[25] Wei, Jianping 2015: 90.
[26] Medić, Pavlović 2014: 168.

collections as well as apps for displaying collections and enhancing the visitor experience.[27]

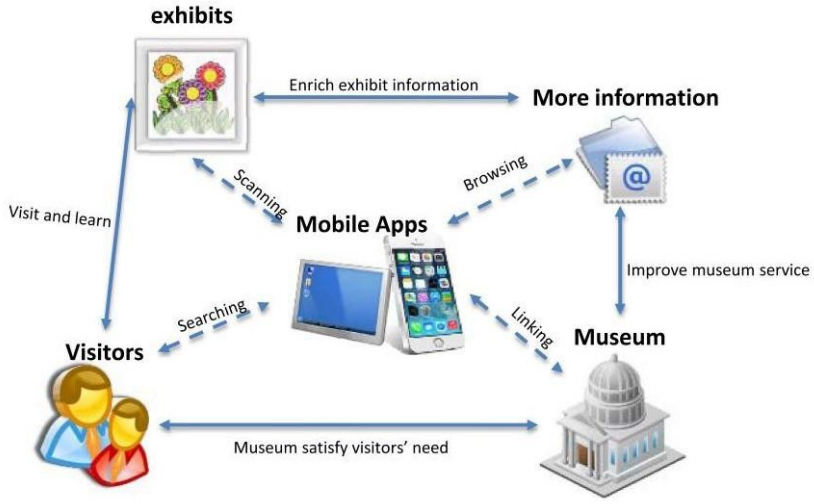

Fig. 6: The role of mobile applications used to link the museum and visitors.
Source: (Wei and Jianping 2015).

There are multiple possibilities for the use of mobile technologies in situ and online through exhibitions, QR codes, AR, mobile phone GPS, multimedia, audio tours, mobile websites, iPad tours, etc.[28] Generally, museums explore digital and mobile technologies to improve communication, content, and the visitor experience,.[29] Moreover, visitors may explore unique artworks, play games created for children and for adults, experience contextualized learning through AR, and access additional sources of information such as visitor guides and interactive maps.[30]

Information kiosks with touchscreens are one of the most important digital devices widely used in museum exhibitions. Some of them are more interactive and offer quizzes and mini-games, for example, while others present multimedia in many ways through text, images, video, and audio.[31] This technology also allows visitors to have attractive personal experiences through video, specimens, details, associated images and texts, QR codes for more information, the museum mobile app, and sharing these experiences with other visitors. These touchscreen kiosks offer advantages such as:

- Dynamic content.
- Multimedia text.[32]
- Creating a comfortable, highly familiar, and collaborative atmosphere

[27] Teslyuk et al. 2020: 314.
[28] Medić, Pavlović 2014: 168.
[29] Tsai, Sung 2012: 95–98.
[30] Petrelli, O'Brien 2018: 1–2
[31] Hall 2013: 11.
[32] Burmistrov 2015: 2–3.

- Increasing the interactive area of the display.[33]
- Enhancing user experience (UX) and learning effectiveness.[34]

Holograms, also known as holographs, are recordings of artwork, but the holograms are shown as the final product. Holography is a laser application that creates a virtual experience. The etymology of term holography comes from ancient Greek and consists of two parts: ὅλοσ (holo), meaning everything, and *γράφω*, which translates as "I describe all things" and indicates writing, coloration, or painting.[35] A hologram is technically a stereoscopic picture that is obtained using a laser and is stored on the level surface of an imaging board. When the laser beam illuminates this photographic plate according to the reference beam original, the beam flows through a transparent space and absorbs dark areas to various degrees, creating a body-composed wave. The result is photography and display applied simultaneously.

The advantages of holograms for exhibitions are:

- Replacing the original object with a holographic copy.
- Significantly enhancing the visual perception of the object by recording multiple images along with the same carrier.
- Enhancing the interpretation.[36]
- Potential to restore a damaged part of an object using a laser.[37]

The internet is a global network that allows devices of all kinds to interact and exchange information and services. It is also a shared global resource for information, knowledge, and cooperation among innumerable multicultural communities. The World Wide Web was mainly produced at CERN in 1989, in Geneva, Switzerland. The *www* is a hypertext distributed information system that enables internet users to create, edit, or browse online documents.[38]

Museum websites promote museum or art gallery brands. These sites publish video ads, broadcast art museum exhibitions, publish pictures of masterpieces, and stream specialized conferences and special programs to pique the interest of visitors and encourage them to visit the museum.[39] Furthermore, visitors—including the disabled—can experience more museaum visits through online museum tours.[40]

There are some points that museum curators should consider when generating effective sites for their audiences, including:

- Diversity of visitors.
- Appropriateness of site content and text.
- Employing virtual agents and avatars.
- Visitor profiles.

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33 Geller 2006: 9.
34 Zaharias et al. 2013: 375.
35 Pietroni et al. 2019: 5.
36 Markov 2011: 66.
37 Fatima, Ahmed 2020: 662.
38 Sabin 1997: 2.
39 Weblium 2019.
40 Navarrete 2019: 204.

2.2. Museum Exhibitions

Exhibitions are an essential part of the museum; there is no museum without a museum display.[41] For an exhibition, the exhibit is generally includes a single display that is often extended to a series of displays covering the same theme, or sometimes there is a wide range of displays with one common theme.[42]

The exhibition is the most significant, forceful, and direct visual communication in any museum. Every day, thousands of people come to visit museum exhibits. Museum displays and visitors are closely linked. While museums have many potential public activities, displays are the primary means of communicating with their audiences. The public's view of a museum is often based on their comprehension of an exhibition. Exhibitions have tremendous influence on museum creativity and resources in terms of content, character, installation demands, development, and operation. The audience is right to identify museums with exhibitions.[43]

When planning to exhibit physically inside the museum, the question that comes to mind about the exhibition is this: Does the exhibited piece require it to be displayed permanently or for a limited period? For the former, the piece is indispensable for the display, while for the latter it is only an essential element for a limited period and can be changed according to the themes of the display. Using various criteria, exhibitions are labeled according to classifications by museologist Belcher.[44] Museum exhibitions can be divided into the following types:

- Permanent exhibitions
- Temporary exhibitions and special exhibitions
- Mobile exhibitions

Based on different criteria and literature, we have further divided the types of exhibitions as follows:

- Permanent exhibitions.
- Temporary exhibitions.
  - Mobile exhibitions.
  - Traveling exhibitions.
- Virtual exhibitions.

2.3. The Sharjah Museum Authority

Since 1971, the Emirate of Sharjah has been one of the seven emirates that comprise the United Arab Emirates (UAE). The UAE is located in the Arabian Gulf in the Middle East.[45] Thanks to the vision of His Highness, the Ruler of Sharjah, and his appreciation of

41 McLean 1999: 83.
42 Bitgood 1992: 4.
43 Kapukotuwa, Anedo 2020: 3.
44 Herreman 2004: 92.
45 Morris 2009: 631.

the value of cultural and natural heritage and Sharjah's identity, there are many different museums in the Emirate that focus on a wide range of topics, including Sharjah history and heritage, Islamic art, traditional art, marine heritage, and the natural sciences such as botany and modern science.[46]

The Sharjah Museum Authority (SMA) coordinates seventeen museums in Sharjah and is responsible for designing potential strategic museum projects. The Sharjah Museums Authority covers Sharjah heritage and history, the arts, archaeology, Islamic culture, and science, and natural history. The Authority aims to be a cultural platform that promotes the Sharjah identity locally and globally and educates the public on the value of museums as cultural and educational institutions. Moreover, the Authority's mission is to continually improve the quality of the Emirate's educational and community displays and activities while also safeguarding the collections.[47]

3. Methodology

The required data were gathered and verified using two methods: a case study (qualitative approach) and a survey (quantitative approach). We used the Sharjah museums as a case study to investigate the hypothesis that ICT applications in museums are beneficial. Surveys of professionals were distributed to learn their thoughts on this and determine their level of satisfaction with ICT applications and programs at exhibitions. Email interviews were conducted only with experts and professionals at the SMA to gather viewpoints regarding ICTs in Sharjah's museums. The interviews were very useful for gathering additional relevant information for the study. Questions were emailed to the SMA staff, who then responded with written answers. Seven open-ended questions were asked that were pertinent to ICTs in Sharjah's museums in the current socio-technological contexts. The seven questions were:

1. How do ICT applications affect the development of a museum exhibition?
2. What technology do you consider to be crucial investments for a museum? (Please describe them).
3. Are there any future projects for new ICT applications at the museums?
4. Do you have an IT staff dedicated to ICT applications in the museum?
5. What are the advantages and disadvantages of having ICT applications in museums?
6. How do ICT applications enhance the visitor experience?
7. What are the categories of museum visitors?

These questions were meant to test the hypothesis regarding the effectiveness of ICT applications (on-site and online) in museum exhibitions and the level of audience satisfaction with the exhibitions provided by the SMA.

[46] Bouchenaki 2011: 96.
[47] Sharjah Museum Authority 2020.

4. Data Analysis

4.1 Data Analysis of Feedback from Museum Professionals

The questionnaire used to collect the museum professionals' feedback was constructed using the online survey software Microsoft Forms. It was distributed to specialists in the museums through various social media tools. Data was gathered between the second and third quarters of 2021. In total, 134 professionals responded. It was arranged in four sections: the practical background of museum professionals, their opinions on the advantages and disadvantages of ICT application, the role of ICT applications during lockdowns and in serving audiences during the COVID-19 pandemic, and the audience categories that used technology in the exhibitions.

The survey had three parts. The first section covered information about the professionals and their functions. The second section covered their perspectives on ICTs in real and virtual exhibitions. The final section focused on ICT applications utilized by museums in response to lockdowns and to serve audiences during the COVID-19 pandemic, and the kinds of people who used the technology in the exhibition.

Q1. *Your job at the museum is related to …?*

In total, 134 professionals answered the questionnaire. According to the participants' responses, around half of them had jobs related to the exhibition department (21%), higher management (19%), and education (13%), followed by database and registration (10%), conservation and restoration (7%), publication and scientific research (6%), and as professors and researchers (6%). Of the remaining respondents, 15% worked in museum-related positions (5% in storage, 5% in marketing, and 5% in facilities and operations). The remaining 3% held administrative positions (Fig. 7).

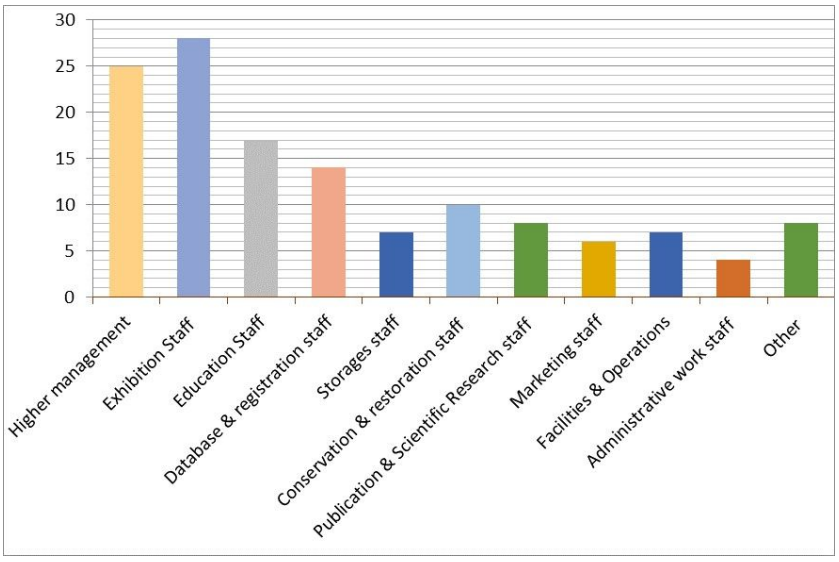

Figure 7: Position of respondents related to museums.

Q2. *Where do you currently work?*

According to the respondents' replies about their current work, the majority of them (70%) worked at a government organization with the rest in the private sector (13%) and in international or regional organizations (9%), and a few (3%) were freelancers (Fig. 8).

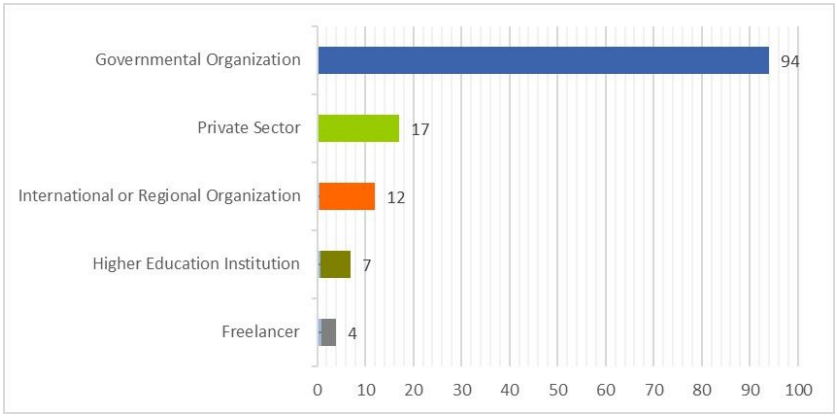

Figure 8: Types of organizations in which respondents work.

Q3. *Which one of the following describes your museum best?*

The respondents were asked to define the type of museum they worked at by selecting one or more of the nine options presented. Multiple replies were permitted, so the total number of responses surpassed the total number of respondents. The majority of respondents describe their museums as being archaeology, anthropology, and ethnographic museums (28%), followed by history and cultural museums (21%), art museums/centers (14%), natural history and agricultural museums, aquariums, or zoos (9%); children's museums (8%); science/technology museums or centers (7%); historic house/site (6%); specialized museums (4%); and open-air museums (3%) (Fig. 9).

Q4. *Which of the following ICT applications does your museum utilize in the museum exhibitions?*

Continuously, the total number of responses surpassed the total number of respondents due to multiple replies being permitted. The applications most commonly used in exhibitions, according to a sizable proportion of respondents, were social media (21%), followed by digital/touch screen kiosks (18%), and websites (17%) as. These were followed by two ICT applications: audio "digital" guide devices and mobile apps in equal proportions (12%). The rest of the ICT applications had smaller proportions: VR (9%), AR (5%), holograms (5%), and others (1%) (Fig. 10).

Q5. *In your opinion, which of the following ICT applications does the museum need to invest in to develop museum exhibitions?*

Once more, the total number of responses surpassed the total number of respondents due to multiple replies being permitted. The respondents selected mobile apps (17%) and VR (17%) as the most effective ICT applications for developing museum exhibitions (Table 22). AR was next (14.5%), followed by holograms (13.5%). The remaining ICT applications had

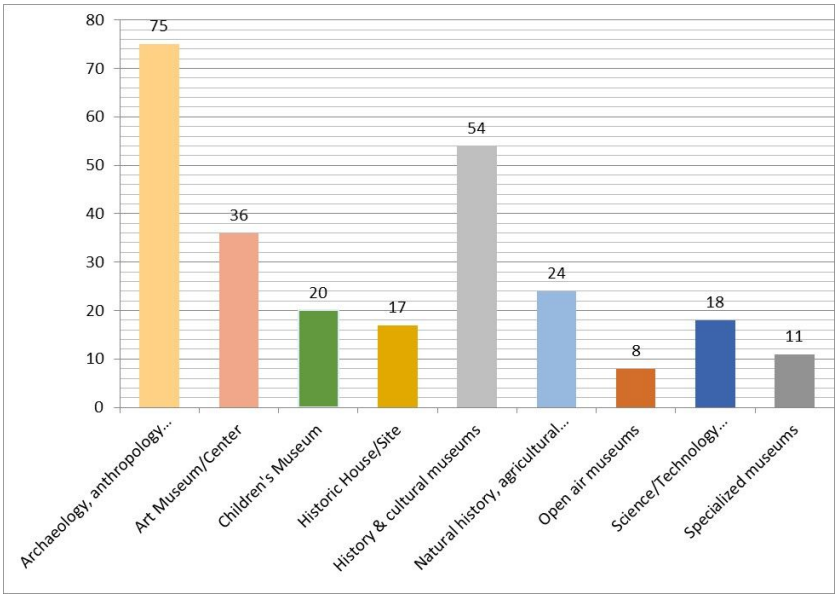

Figure 9: Types of museums in which respondents work.

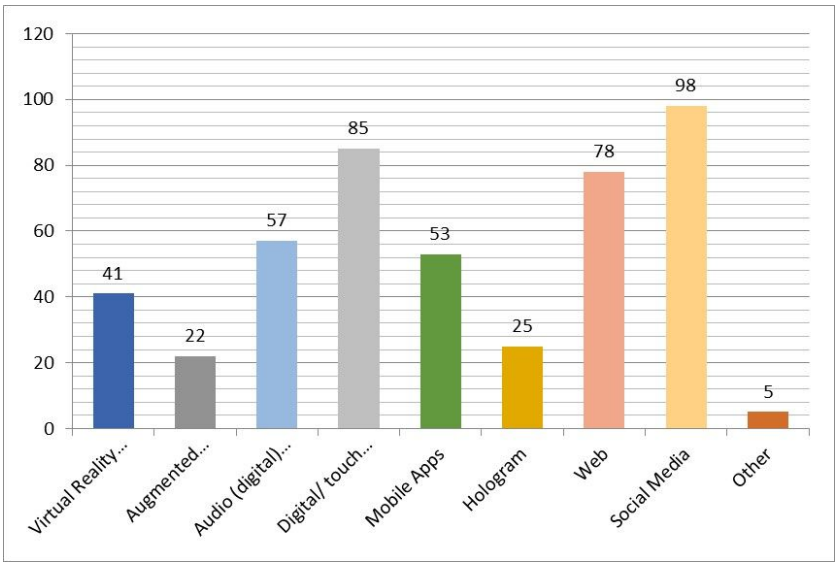

Figure 10: The ICT applications which the respondents' museums utilize in the exhibitions.

lower but still crucial percentages: websites (12%), digital/ touch screen kiosks (10%), social media (9%), and audio "digital" guide devices (7%). It was noticeable that, when allowing for multiple responses, the percentages for selecting ICT applications were very close (Fig. 11).

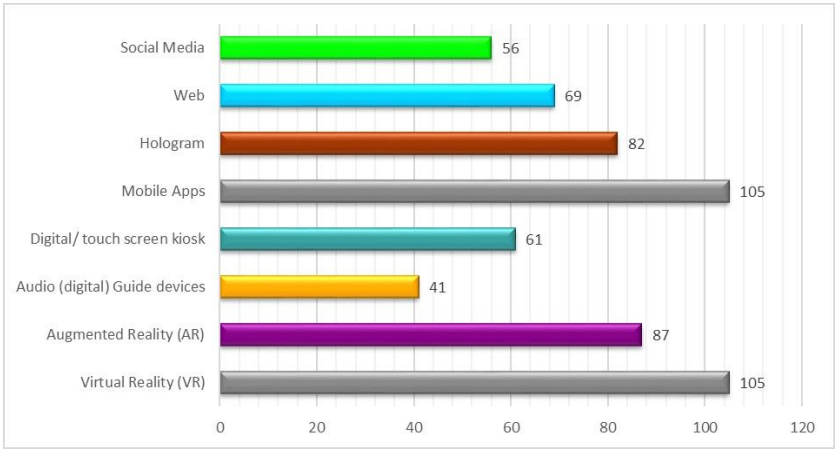

Figure 11: ICT applications that the museum should invest in to develop museum exhibitions.

Q6. *In your opinion, what are the advantages of using ICT applications in museum exhibitions?*

One more time, the total number of responses surpassed the total number of respondents due to multiple replies being permitted. The majority of respondents stated that ICT applications in museum exhibitions had many advantages. Within close percentages, they agreed on eight points: 17% of the respondents agreed that they enhanced the visitor experience and increased overall comprehension of the museum collections. A share of 15.5% of the respondents indicated that they had provided an important role via the web in communication between the museum and its audience during the COVID-19 pandemic. Then 14.5% said that they delivered a new learning experience for the audience, while the same 14.5% stated that they allowed museums to reach new audiences. Furthermore, 14% of respondents believed they delivered an engaging, interpretive experience both on-site and online. Along with this, 13% of the respondents claimed they provided an interactive online and on-site experience. Also, 11.5% of the respondents stated that they highlighted the objects and created hot spots in the exhibitions. Consequently, the majority of respondents agreed that ICT application played an effective role in enhancing museum functions and especially exhibitions (Fig. 12).

Q7. *In your opinion, what are the disadvantages of using ICT applications in museum exhibitions?*

A total of 59% of respondents stated that ICT applications in museum exhibitions act as a distraction rather than an informative tool through shortening attention spans (Table 24). Approximately one-third of survey respondents (31%) indicated that it distracted from

the visitors' experience of the museum exhibition. However, the remaining 9% felt there were no disadvantages to using ICT applications in museum exhibitions (Fig. 13).

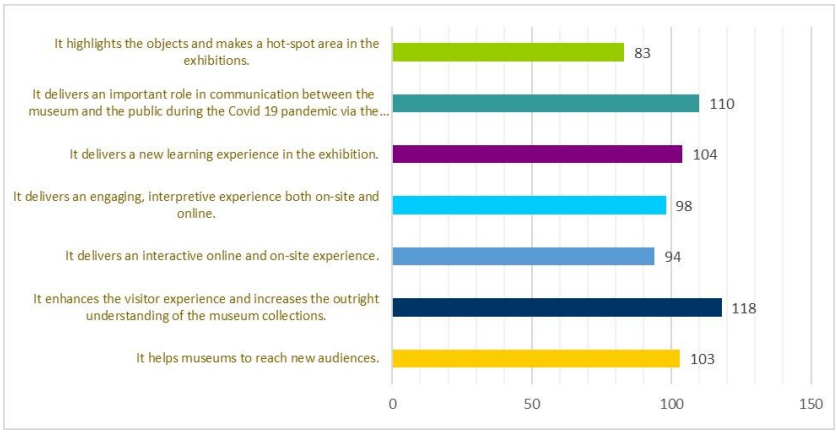

Figure 12: The percentage of the advantage of using the ICT applications in museum Exhibitions.

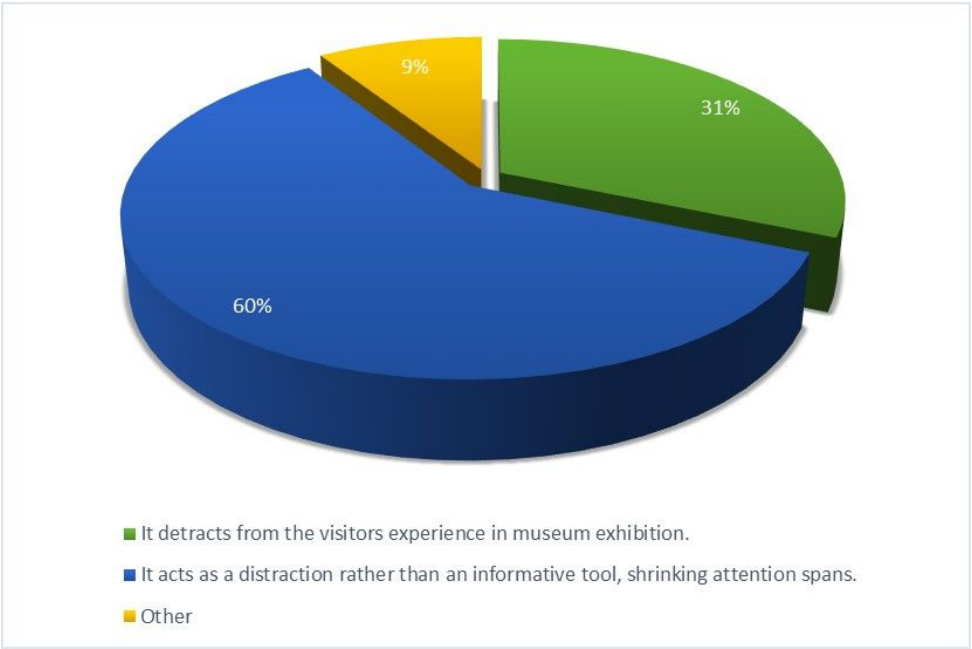

Figure 13: The disadvantages of using ICT applications in museum exhibitions.

Q8. *In your opinion, what are the main obstacles museums face when using ICTs in museum exhibitions?*

Again, the total number of responses surpassed the total number of respondents due to multiple replies being permitted. Half of respondents chose the lack of financial support (50%). Nearly a quarter of respondents saw rejection of digital technologies as being an obstacle for the role of traditional museums (24%). A smaller number of respondents selected indicated that museum staff's digital skills were still limited (16%) or they had no digital knowledge at all (10%) (Fig. 14).

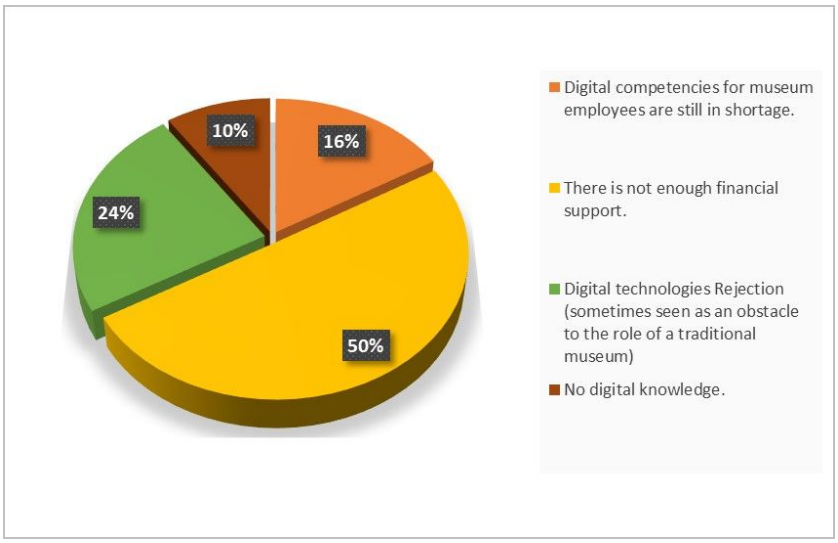

Figure 14: Obstacles that face the use of ICT applications in museum exhibitions.

Q9. *If your museum used ICT applications to respond to lockdowns and serve audiences during the COVID-19 pandemic, which of the following methods was used?*

Once again, the total number of responses surpassed the total number of respondents due to multiple replies being permitted. Several respondents stated that their museums had used ICT applications during the pandemic. By far, the most frequently used methods cited by the specialists were offering digital content (27%), live streaming (20%), virtual tours (19%), virtual events (9%), offering activities online (8%), mobile apps (7%), and VR (5%). Museum podcasts (digital audio files) are kept by only 4% of specialists (Table 28), and only 1% of the specialists said other methods had been used in response to lockdowns (Fig. 15).

Q10. *In your opinion, what categories of museum visitors interact with ICT applications within the museum exhibitions?*

As before, the total number of responses surpassed the total number of respondents due to multiple replies being permitted. The majority of specialists stated there were three main categories of visitors to museums who engaged with ICT applications within the

museum exhibitions (Table 29): educational visitors (39%), general visitors (36%), specialist visitors (23%), along with some other categories (2%) (Fig. 16).

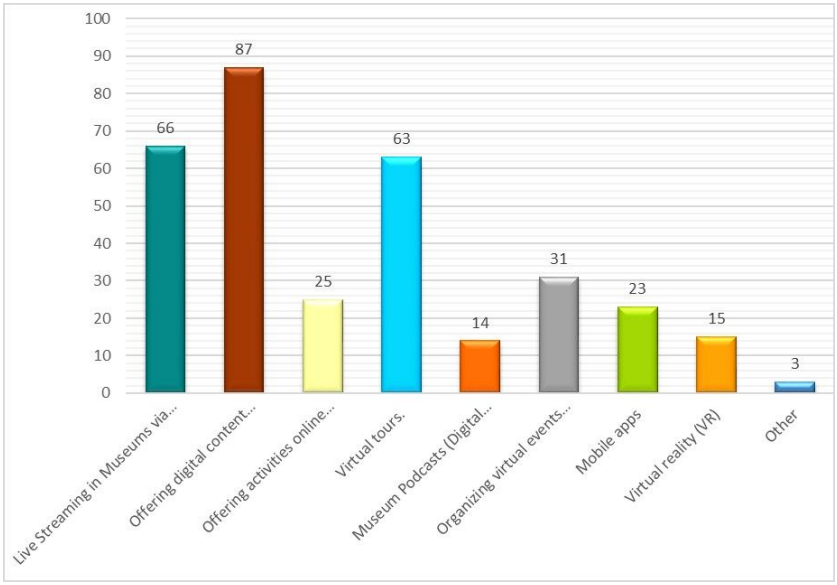

Figure 15: Methods used to overcome lockdown during the covid 19 pandemic.

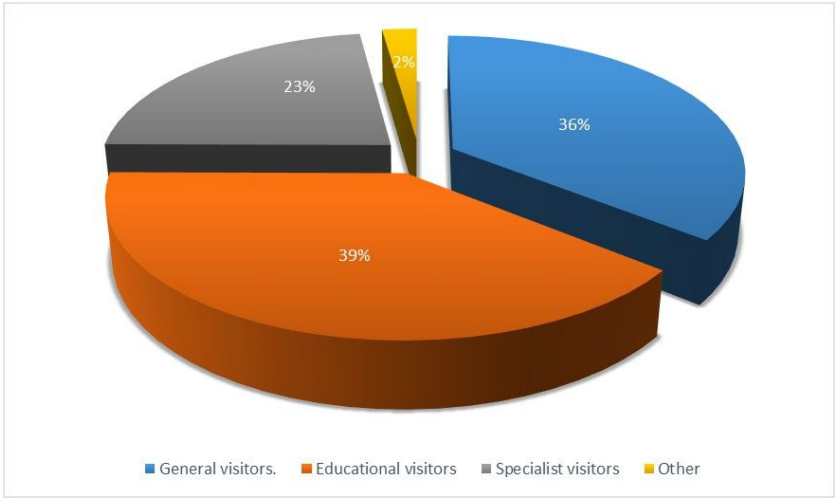

Figure 16: Categories of museum visitors who interact with ICTs.

5. Results and Discussion

This study was conducted out of a need to understand and investigate ICT applications and their effectiveness for developing displays in museums in general and the Sharjah museums in particular. According to the research questionnaire and an analysis of the interviews, the findings can be summed up in two points related to the analysis of the research questions.

The first is related to the effectiveness of ICTs in producing a new perspective of the museum exhibition. According to the interviews and surveys, many museum professionals currently believe that the audience prefers for there to be digital technology and virtual experiences alongside static artwork. Museum visitors regularly use contemporary technology devices in daily life. This experience has an impact on how they perceive museum objects. Consequently, museums must keep pace with the times and not retain the old concept of museums with their deep-rooted, low-tech settings. Experts believe that ICTs in exhibitions provide a variety of applications. As one of them commented, "ICT improves the interpretation methods." One member of management also noted in an interview response: "ICT is one element to attract more visitors to the museums, interactive environments, is easy to reach more stories from different new ways."

According to data retrieved from the research questionnaire sent to experts, most participants believe that ICTs play an essential role in enriching museum exhibitions and creating a new vision for museum exhibitions. Nevertheless, many museum professionals argued that museums should use ICTs but within limits. One of the respondents said that "ICT is very important to use but with a limit that will give the visitor the ability to interact with the objects, to see and enjoy them, and to feel the history." Therefore, integrating ICTs into museum exhibits and working closely with museum scholars may open up new vistas for visitors. However, museums should make sure to also look for the best methods to combine technologies and enhance exhibitions rather than just using them for the sake of using technology.

The second is related to using ICT applications to develop museum exhibitions. In the interviews and in Q5 of the questionnaire, the experts indicated the most effective applications for this were mobile phones, VR, AR, holograms, and digital kiosks. Therefore, the SMA should consider investing in these applications.

6. Conclusion

In conclusion, ICT applications are now present in all aspects of our daily life. Consequently, all enterprises, large and small, around the world are attempting to integrate technology into their operations in some way. Museums are not far behind. On a global scale, it has become apparent that museums are adopting technology into their operations to attract a wider audience and enhance how they display their priceless objects and exhibitions in the best possible manner. Thus, incorporating ICT applications into such exhibitions is undoubtedly beneficial. As we mentioned previously, such initiatives in museums have generally been highly successful and demonstrated the extent of their advantages.

All the findings reveal that experts and audiences are interested in adopting and integrating sophisticated technology into Sharjah's museums, and that doing so will heighten the visitors' overall experience. The main conclusions of this study are as follows:

- ICTs can be used as a development tool for museum exhibitions and to attract a broader audience, but they should be used to support the visit without creating a distraction for the visitor. To that end, ICT technology must strike a balance between attraction, surprise impact, and content quality to supply the educational and entertaining experience visitors demand.
- Although ICT technologies show promise, they must be installed in accordance with the unique characteristics of the museum context and the ecology of museum artifacts.
- Despite the many advantages of ICT technology, there are some obstacles hindering their use, and foremost of these is financial support.
- Digital transformation is just a tool rather than a mission in its own right.

Therefore, in light of ICTs' impact on the development of museum exhibitions and enhancing the visitor experience, these results should encourage museums to employ ICTs in exhibitions. In addition, they must take advantage of their technical and functional characteristics. Over time, these ICTs tools have effectively demonstrated their ability to assist museums in communicating their mission, values, and content. ICTs also foster deep experiences and engagement with audiences, both in situ and online.

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ЕФЕКТИВНОСТ УПОТРЕБЕ ИНФОРМАЦИОНИХ И КОМУНИКАЦИОНИХ ТЕХНОЛОГИЈА У РАЗВОЈУ МУЗЕЈСКЕ ИЗЛОЖБЕ: ПРИМЕР МУЗЕЈА У ЕМИРАТУ ШАРЏА

Резиме

Музеји све више прихватају информационе и комуникационе технологије (ИКТ) да би промовисали културни туризам и остали у кораку са променама. Културне вредности, заоставштина и обичаји преносе се путем музеја, повезујући генерације са прошлошћу. ИКТ се користе у готово свим музејским активностима, у самим институцијама и изван њих, нарочито за излагање и заштиту. Претходна истраживања показују да музеји употребљавају разноврсне ИКТ да би изложбе и предмете начинили савременијим и како би умнапредили искуства посетилаца. Такође, музеји користе различите алате за дигиталну комуникацију како би обогатили доживљаје посетилаца. Ипак, многе функције ИКТ за интерактивне процесе и даље се истражују од стране музејских радника.

Стога, ово истраживање има за циљ ефективност употребе ИКТ са становишта стручњака и музејских радника ка стварању тренда развоја музејских изложби у Емирату Шарџа. Такође разматра доступне ИКТ апликације које музеји могу применити како би побољшали своје технолошке услуге за публику.

Истраживање је спроведено на примеру Шарџа музеја исламске цивилизације, будући да је то један од највећих музеја у Емирату Шарџа. Примењени су и квалитативни и квантитативни подаци, а упитник је био главни начин прикупљања информација. Упитник је прослеђен како би се дознала мишљења стручњака у погледу примене ИКТ у музејским изложбама. Истраживање предлаже да се ИКТ осмишљавају уз разматрање физичког окружења, и да се физичка раздаљина може премостити употребом „мешаних интерфејса“ мобилних уређаја.

Кључне речи: Информационе и комуникационе технологије (ИКТ), Управа Шарџа музеја, Шарџа музеј исламске цивилизације, дигиталне технологије, музејске изложбе.

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