

Digitization and the Collection Sustainability: Report on the Grand Egyptian Museum Project, Egypt

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This study focuses on the efforts and projects to create and sustain the digital transformation of the museum collection in the Grand Egyptian Museum project. GEM is considered one of the cultural enlightenment projects where Egyptian heritage truly meets the latest technological innovations. GEM's one-of-a-kind and valuable collection will be displayed under overwhelming themes and narratives that will depict the ancient Egyptians' life, customs, death, and rebirth beliefs, which they performed and lived for almost 5,000 years. Egyptian cultural materials are spread across all of Egypt and managed by hundreds of museums; the task of digitization is a common challenge for all these museums. The study relied mainly on the quantitative method. The literature review and systematic observation were examined to study the trend toward the sustainability of GEM museum collections. Digital sustainability and digitization in Egyptian museums are constrained by limited knowledge capacity, fundraising resources, and ICT infrastructure. Faced with these constraints, the Grand Egyptian Museum has addressed these challenges with an interdisciplinary approach through collaborative planning, management, digitization, and digital presentation of its collections.

Keywords

Grand Egyptian Museum, Digitization, Museum Collection, Sustainability, Technology.

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1. INTRODUCTION

Museums have a large societal impact as they provide an essential sociocultural role through wide-ranging exhibitions. Today's museum must be sustainable to enable continuous operations with as little impact and transmission as feasible when influenced by external circumstances impeding its business [Ahmed et al. 2020]. Even though culture was not included in the Brundtland report's definition of sustainable development when it was first drafted in 1987, the importance of cultural institutions to long-term progress is being recognized in an increasing number of studies. These institutions may be economic expansion engines (via cultural industries, heritage tourism, and traditional incomes), along with benefactors to social stability, ecological sustainability, and resilient societies [Pop and Borza 2016]. Consequently, the United Nations acknowledged the significance of

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culture and heritage in sustainable development in the 2030 Agenda, alongside the 17 Sustainable Development Goals El [Shaer et al. 2021]. So, cultural legacy must be given special consideration as must museums, which were established to preserve cultural heritage.

This report aims to shed light on the role of the Grand Egyptian Museum in promoting the sustainability of Egyptian museums through digitization and the use of technology. Through digital technology, museums can successfully manage their collections, provide exceptional experiences to their visitors, and expand beyond their physical boundaries. Furthermore, with technological advancements, museums gain a competitive edge by delivering enjoyable visitor experiences.

2. DIGITIZATION AND SUSTAINABILITY OF MUSEUM COLLECTION

Digitization is merely the process of creating a digital equivalent of a printed analog. There are several digitization processes and materials to be digitized. However, the primary focus is on objects, pictures, and texts, as these are the primary items in the digitization process; hence, it refers to the conversion of resources that were previously generated in another format. Technically, digitization is the process of transforming an analog image into its matching quantitative values [Swain and Panda 2009].

Digitization has become an increasing trend in museums, transforming the whole concept of such institutions, so it fundamentally alters the way we think about museums. Culture and technology are intertwined. The advancement of one field aids the advancement of another. It is how we interact with each of them that changes as time passes [Janowska and Malik 2020]. Technology has begun to influence our lives in an astonishing variety of ways. The most remarkable thing is how quickly things have changed. We have begun to observe a shift in the way we experience museums because of the advancements in technology [Domnina 2021].

Digitization today supports and enriches all parts of museum work. Although digital technology was first seen as a contradiction for cultural institutions that center around their physical collections, it has become crucial in the entire administration of collections. Museums are increasingly relying on technology to link all the information about the artifacts in a digital repository, including photographs, the object's history, conservation reports, display materials, and associated publications [Navarrete 2020]. Consequently, digitization performs the adoption of a new working format backed by new technology that enables museums to engage in the digital world. It also represents a major investment. One component of museum digitalization is hence the online sharing of museum collections [Borowiecki and Navarrete 2017].

Since the function of museums is to conserve collections, preserve, present, and exhibit heritage, technology programs that assist in the organization and management of museum collections including all items held by the museum are particularly useful. Technology facilitates the management, collection, storage, and display of museum collections, and based on it, reports can be generated on the movement of pieces inside and outside the museum, the number of exhibitions for each piece, and the recovery procedures that each item has undergone. As a result, it makes it easier

for professionals to do a study of the museum's collections. This helps sustain the museum's collections [Pop and Borza 2016].

3. GRAND EGYPTIAN MUSEUM AND DIGITIZATION

A substantial body of research on museum digitization has demonstrated that museums confront major challenges while implementing new digital platforms. The alleged inability to take advantage of technological advances in digitization is part of a broader stream of literature discussing the causes and possible solutions to the crisis in museology that some museologists have claimed [Janowska and Malik 2020].

3.1 Digitization challenges

Museums in Egypt face many challenges in order to go digital. It is possible to consider these challenges as factors for digital transformation:

3.1.1 Lack of funding and resources in the cultural heritage sector

Egyptian archaeological museums are managed centrally by the Ministry of Tourism and Antiquities (MOTA). They face limited funding opportunities owing to the economic challenges following the events of 2011 and the COVID-19 pandemic in 2020. Additionally, stringent regulations by MOTA on external funding from international organizations further restrict financial support. This financial strain has hindered the museums' ability to enhance their digital capabilities, particularly in digitizing their collections [Wendy 2008].

3.1.2 Availability of the necessary expertise and tools to work on digital transformation

Transforming museums digitally demands specialized skills and tools, such as proficiency in IT, digital archiving, database management, and UI design. A very low percentage of professionals in Egyptian museums have adapted to digitization software, metadata standards, and cybersecurity. This small percentage cannot cover the needs of all the Egyptian museums. The lack of essential tools including high-resolution scanners, digital asset management systems, and a strong IT infrastructure has hindered museums' ability to digitally preserve and share collections, leading to reduced accessibility, lower engagement, and potential loss of cultural heritage due to inadequate preservation.

3.1.3 Developing a collaborative IT infrastructure within museums

Creating a collaborative IT infrastructure in museums entails establishing an integrated digital system that promotes efficient interdepartmental collaboration. This involves deploying a strong network infrastructure, centralizing databases for collection management, and securing access to digital assets. Therefore, the year 2000 saw the first attempt at the Egyptian Museum in Cairo for a digital documentation project in collaboration with the Ministry of Communications. The project failed due to insufficient funding [Mahrous 2019]. However, in 2006, the "Egyptian Museum Database

Project" was launched with funding from the United States Agency for International Development (USAID) and the American Research Center in Egypt (ARCE). Utilizing the KE EMu system, this project aimed to document display objects and create a digital photo archive [Janice 2007]. Currently, over 160,000 objects have been recorded and digitized. This project is considered one of the most important steps that paved the way for the GEM to digitize its collection.

3.1.4 Protecting the copyright of museum collections

Copyright of museum collections encompasses ownership and rights related to reproducing, distributing, and displaying artifacts and artworks. Museums typically hold copyright for items they create or commission, like photographs, publications, and digital content. (Simmons, John E., "Collection Management Policies", in *Museum Registration Methods*, 6th edition, edited by John E. Simmons and Toni M. Kiser. (Washington, DC, 2020), 30.) However, many Egyptian museums did not set clear and strong guidelines or policies to protect intellectual property and ensure proper use of its collections and data. In turn, this limited the accessibility to the collection, information, and photographs and limited the digitization potential.

3.2 Grand Egyptian Museum overview and leadership

The Grand Egyptian Museum is located about 2 km from the Giza Pyramid plateau, which is a UNESCO World Heritage Site (Fig. 1). While the majority of museums in Egypt are still decades behind their counterparts from around the world, GEM will reflect the role of museums in the twenty-first century. Accordingly, it is expected to make a modern renaissance and great shift in the Egyptian museums to redefine and reshape their role, goals, functions, and strategies to reflect the expectations, challenges, and changes of their society. The GEM leads a modern revolution towards modernizing and supporting the museum's role towards antiquities as well as society, with its various backgrounds, cultural, social, and financial levels. The GEM leadership started with a new management approach by fostering collaboration between the government and private sectors, transforming it into a community cultural institution. This is the first instance in the museum and cultural heritage sector in Egypt where a private company operates a museum under the umbrella of the MOTA to avoid previous managerial and operational shortcomings that occurred under government management. This partnership ensures sustained financial support, facilitating the use of modern technologies and enhancing museum displays. It also improves access to collections and information, while establishing governance over intellectual property, including publications, information, replicas, and photographs. Moreover, through this collaboration, the GEM highlights the Egyptian Government's framework and commitment to support its tourism and heritage industry [Grand Egyptian Museum 2024].

The GEM is able to use its unique resources and potential to become more responsive to the dynamics of Egyptian modern society and urban change as a tool of progress by drawing attention to visions and plans that will encourage development in society through heritage. Also, it will be a strong tool in promoting peace and cultural exchange by applying the principle of heritage for building peace through the international cultural conferences held by the museum. It will annually attract hundreds

of scholars and researchers who come to Egypt and participate in these important international gatherings [Hawass 2005].



Figure 1. Overview of the GEM site. source: GEM.

3.2.1 Gem's collection

Assessing the significance of the museum objects and collection would greatly help the GEM to define and communicate all the cultural values associated with its collection and meaning to people visiting the museum and local communities [Cowton 1994]. It will help the GEM to showcase the potential of its collections and to create opportunities for visitors and communities to access and enjoy galleries and collections, and to understand their history, cultures as well as heritage [Russell and Winkworth 2009].

The GEM is devoted to exhibiting the pre-historical and pharaonic periods of Egypt down to Ptolemaic-Roman times. The exhibits inside the museum are formed in a thematic and historical structure where artifacts and modern tools are combined into stories. The 45.000 M2 permanent exhibition is organized into three main components: The Grand Staircase, the Tutankhamun Gallery, and the Main Galleries [Rashed 2014].

ICOM and the UK Museum Documentation Standard have defined and recognized the assessment guidelines for museums, archives, and libraries by considering four key values:

- **Historic:** Associating an object with a person or important event in the past and telling a story about a particular era, illustrating a way of life and contributing to understanding the past. This key value can be applied to the royal statues and inscriptions of significant hieroglyphic texts telling stories and given dates about important historical events.
- **Artistic / Aesthetic:** communicating what the object expresses and how it does so. This considers such topics as whether it is remarkably beautiful or ugly, what it represents, its level of artistic innovation and authenticity, and its level of craftsmanship and the skills

utilized in its creation. This key value can be applied to some objects of King Tutankhamun's collection such as its golden mask, golden throne, and coffins.

- **Social:** Demonstrating the identity of a group of people or a specific community, or also representing beliefs, traditional handcraft products, customs, tradition, or social practice that is important for that community. This key value can be applied to the wooden models from the Meshty collection which represent the daily life activities and social practices practiced by ancient Egyptians and is still practiced in our modern times in some villages.
- **Scientific / Technological:** Bringing out the technological or scientific value of objects in the collection [Avaro et al. 2010]. This key value can be applied to the mummies and the story of mummification procedures as well as to the organic materials used in the pigments in tomb paintings (e.g., the Tomb of Sabi).

It is opportune that the collection of GEM can add many examples of these four key values, which add more significance to the GEM and its potential impact.

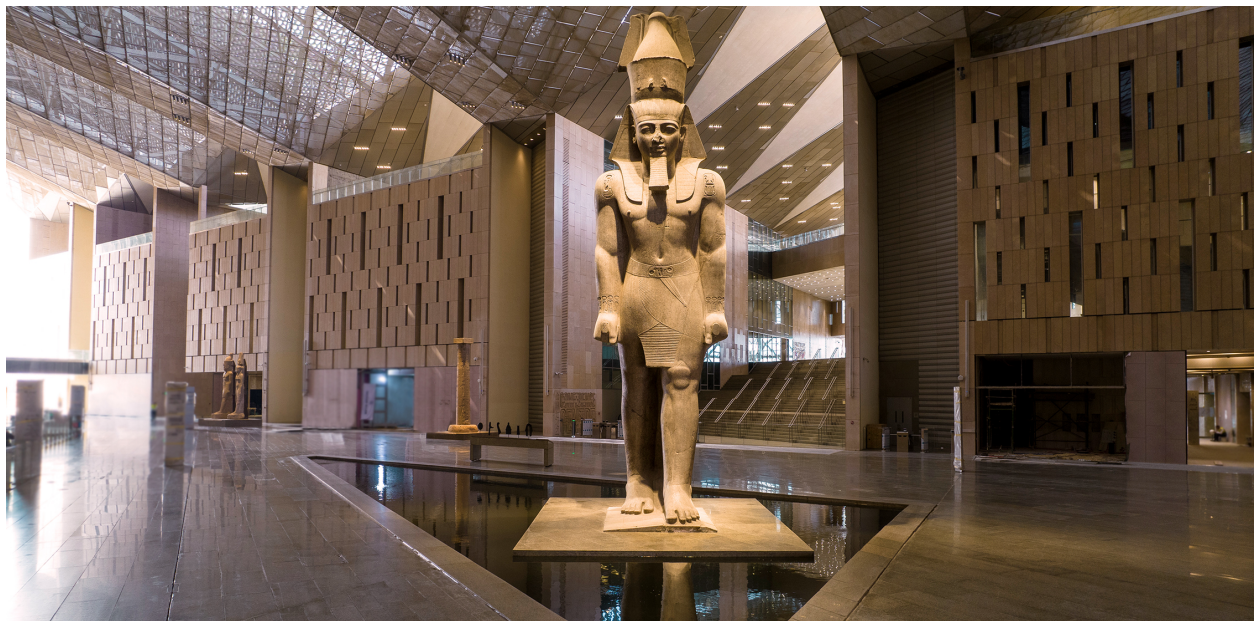


Figure 2. Statue of Ramses II in the Grand Hall of the GEM. Source: GEM.

3.3 Gem digital presentation and preservation

Nine digital streams with interactive and media displays, and four caves with smaller, self-contained exhibitions exemplify the use of digital presentation in the GEM. The exhibitions place all of the permanent collection on the continuous floor at the highest level, looking directly at the great three pyramids, so that the objects can be seen as both individual artifacts and as parts of a larger context of civilization reflecting the heritage of ancient Egypt integrated with modern technology and methods of display.

3.3.1 Digital presentation

Over the past few years, Egypt has taken ambitious steps in technological developments. The GEM is one of the cultural projects where Egyptian heritage truly takes advantage of the latest technological innovations. The GEM administration has understood how museums and the culture industry worldwide are going through a digital transformation. The GEM has applied the best and latest technology solutions for interpreting its collections. It has also promoted heritage sustainability by illustrating Egyptian heritage and telling its stories through the use of Virtual Reality technologies. The goal is to engage younger generations with Egyptian heritage, raising their awareness of their heritage through technologies with which many young people are already familiar. The GEM has been keen on partnering with international companies in the field of technology to build an effective museum digital platform through four tools:

3.3.2 Digital interpretation devices

Among the most significant digital tools frequently utilized in museum displays are information kiosks with touchscreens. Some deliver multimedia in several ways using text, photos, video, and music. Others are more interactive and provide mini-games and quizzes [Said 2022] as tools to interpret the collection through interactive touch screens, maps, and graphics (Fig. 3).

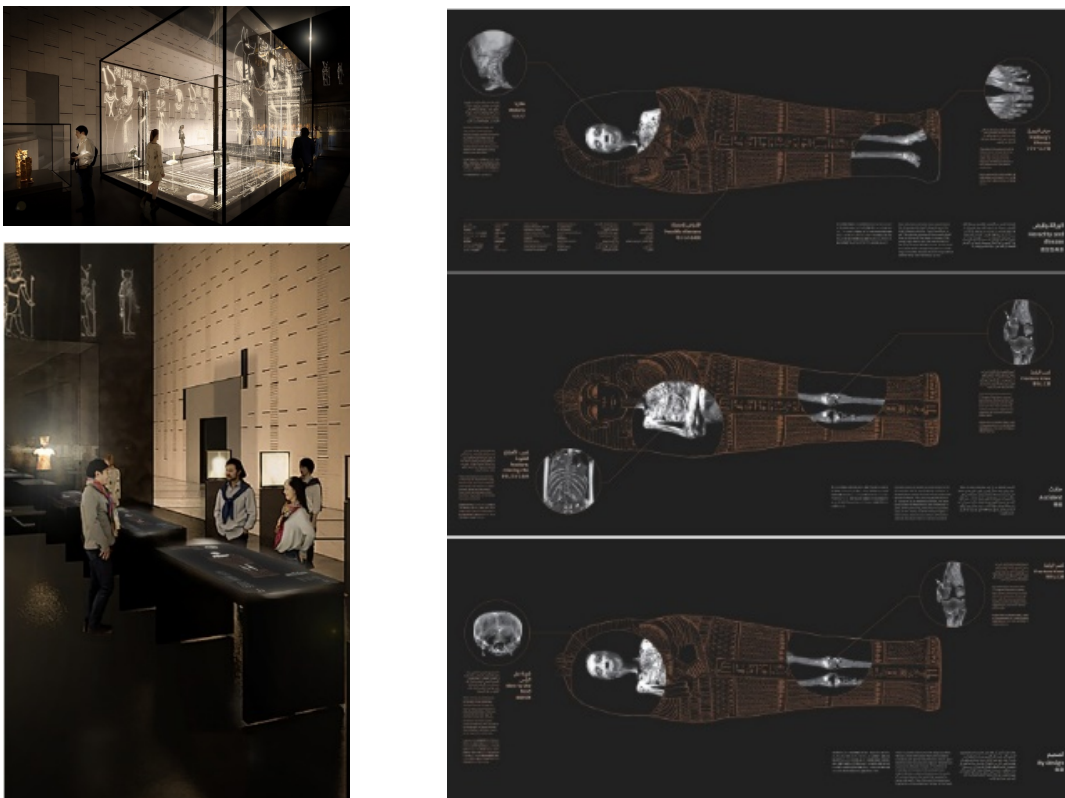


Figure 3. Shows the interactive tools at the GEM. Source: GEM.

3.3.3 Website and mobile app

The GEM official website and Mop App will be launched for the public very soon in parallel with its official opening. This will enable the GEM to reach millions of people who are interested in Egyptian heritage, helping them to experience and discover the Egyptian heritage represented in the website's "collections and events." The GEM management understood the fact that online access to the collection on museum websites represents one of the most straightforward and widespread applications of digitized collections. While traditionally museum websites simply duplicate familiar museum objects and information, the growing adoption of new technologies has given rise to complete virtual experiences of collections for art lovers and museum visitors in online exhibitions [Chern Li Liew 2005]. Accordingly, the GEM website is planned to enhance accessibility to trusted and authoritative content and its related information by complementing the real visitors' experience of physical collections through the free access collection database, and controlled collection images.

The Mobile App is targeting museum visitors to enhance their experience and interaction with the physical museum. The GEM mobile application is the official application authorized by MOTA to help you explore the GEM interactively in the following ways:

3.3.3.1 *Before the visit*

- Plan the visit and select which places to see inside the museum and also at nearby attractions
- Book your ticket and pay online
- Learn about upcoming events at the museum
- Receive notifications about important updates and news

3.3.3.2 *During the visit:*

- Explore the museum and easily move from one point of interest to another using the interactive indoor navigation feature.
- Search for nearby locations (e.g., artifacts, facilities, restaurants, and more).

3.3.3.3 *After the visit*

- Share your experience with others.
- Find nearby attractions and services (e.g., hotels, restaurants, hospitals, and more).
- Contact the museum's administration to communicate your suggestions or complaints.

4. THE AUGMENTED AND VIRTUAL REALITY HALL

Various devices and applications are used for mediation in museums and cultural heritage sites. The key elements of its exposition in the cultural heritage sites and museum communication process are

presentations, audience attraction, creation of an effective experience, entertainment, and education (Fig. 4) [Said et al. 2022].



Figure 4. Benefits of VR and AR applications in museums. Source: the authors.

The GEM is the first Egyptian museum which integrates augmented and virtual reality technology within its galleries, providing the museum's visitors with an interactive digital experience that enhances their experience of Egyptian heritage through virtual stories and adventures (Fig. 5).



Figure 5. Augmented Reality at GEM. Source: GEM.

5. GEM DATABASE

Since 2008, the GEM has relied on the museum's central database created using File Maker Pro (Fig. 6). This software differs from the Egyptian Museum in Cairo collection management system KE Emu. File Maker Pro is characterized by its flexibility to modify, add, and delete units according to the work requirements. It also provides the possibility to extract reports in Excel sheets to facilitate the data transfer between GEM staff, scholars, and stakeholders. The primary aim of developing this system was to achieve a high level of digital information products to support one of the GEM's strategic goals of having a complete frame of data and knowledge about the artifacts and collections, which could then be used in exhibition design, academic research, interpretation, and education activities. This digital information would be used and accessed by both the general stakeholders and researchers who might require more specialized and specific data about the museum collection [Interview 2022]. In this frame, the Documentation team took responsibility for collecting data, documenting, photographing, digitizing, and managing the data entry of the selected artifacts. From 2008 to 2023, the GEM database team digitized more than 85,000 records, which are part of a greater number of actual artifacts, which is about 100,000 objects.

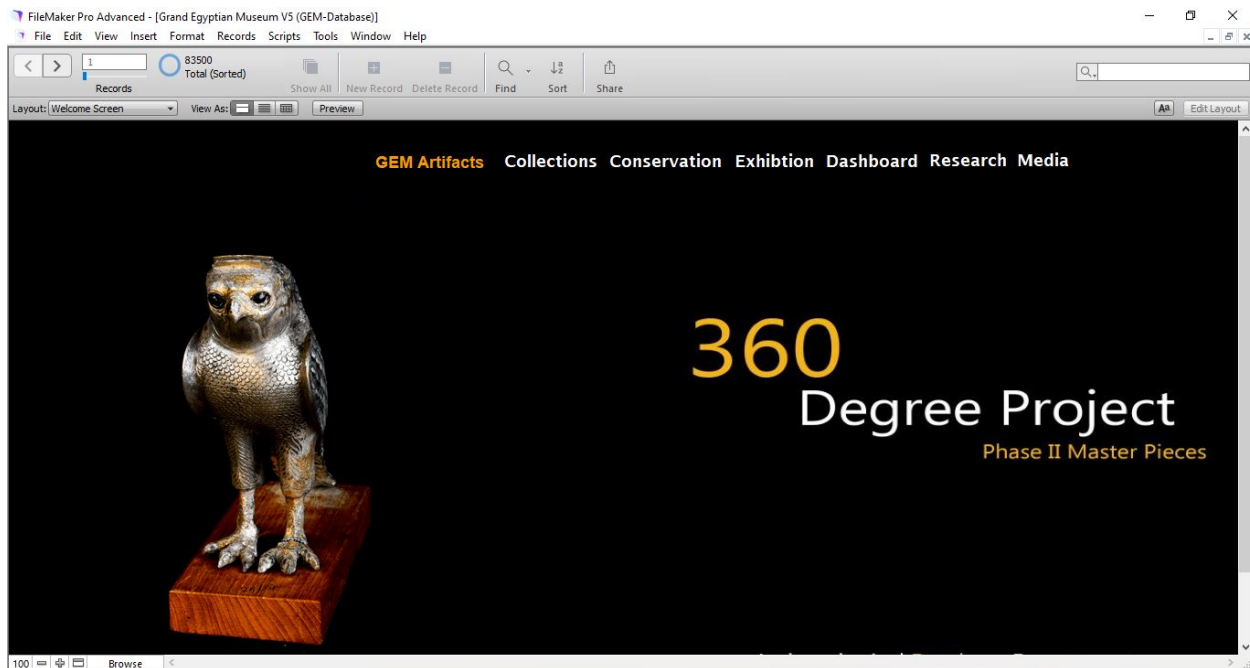


Figure 6. GEM Database. Source: GEM.

5.1 Digital preservation

There really is no sustainability in museums without digital preservation. To date, Egyptian museums do not have a digital preservation infrastructure fully suitable for collaborative use. Therefore, the GEM cooperated with international institutions such as JICA, which established a

Conservation center at GEM equipped with all modern technology tools to help preserve, document and restore the collections. Additionally, a multidisciplinary team was created which addressed the sustainability gap at this point within the Egyptian museums. GEM develops solutions for the digital preservation of Egypt's cultural heritage.

Conservation experts in the GEM used many modern technology tools to document and restore the archaeological collections inside the museum. Examples of these tools include portable XRF, portable Fourier-Transform Infrared Spectroscopy (FTIR), Fiber Optic Reflectance Spectroscopy (FORS), and Raman Spectroscopy (Fig. 7).



Figure 7. These photographs show study and documentation of objects using modern technology tools in GEM's laboratories. Source: jicagem.com.

6. CONCLUSION

In the past, relatively little use has been made of the latest technology in Egyptian heritage institutions. The issue of sustainability in museums and the GEM in particular is very important. The GEM plays an important role in preserving Egyptian heritage, displaying Egyptian antiquities, and

managing collections professionally using modern technology. The results can be summarized in several points:

- GEM is a tool for culture and long-term sustainability.
- GEM has employed technology tools for the sustainability of museum collections.
- Digital tools are used by GEM including the website, mobile application, database, augmented and virtual reality.
- Financial resources must be provided to preserve digital resources.

We conclude by urging that the GEM should develop a digital strategy (Fig. 8). It is essential for museums to thrive in modern times. It enables us to draw out of prospective actions and goals in accordance with available resources. Standardizing the digitalization of collections and establishing rules for sustainable digitization procedures may increase the accessibility of collections to a wider audience and enhance exhibits and programs. Additionally, methods of monitoring effectiveness and enhancing online presence should be taken into account, as well as effective online communication through a variety of media. Iterative documents that are accessible for assessment and improvement should be used to create the digital strategy.

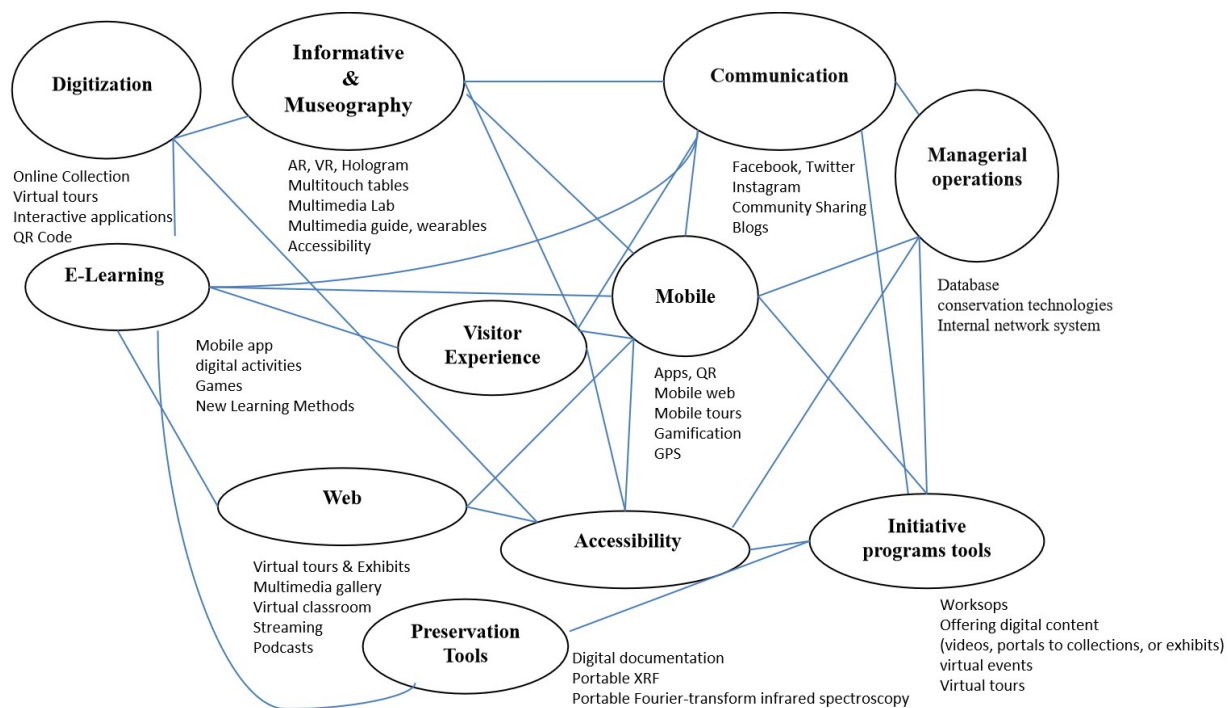


Figure 8. Proposed Digital Strategy Map for GEM. Source: the authors.

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