

# A Systematic Literature Review of the Digital Transformation of Cultural Heritage Assets during the COVID-19 Pandemic

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## Abstract

The repercussions of COVID-19 resulted in physical movement restrictions in the beginning of 2020. Due to these restrictions, which were imposed due to health policy considerations, cultural heritage assets are now under more pressure to continue operating and preserving their legacy. The approach for the protection and preservation of cultural heritage assets must be upgraded digitally. By conducting a thorough literature analysis, this research seeks to investigate how cultural heritage assets underwent digital change during the COVID-19 epidemic. A total of 334 results were returned for the search term. Unfortunately, only a total of 19 papers that were evaluated to be pertinent to the study issue. The analysis of these 19 papers showed that cultural heritage must be transformed digitally not just for conservation and preservation but also for improving visitor experiences, increasing understanding of the past, and educating, promoting, and managing heritage sites. The use of digital technology is mostly done to boost consumer interaction, enhance business performance, and support management needs. Advanced technologies including augmented and virtual reality, 3D reconstruction, digital twins, and the Internet of Things (IoT) are used to assist these purposes. Heritage managers may now continue their operations by providing visitors with virtual tours and displays. Also, certain institutes of higher learning are utilising this occasion to do study on the digitisation of historical assets. The analysis also suggests that the present stage of research on the digital transformation of cultural heritage assets is digitalisation. This is where technology adoption is focused on automating current business operations and procedures. Therefore, there are more opportunities for exploring the digital transformation of cultural heritage assets in order to reach a greater degree of digital transformation.

*Keywords:* Digital transformation, cultural heritage assets, business sustainability, technology adoption, COVID-19 pandemic

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## 01.0 INTRODUCTION

According to Chawla and Goyal (2022), the evolution of digital transformation is said to have begun in the 1960s with the advent of the internet by transmitting messages over APRANET and has progressed along with the technical progress of each period. This is not a new occurrence; in fact, it has been recognised as a learning process since the second industrial revolution (1870-1970) and the third industrial revolution (1971-2010) (Martinelli et al., 2021). However, based on a systematic literature review performed by previous scholars, digital transformation has attracted interest among practitioner communities (Hanelt et al., 2021; Tekic & Koroteev, 2019) and scholars (Chawla & Goyal, 2022; Nadkarni & Prügl, 2021; Tekic & Koroteev, 2019) since the 1990s (Chawla & Goyal, 2022; Nadkarni & Prügl, 2021). It has created new research interest across different disciplines (Bharadwaj et al., 2013; Lucas et al., 2013; Setia et al., 2013) and has resulted in multifaceted development dominated by numerous sectors (Endres et al., 2020). These scenarios happened due to the advancement of digital technology as an enabler for transformation (Lanzolla & Anderson, 2008).

The use of cutting-edge digital technologies, such as social media, mobile technology, analytics, or embedded devices, to enhance customer interactions and digitise processes in order to achieve a competitive advantage is known as digital transformation (Fitzgerald et al., 2013). It aids in the improvement of customer interactions and the digitization of activities in order to achieve a competitive edge (Vial, 2019). Besides, it is also referred to as the realignment of technology and business models (Solis et al., 2014), and the integration of digital technologies (Liu et al., 2011) to improve business performance (Westerman et al., 2014), engage and enhance customer experiences (Solis et al., 2014), and streamline operations (Fitzgerald et al., 2013). Hence, in order to improve a company's performance or efficiency, digital transformation requires a new way of thinking and strategy. In order to maximise customer value, find new monetization opportunities, boost efficiency, and manage risk, the projects should include the use of digital technology to business operations, products, and assets.

The use of digital technology in the context of cultural heritage assets is a way to safeguard and conserving cultural heritage. It should be noted that cultural heritage is part of the tourism industry. Unfortunately, the COVID-19 pandemic has brought the cultural tourism business to a halt and accelerated the pace of digital transformation (Klein & Todesco, 2021). The pandemic has also impacted the long-

term viability of cultural heritage assets as a tourist product. When the pandemic struck, movement control orders were implemented, causing several nations to close international and state borders, as well as establish work-from-home policy as measures to control the spread of the virus. Due to the status of the health declaration by the World Health Organization (WHO), most sectors were required to close for a certain period, including the restriction of tourism activities. As a result, the income generated by heritage sites has decreased dramatically because of the pandemic. Data from the World Tourism Organization of the United Nations (UNWTO) show that the number of tourist arrivals decreased by 74%, or 381 million, in the year 2020, despite recording 1.5 billion tourists in 2019. Additionally, the pandemic caused these cultural heritage assets to lack protection and maintenance, increased illegal activities, and notably led to an aggravation of poverty (UNESCO, 2021). Among the shuttered businesses were museums, cultural foundations, and other art market participants (Vilá, 2020). Thus, this study will examine more relevant examples or digital transformation of cultural heritage.

A pandemic presents a unique opportunity to continue protecting cultural heritage assets. Given that the tourism industry is not yet completely operational, it must be affected from a smartness standpoint by data-driven logic made possible by technology advancements (Rathi, 2018; Vargas, 2020). Site managers and local governments have established or improved digital access to the world heritage (UNESCO, 2021). This includes virtual visits to properties, such as live streaming of the Ngorongoro Conservation Area and site museums, as well as drone overflights to feature sites without any visitors. Using digitalisation (Mensah & Boakye, 2023) and relying on technologies (Gharibi, 2021) such as apps, artificial intelligence, augmented reality, and big data may not be a solid solution to sustain business during and after a pandemic (Corbisiero & Monaco, 2021), but it is more geared toward supporting business growth and benefiting customers.

This study uses a thorough literature analysis to investigate how cultural heritage assets were preserved into digital assets during the COVID-19 pandemic. The researcher analysed the presence of digital tools that have been implemented to sustain cultural heritage assets. Furthermore, the identification of digital tools has allowed the researcher to understand the level of digital transformation in the cultural heritage sector. Therefore, the following research questions and research objectives have been constructed:

**Table 1** Research questions and research objectives of the study

Research Questions	Research Objectives
What is the goal of implementing the digital transformation of cultural heritage assets during the COVID-19 pandemic?	To determine the goal of implementing the digital transformation of cultural heritage assets during the COVID- 19 pandemic?
What digital technologies were employed to preserve cultural heritage assets during the COVID-19 pandemic?	To identify type of digital technologies were employed to preserve cultural heritage assets during the COVID-19 pandemic.

The remainder of this paper is structured as follows: The second section is a literature review that provides context for the digital transformation of cultural heritage assets. Section three is the methodology, which elaborates on the procedures undertaken to conduct the review. Next is section four, which presents the results of this review. Finally, the conclusion part consists of limitations and future study. In conclusion, this study contributes a small piece to the body of knowledge on digital transformation and cultural heritage. The study's findings will aid researchers, students, tourism managers, historic site managers, and museum managers in gaining a full understanding on the benefits of adopting digital technologies. The digital transformation is about the use of technology to improve, enhance, and solve the existing problems of a business or institution. Therefore, the empirical evidence from this study about the types of technologies used to protect and safeguard cultural heritage assets could be a good reference.

## 02.0 LITERATURE REVIEW

### 2.1 Definition and Purpose of Digital Transformation

The pandemic has increased the speed of digital transformation (Klein & Todesco, 2021), since it is the only secure means to engage with people, drive corporate activity (Priyono et al., 2020), and be resilient in times of disaster (Hajishirzi et al., 2022; Hussain, 2021). The digital transformation is the application of new digital technologies, including social media, mobile technology, analytics, or embedded devices (Fitzgerald et al., 2013), technology and business model realignment (Solis et al., 2014), and digital technology integration (Liu et al., 2011) to improve business performance (Westerman et al., 2014), engage and enhance customer experiences (Solis et al., 2014), and streamline operations (Fitzgerald et al., 2013). There are several definitions of digital transformation in the literature; nevertheless, there is no universal consensus on any one term. According to the various definitions, digital transformation is the use of new-age digital technology to improve customer engagement or to digitalise activities in order to obtain a competitive edge (Vial, 2019). According to Guo et al., (2020), the five elements of digital transformation are as follows: (1) strengthening the application of online office tasks; (2) improving the digitalisation of supply chain channels; (3) adopting digital artefacts such as digital products or services; (4) adopting digital platforms such as digital communication platforms; and (5) adopting digital infrastructures such as digital technology systems. As a result, digital transformation is all about deploying new or present digital technology and products or services in digital versions to give a physical product to their clientele.

#### 2.1.1 Types of Digital Transformation

This section was created to explain about different types of digital transformation. A host of scholars refer to digital transformation as “strategy” (Matt et al., 2015; Tekic & Koroteev, 2019) and “elements of digital transformation” (Bonnet & Westerman, 2021; Westerman

et al., 2014) rather than “type of digital transformation”. It is important to understand the type of digital transformation as it allows researchers and readers to determine and evaluate various options as well as the big picture of digital transformation (Tekic & Koroteev, 2019). In total, 12 types of digital transformation are identified from six previous research (see Table 2). Customer experience, operational improvements, business model, transformation, technology utilization, changes in value generation, structural changes, financial aspect, employee experience, a digital platform, expertise in digital technologies, organization, and culture are all included. Customer experience, operational enhancements, and business model change have generated the greatest argument among the 12 types of digital transformation.

**Table 2** Types of digital transformation based on past studies  
(Source: Author’s compilation)

Type of Digital Transformation	Fitzgerald et al. (2013)	Westerman et al. (2014)	Matt et al. (2015)	Deloitte Development LLC (2018)	Tekic and Koroteev (2019)	Bonnet and Westerman (2021)
Customer Experience	•	•		•		•
Operational Improvements	•	•		•		•
Business Model Change/Transformation /Strategy	•	•		•	•	•
Use of Technologies			•	•		
Changes in Value Creation			•			
Structural Changes			•			
Financial Aspect			•			
Employee Experience						•
Digital Platform						•
Mastery of Digital Technologies					•	
Organization and Culture				•		

### 2.1.2 Phases of Digital Transformation

Digital transformation has progressed from relatively straightforward adjustments to more pervasive ones (Verhoef et al., 2021). The digital transformation process must be carried out with the integration of people and technology (Nadkarni & Prügl, 2021). In a few studies, the words “level of digital transformation”, “phase of digital transformation”, and “stage of digital transformation” have been used to describe the process of digital transformation (Perera et al., 2023; Soluk et al., 2021). Despite the differences in terminology, the ideas remain the same. This study preferred to use phases of digital transformation to portray the process of digital transformation. According to previous research, the stages of digital transformation range from digital awareness to digital requirement (Garzoni et al., 2020) to digitisation (Verhoef et al., 2021) to digitalisation (Perera et al., 2023; Soluk et al., 2021; Verhoef et al., 2021) and digital collaboration (Garzoni et al., 2020) and finally digital transformation (Garzoni et al., 2020; Verhoef et al., 2021). These phases of digital transformation are important because they will paint a picture of the digital transformation of cultural heritage assets. This study, however, applied the phases of digital transformation suggested by Verhoef et al. (2021), which consist of digitisation, digitalisation, and digital transformation. The ensuing Table 3 indicates strategic imperatives according to phases of digital transformation.

## 2.2 Cultural Heritage

These cultural heritage assets do not have a universal definition. In essence, cultural legacy refers to anything that existed in the past, whereas the term ‘asset’ refers to things, activities, or resources. This broad definition encompasses assets that have possess historical, artistic, scientific, technical, geophysical, or environmental significance, such as historic structures, monuments, archaeological sites, nature reserves, protected areas, and works of art (Aversano, 2018). As a result, cultural heritage assets can be described as structures, monuments, customs, and works of art that existed in the past and continue to exist today.

### 2.3 Digital Transformation of Cultural Heritage Assets

A subject of expanding interest is the digital transformation of cultural assets (Solima, 2020). Its focus has been on historical sites and museums (Hamid, 2021). Unlike other types of heritage assets, such as intangible cultural heritage like dance and handicrafts, which require people to represent the legacy, museums and cultural sites are physically visible. Additionally, the government oversees cultural institutions and museums, particularly those located on UNESCO territory. A museum is an institution that houses a collection of artefacts and other things with aesthetic, cultural, and historical value, rather than a heritage asset. Museums have used digital transformation to engage with visitors, support their businesses, and spread knowledge of their legacies. Before the pandemic, museum administrators had to deal with a variety of issues, including a lack of excitement and low museum attendance rates (Gonsales, 2021). Engaging with people is therefore crucial to keeping the museum alive and attracting visitors. Social media is an essential tool for engaging with people by informing them about the museum's activities and spreading awareness. Furthermore, by offering virtual tours to visitors and employment of digital technologies like augmented and virtual reality, 3D reconstruction, and the Internet of Things (IoT), museums able to maintain their operations. In addition, the options for digital enjoyment of cultural heritage are 360-degree panoramic visualization, photogrammetry, 3D reconstruction, 3D modelling, laser scanning, Virtual Research Environment (VRE) or BIM technologies (Pfarr-Harfst, 2020). This research attempts to examine further empirical studies that demonstrate how cultural heritage assets are being transformed by digital technology. The following Table 4 reveals the digital technology adoption of museum and cultural sites.

**Table 3** Strategic imperatives according to phases of digital transformation  
(Source: Verhoef et al., 2021)

Type	Examples	Digital Resources	Organisational Structure	Digital Growth Strategies	Metrics	Goal
Digitisation	Automated routines and tasks, conversion of analog into digital information	Digital assets	Standard top-down hierarchy	- Market penetration - Product-based market development	Traditional KPIs: cost-to-serve, ROI, ROA	Cost savings: more efficient deployment of resources for existing activities
Digitalisation	Use of robots in production, addition of digital components to product or service offering, introduction of digital distribution and communication channels	- Digital assets - Digital agility - Digital networking capability	Separate, agile units	- Market penetration - Product-based market development - Platform-based market penetration - Co-creation platform	Traditional and digital KPIs: user experience, unique customers/users, active customer/users	Cost savings and increased revenues: more efficient production through business process re-engineering; enhanced customer experience
Digital Transformation	Introduction of new business models like 'product-as-a-service', digital platforms, and pure data-driven business models	- Digital assets - Digital agility - Digital networking capability - Big data analytics capability	Separate units with flexible organizational forms, internalization of IT and analytical functional areas	- Market penetration - Product-based market development - Platform-based market penetration - Co-creation platform - Platform diversification	Digital KPIs: digital share, magnitude and momentum, co-creator sentiment	New cost-revenue model: reconfiguration of assets to develop new business models

**Table 4** Digital technology adoption of museums and cultural sites  
(Source: Hamid, 2021)

Type of Cultural Heritage Assets	The Digital Technology Adoption	Authors
Museum	Interactive programmes such as virtual tours (as is the case for the Uffizi Gallery), to 'meet-the-experts' (Archaeological Park of Paestum) and educational initiatives (National Roman Museum).	Agostino et al. (2021)
Museum	Opera di Santa Maria del Fiore in Florence started its digitalization some time ago, but the pandemic has accelerated it. This museum has been developing several new digital projects using various online and onsite tools.	Fissi et al. (2022)
Museum	(1) A back-office approach to improve the preservation of cultural heritage; (2) An onsite approach to enhance the quality of the museum experience; (3) An online approach to extend the museum experience beyond the museum doors; and (4) An online approach based on multisensory and interactive technologies, LOD and IoT, to create a wider, more accessible and hybrid museum experience.	Simone et al. (2021)
Cultural Sites	Advanced digital technologies, such as augmented and virtual reality, holograms, and digital twins, are being utilized to make cultural sites more appealing to a diverse range of tourists.	Frey and Briviba (2021)
Museum	Over the past 80-plus days, the museum has leveraged the advantages of the internet to digitalize some of its exhibits for virtual tours, organize online classes for school children, open up the 'CSTM Cloud Lecture Hall' to audiences who are semi-confined at home, conduct cyber education programs, broadcast science experiments on live-streaming platforms, produce videos of science communicators performing live science shows on social media, offer prizes for quizzes and guessing games. It even staged an online exhibition entitled 'The New PK—Virtual Themed Exhibition on the Fight against Novel Coronavirus', which has welcomed nearly 5 million virtual visits over the past month since its debut.	Ou (2020)
Museum	A study of the 100 largest Italian state museums has shown that despite the weeks of lockdown, their cultural initiatives did not come to a halt. On the contrary, there has been a sharp rise in online cultural material and initiatives taking place through social media, with museums doubling their online activity.	Agostino et al. (2020)



### **03.0 METHODOLOGY**

The goal of this section is to describe how to conduct a systematic literature review using PRISMA principles. Through a survey of the literature, this article gives a theoretical assessment of the state of digital transformation in cultural heritage assets.

#### **3.1 PRISMA**

The PRISMA guidelines are established guidelines for performing a systematic review of the literature. In general, publishing standards evaluate the quality and rigour of reviews and provide writers with relevant and essential information. The PRISMA approach was used to guide the selection process, which included four steps: (1) identifying relevant research by quickly scanning the database; (2) screening of articles; (3) full-text evaluation; and (4) data abstraction and analysis.

#### **3.2 Resources**

Scopus was used for this study since it is a source-neutral abstract and citation database vetted by independent subject matter experts who are the recognised leaders in their disciplines. Scopus empowers academics, librarians, research managers, and funders with sophisticated discovery and analytics tools to promote ideas, people, and institutions. Furthermore, 35% of the studies published have a social science base. However, it should be noted that no database is perfect or comprehensive (Shaffril et al., 2019). Therefore, this study conducted additional search using Google Scholar as previous works also scouted articles through this database engine too (Nadkarni & Prügl, 2021; Yoo & Yi, 2022) as well as manual searching using Emerald and MDPI.

#### **3.3 The Systematic Review Process**

##### **3.3.1 The Identification of Relevant Research by Briefly Searching through the Database**

The systematic review method was used to choose a number of relevant publications for the present research. The search strings applied is TITLE-ABS-KEY (heritage AND digitization OR digital AND heritage OR heritage AND building\* OR heritage AND site\* OR museum\*) AND (pandemic OR COVID-19). The current research work successfully retrieved a total of 259 articles from both the Scopus and Google Scholar databases. As previously stated, manual searching based on similar keywords was conducted on other databases, which resulted in an additional 75 articles. The first round of the systematic review procedure yielded 334 publications in total.

##### **3.3.2 The Screening of the Article**

The goal of the initial screening stage was to eliminate duplicate articles. A total of 7 articles were excluded during the first stage, while 327 articles were screened based on several criteria, namely: research articles that offer empirical data; the article is written in English; the publication period is from the year 2020 until 2022 as this is the timeline of pandemic; and lastly, the article is fully accessible by researcher. Overall, a total of 104 articles were selected based on these criteria.

##### **3.3.3 A Full-Text Assessment**

At this stage, only relevant articles were selected and examined thoroughly to answer the research questions of this study. The assessment is based on the title, abstracts, keywords, findings and the main content. Consequently, only 19 articles are suitable to be analyzed.

##### **3.3.3 Data Abstraction and Analysis**

The thematic analysis has been chosen for this study. An inductive thematic analysis of the articles was performed manually, guided by the coding and theme generation steps developed by Braun and Clarke (2013) to facilitate interpretation beyond the mere description.

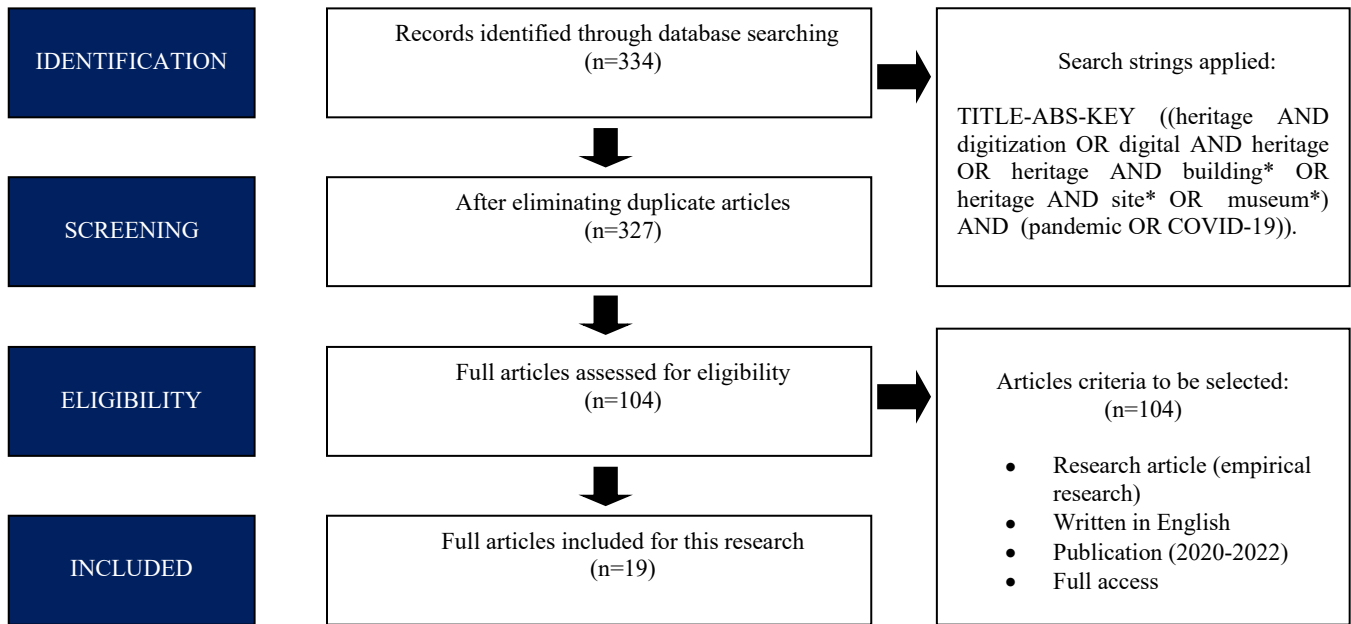


Figure 3 PRISMA flowchart

4.0 RESULTS

Three main conclusions are reached as a result of the qualitative analysis of the 19 articles. The conclusions began with a discussion of the purpose and type of digital transformation of cultural heritage assets. Next, the findings expose the different types of cultural heritage assets that have adopted digital technologies. These findings are significant because they could reveal the phases of digital transformation of cultural heritage assets during the pandemic, which are mentioned in the discussion section.

4.1 The Purpose and Type of Digital Transformation of Cultural Heritage Assets during Pandemic

Three primary goals of the pandemic-related digital transformation of cultural heritage assets have been identified through this study. The goals are connected to the customer, business or institution, as well as management.

Table 5 The codebook

First Order	Second Order	Aggregate Dimension
Increase customer value	Customer	Purpose of Digital Transformation during Pandemic
Improve customer interaction		
Engage and enhance customer experience		
Promotion of cultural heritage asset	Business or Institution	
Awareness of cultural heritage asset		
Education purpose		
Sustain the business	Management	
Increase access to cultural heritage asset		
Preserving and conserving cultural heritage asset		
Over-tourism issue		

4.1.1 Customer

The digital transformation should prioritize the customer experience. With technology, there are new opportunities to interact with customers, enhance their experiences, and involve them in the decision-making process (Dörner & Edelman, 2015). The goal of digitally transforming cultural heritage assets, according to this study, is to improve customer interaction, engage customers, and ultimately improve customer experience. First, during lockdown, more people are visiting historic locations, which indicates an increase in their value. To overcome physical limitations, applications such as virtual reality (Farooq et al., 2022; King et al., 2021; Samaroudi et al., 2020); augmented reality (Nevola et al., 2022); extended reality (O'Dwyer et al., 2022); and digital twins (Gabellone, 2022) have been developed.

Secondly, the adoption of technology also enhances customer interaction. Despite the restriction to cultural heritage areas, the technology allows customers to visit and interact through online medium such as virtual tour (Farooq et al., 2022; King et al., 2021; Samaroudi et al., 2020), social media (Ginzarly & Srour, 2022; Ryder et al., 2021; Samaroudi et al., 2020) and e-commerce (Fahmi & Savira, 2023; Priyono et al., 2020; Purnomo et al., 2021). According to Baratta et al. (2022), the online and offline experience shared by visitors have a positive impact on tourists' attitudes and behavioral intentions because it adds to memorable experience. A research effort

by Samaroudi et al. (2020) concludes that the cultural institution needs to go for digital experience because of the increasing trend towards online consumption.

Thirdly, the transformation brings a new experience to the customer. Technologies such as virtual reality, augmented reality, extended reality, and digital twin have provided a new digital experience for visitors through which they could make comparisons between visiting cultural heritage assets online and offline. A study by Baratta et al. (2022) shows that the application of web applications and QR codes enhances local cultural tourism through memorable experiences. Another interesting finding is the transformation of data into narrative themes that can be included in virtual heritage experiences (Basaraba, 2022). The discovery of the interests of prospective audiences is important because each visitor may be interested in different layers and aspects of culture and history (Basaraba, 2022).

#### 4.1.2 Business or Institution

This study discovered four purposes of digital transformation related to business, namely: promoting cultural heritage assets, raising awareness of cultural heritage assets, education, and sustaining the business. Firstly, digital promotion aids in the identification of local products that might be useful in crisis scenarios, such as pandemics. The promotion of cultural heritage assets must continue because it contributes to the conservation and preservation of the heritage. All digital applications can be used for lifelong learning, training, and education, and they are free for everyone, including handicapped individuals and those who are unable to travel. Hence, they are inclusive, integrated, and equal, as defined by Sustainable Development Goal 4 (SDG 4) (Fassoulas et al., 2022). The value of cultural heritage assets as a tourist product depends not only on their significance but also on their accessibility. The number of tourists visiting an area is influenced by its attractiveness, as well as the availability of infrastructure and services. However, the pandemic has created an opportunity for people from all over the world to visit cultural heritage sites virtually. Virtual access enables people with disabilities to participate in a multi-user, multi-platform environment (Gabellone, 2022). Through activities organized around virtual site-specific experiences such as social virtual reality and storytelling, unique performances can be shared and discussed (O'Dwyer et al., 2022). Virtual reality has made it possible for anyone to visit cultural sites that were previously inaccessible due to physical constraints. For example, the Monumental Complex of Laorca represents the identity of the local community; documenting and making the site digitally accessible has made it possible to keep contact between the community and its heritage alive and constant (Fiorillo et al., 2021). The virtual tour brings the physical world into the digital realm to recreate real-world places in shared digital spaces (O'Dwyer et al., 2022). On the other hand, social media is becoming an essential part of the promotion platform. Facebook, Instagram, and Tiktok are the main social media platforms with a large public reach. According to Ryder et al. (2021), cultural institutions used live and serialized material, collaborations, fundraising, enhanced transparency, and increased accessibility during temporary closures to strengthen communities. To achieve great reach and involvement, digital content must be appealing and target a certain sort of audience.

The second aspect is cultural heritage assets awareness. Heritage is also widely recognised as a tourist destination. Some heritage attractions have been designated as UNESCO World Heritage Sites, National Heritage Sites, or even have no status at all. The status has an effect on the number of tourists visiting a certain locality. Due to time and financial constraints, only popular heritage sites will be visited. However, advances in technology enable individuals to disseminate visits to other locations. Referring to a work done by Nevola et al. (2022), technology allows all the attractions to be promoted and visited, besides providing more detailed user-related data. Furthermore, the many forms of cultural heritage assets can be shown on a single website as technology advances. People's backgrounds differ depending on their age, education, and purpose, and as a result, their interests may be diametrically opposed. In this instance, Samaroudi et al. (2020) stated that technology could offer a variety of packages to specific audiences such as those who have interest with the collection at the institution. Memory institutions, in particular, have modified or expanded their communication skills with their existing audiences while also attempting to attract new audiences online. Besides that, another finding can be traced to an article written by Basaraba (2022), who acknowledged that future virtual experiences could combine and develop variety of themes of culture and history within one cultural heritage site. Besides, virtual narratives offer an opportunity to broaden the range of social groups interested in heritage, the types of histories (e.g. different social groups) that are shared in the digital space, and the scope of evolving interpretations and public contributions to cultural heritage narratives. These themes can be identified through multimodal discourse analysis of exciting datasets.

The third component is education, and the importance of the digital revolution in education is examined in this research. The digital transition is also apparent in the education sector, where online teaching is replacing conventional teaching methods. Online teaching, according to Farooq et al. (2022), provides a better learning environment than traditional techniques. Furthermore, the virtual reality tour has allowed students to explore cultural heritage sites. Furthermore, it has been found that the digital transformation can provide information about cultural heritage assets. For example, a study by Pena et al. (2021) indicated that the technological advancements in cultural heritage could increase access to information about culture for many people regardless of location. Furthermore, the dissemination of information becomes faster and helps rural communities identify new opportunities and innovate (Fahmi & Savira, 2023). Additionally, the digital transformation allows for a comparative studies to be conducted. The digital transformation is not a new agenda. Fortunately, the pandemic has accelerated the process of digital transformation in many sectors, including the cultural heritage sector. One article in this review paper shows that a comparative study was conducted during the pandemic to determine the best method for conserving cultural heritage assets. Barszcz et al. (2021) conducted a study titled '*Comparative Analysis of Digital Models of Cultural Heritage Objects Obtained by the 3D SLS and SfM Methods*'. Another key point is that digital transformation can improve students' or visitors' understanding of cultural heritage assets. Even if a person is unable to visit the actual heritage site for the purpose of learning, technology has made it possible to do so virtually. A study by Xi and Cong (2022) indicated that, the learning course such as HBIM models can be completed through virtual tours and other online methods.

The fourth element is about sustaining the business. The COVID-19 pandemic has accelerated the pace of digital transformation (Klein & Todesco, 2021), as it has become the only secure way to interact with people, stimulate business activity (Priyono et al., 2020), and ensure resilience during times of crisis (Hajishirzi et al., 2022; Hussain, 2021). Digital transformation provides new hope for many



organizations, especially small business owners, to build their resilience in the face of pandemic-related challenges. While history has recorded many crises and epidemic episodes, none of the previous global crises compares to the recent COVID-19 pandemic in terms of the damage caused to the economy and the number of people affected. As the COVID-19 crisis continues to persist, there is a great deal of uncertainty about future economic and social conditions. Numerous studies have shown that small businesses have been among the hardest hit by the pandemic (Fairlie, 2020; Gaffar et al., 2022; International Trade Centre, 2020). According to the findings of this study, the goal of sustaining the business is particularly relevant to SME that sell craft (Fahmi & Savira, 2023; Priyono et al., 2020; Purnomo et al., 2021). The adoption of digital technology had already begun before the pandemic; however, digital technology is valued differently by each individual and provides varying benefits for entrepreneurial development (Fahmi & Savira, 2023). According to Priyono et al. (2020), three situations can be observed for a business entity: (1) some business entities may be ready to transition to a digitalised firm; (2) the business may adopt selective digital adoption due to financial distress; or (3) a business may be rich in social capital but lacking in digital literacy, which motivates them to engage in collaboration.

#### **4.1.3 Management**

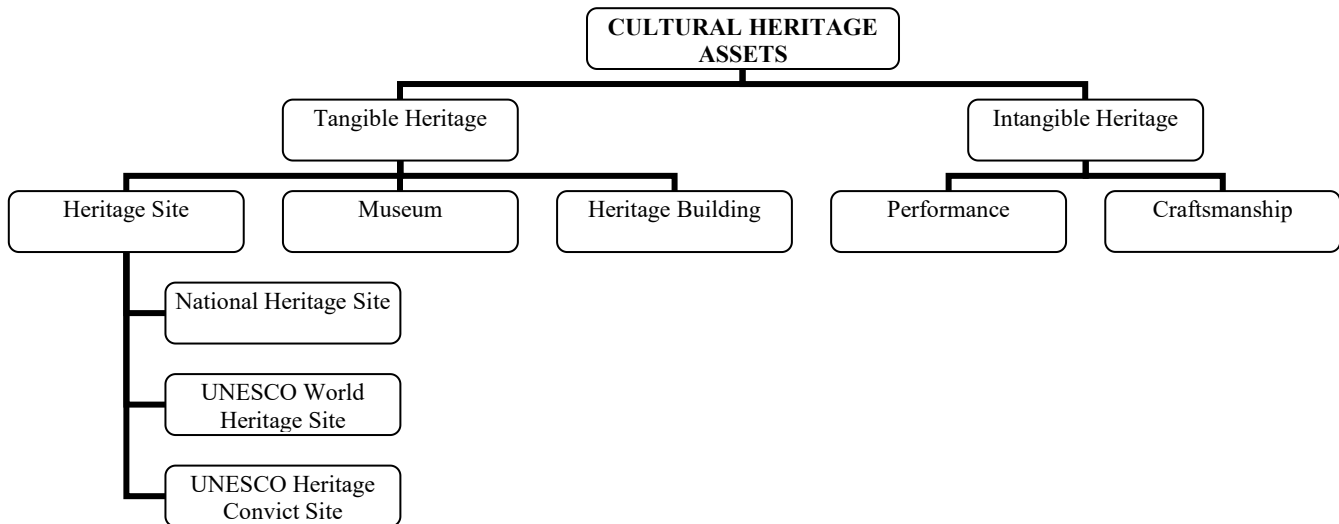
Many industries were forced to shift to remote work. However, not all industries can be entirely run from home. Therefore, the role of digital transformation is to enable remote monitoring systems that can be accessed from anywhere, at any time, and from any location. The management of cultural heritage sites during a pandemic is described in the perspective of accessibility. For example, according to Gabellone's (2022) research, creating an immersive platform like a digital twin and virtual visit with a real remote guide and e-learning capabilities has enabled people with disabilities to access heritage sites and allowed visitors to visit museums virtually despite their physical closure during the pandemic. Understanding digital twins is essential to optimize processes, increase efficiency, and detect problems before they occur (Gabellone, 2022). Furthermore, activating data analysis and system monitoring can facilitate working in predictive mode by identifying issues even before they arise. According to Nevola et al. (2022), in order to effectively manage existing cultural sites, augmented reality applications and the data they produce must be utilised.

On the other hand, the management of cultural heritage assets is reflected in ideas related to heritage appreciation and conservation. This notion is highlighted in Fassoulas et al.'s (2022) study, which stated that the appreciation of natural and cultural heritage could be increased through the digital apps. Similarly, Ginzarly and Srour (2022) found that technology had emphasized the social value of heritage during the pandemic. In contrast, the conservation aspect is underlined in a research by Gabellone (2022), who stated that the construction of digital twins attached to cultural heritage enables the development of models that are representative of reality and may be utilised for conservation motives.

The next topic is the problem of overtourism, which has been a prominent issue in the global tourism management community. The continual expansion of international tourism places a strain on many high-profile metropolitan sites that house some of the world's most valuable cultural assets. However, the pandemic has had a positive impact on heritage attractions that were facing the issue of overtourism. A recent contribution by Nevola et al. (2022) suggested using AR apps in the maintenance of established historic attractions. The benefits of using this app included increasing in-destination usage, shifting visitor traffic away from less popular areas of Florence by finishing the tours, and improving data protection in terms of obtaining more specific user-related data (Nevola et al., 2022).

#### **4.2 Type of Cultural Heritage Assets Using Technologies during the Pandemic**

Another finding is about the types of cultural heritage assets that underwent digital transformation during the pandemic. It should be emphasized that cultural heritage assets are classified as tangible or intangible. Both types of heritage were documented in this study in preparation for digital transformation during a pandemic. Most of the transformations in this study were applied to tangible heritage, including heritage sites (Basaraba, 2022; Farooq et al., 2022; Fassoulas et al., 2022; Gabellone, 2022; Nevola et al., 2022); museums (Baratta et al., 2022; Barszcz et al., 2021); and heritage building (Fiorillo et al., 2021; Xi & Cong, 2022). Only four studies (Fahmi & Savira, 2023; O'Dwyer et al., 2022; Priyono et al., 2020; Purnomo et al., 2021) investigated the digital transition of intangible cultural heritage. The numerous different kinds of cultural heritage assets that experienced digital transformation throughout the pandemic are shown in the graphic below.

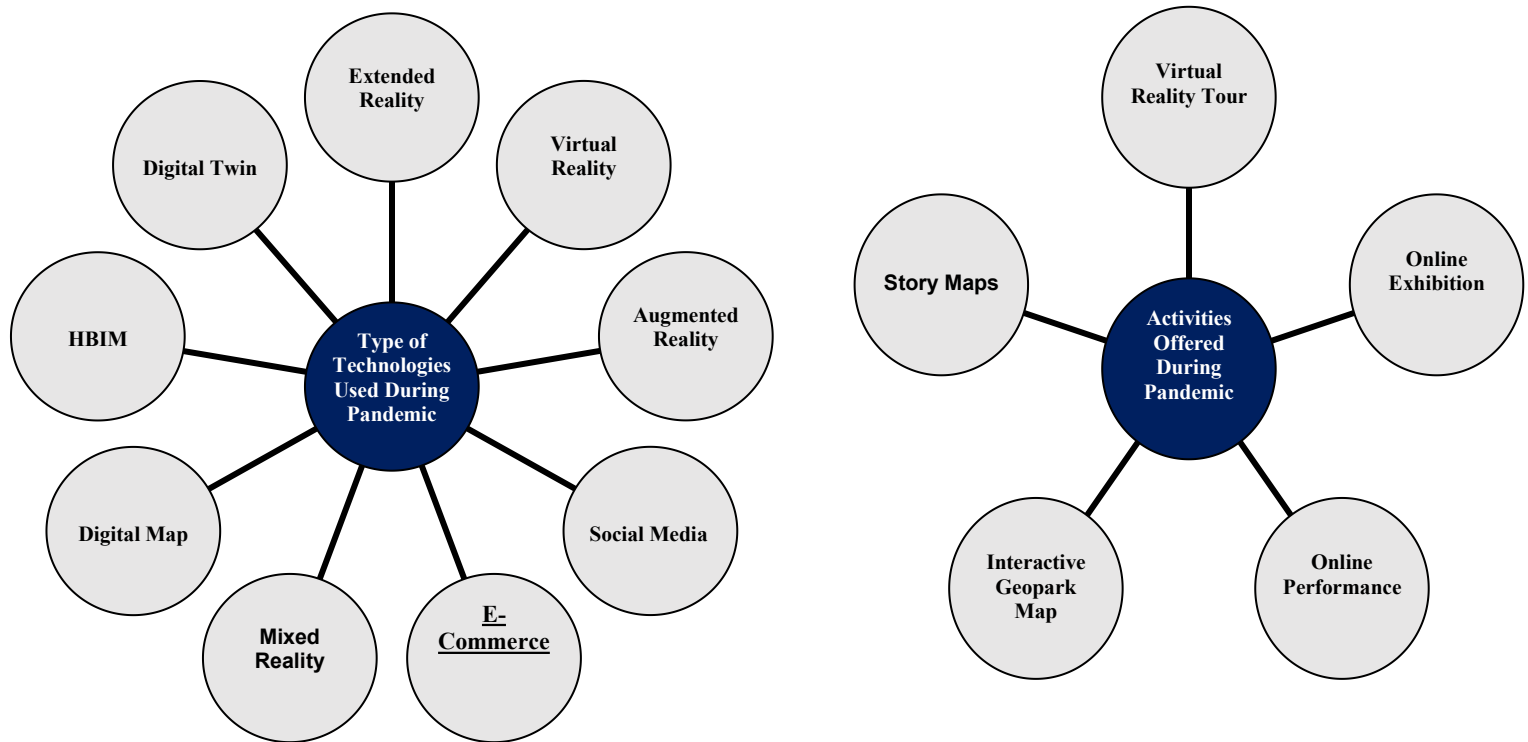


**Figure 4** Types of cultural heritage assets adopted digital transformation during pandemic  
(Source: Author's interpretation)

### 4.3 A Transformational Shift to Disruptive Technologies

Due to the COVID-19 pandemic, people and cultural heritage assets could not interact as they used to. Many heritage sites and museums were forced to close due to health concerns. This study found that the management of cultural heritage assets has shifted to an online platform to resume their activities. Although physical restrictions caused many businesses to close, heritage sites or museums were not allowed to have any visitors, but the business still had to operate. This study found that the adoption of disruptive technologies has allowed visitors to experience heritage sites remotely. Among the 18 articles, the most commonly adopted technique is producing virtual reality tours (Basaraba, 2022; Farooq et al., 2022; Fassoulas et al., 2022; Fiorillo et al., 2021; Gabellone, 2022; King et al., 2021). Second, the usage of social media, such as Facebook and Instagram, to engage with visitors (Fassoulas et al., 2022; Ginzarly & Srour, 2022; Pena et al., 2021; Priyono et al., 2020; Purnomo et al., 2021; Ryder et al., 2021). Third is the use of digital maps, such as an interactive Geopark Map and story maps (Fassoulas et al., 2022). Other types of digital technologies identified in this study include augmented reality (Nevola et al., 2022), extended reality (Bertrand et al., 2021; O'Dwyer et al., 2022), mixed reality (Bertrand et al., 2021) HBIM (Xi & Cong, 2022), digital twin (Gabellone, 2022), 3D scanning (Barszcz et al., 2021), and e-commerce (Fahmi & Savira, 2023).

Furthermore, this study discovered that these technologies have been employed to provide activities to restart businesses associated with cultural heritage assets during the pandemic. Five significant activities have been identified, beginning with virtual reality tours (Farooq et al., 2022; Fassoulas et al., 2022), a typical strategy utilized by cultural heritage asset management teams. It is because the heritage site or museum is not open to the public that a virtual reality tour is a solution to continue operating the business or allow visitors to come. The second activity is an online exhibition. Any unique event or occasion can still be held, but without a physical building, allowing people from various nations to visit at a reasonable cost. The third activity is online performance. Typically, every performance requires an audience or crowd which is not possible due to the pandemic. As a result, the approach is to include only the performers in online performances. Lastly, there is the interactive Geopark map and a narrative map (Fassoulas et al., 2022). The interactive digital map is like an online book with interactive chapters that provides a strong spatial reference. Figure 2 illustrates the transformational shift to disruptive technologies throughout the pandemic.



**Figure 5** Type of technologies and activities offered during pandemic  
(Source: Author's interpretation)

## 05.0 DISCUSSION AND CONCLUSION

Based on a series of literature reviews, this study is perceived as among the few that investigate the digital transformation of cultural heritage assets during pandemics. The key motivation of this paper is to explore how the digital transformation of cultural heritage assets can help sustain them. The structure of the paper starts with the purpose, followed by the type of digital transformation. Both are interrelated because the digital transformation is dependent on the needs of an institution or business entity (Tekic & Koroteev, 2019). Next, the study reveals the types of cultural heritage assets that adopted digital technologies during the pandemic. It demonstrates the adoption of digital technologies into tangible cultural heritage assets as opposed to intangible cultural heritage. The last section of results provides details about the types of technologies and activities offered during the pandemic. These implementations were necessary for cultural heritage assets to preserve and conserve their value, continue their operation, sustain the business, and interact with customers. Furthermore, based on strategic imperatives in accordance with the phases of digital transformation recommended by Verhoef et al. (2021), the phases of digital transformation of cultural heritage assets during a pandemic in this study are at the digitalisation level. Digital transformation is a process that begins with digital awareness and goes on until it reaches digital transformation (Garzoni et al., 2020; Verhoef et al., 2021). Digital transformation is the most advanced level at which it modifies the business model of an institution or company and adjusts to new market realities.

This review paper has some limitations. There is a selection bias inherent in the process of filtering the suitable papers. The data collection, analysis, and interpretation remain influenced by the subjective assessments of the author. Furthermore, because the search strings are specific to several terms, such as heritage digitisation, technology, museum, heritage building, and pandemic, searching exclusively in reputable academic journals may have omitted some relevant research. Therefore, the findings of this research were only extracted from 18 articles. Future research should add more keywords and synonyms so that the identification of articles is more accurate and relevant. The review shows that the digital transformation supports the sustainability of the preservation and conservation of cultural heritage assets during the COVID-19 pandemic. This study contributes to many functions of the digital transformation of cultural heritage assets. The advancement of technology has allowed business associated with cultural heritage assets to remain viable and has attracted many newcomers from all over the world. The process of digitisation of cultural heritage assets should be continued and make use of available technology to provide good services and products to people, especially in the tourism sector where people interested in heritage come from a variety of backgrounds. The accumulated data should be analysed in detail so that the heritage destination can meet the expectations of tourists and create high satisfaction among them. In addition, the most important thing is that the preservation and conservation of cultural heritage assets could be done without any barriers in the future. These findings only describe a few implementations of technology in museums, heritage sites, heritage sites, and site performance. Therefore, it could create more

opportunities for future research on other aspects of heritage assets. With the evolution of technology, the experience of cultural heritage assets is no longer restricted by brick and mortar. The digital transformation of cultural heritage assets does not focus only on the application of digital technologies. It is about change within the organisation and how it engages with the audience using technology such as augmented reality, digital twins, heritage building information modelling, and social media.

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