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The impact of digitalisation and digitisation in museums on memory-making

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ABSTRACT

Museums have expanded beyond their initial role in preserving artefacts as memory intuitions, playing an educational role and being tourist attractions. They had to adapt and increasingly utilise digital technologies to stay relevant in contemporary times. The use of technology in museums can be divided into two domains: digitalisation and digitisation. This study reviews 83 screened articles aligning with the guidelines of PRISMA systematic review to analyse existing knowledge about digitalisation and digitisation in museums, to demonstrate how these processes impact the role of museums, memory-making, and identify gaps for further research. The results indicate that digitalisation and digitisation enhance the overall museum experience for museum visitors and promote the educational aspect of museums as an 'interconnected space'. Notable use of digitalisation includes the use of Virtual Reality and Augmented Reality, while digitisation often is present through museum websites. Nonetheless, four current challenges for museums have been identified that warrant further research.

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Museums; tourism planning; digitisation; digitalisation; memory-making; collective memory

1. Introduction

Museums were created by intellectuals and the ruling class of the eighteenth century (Hakimian, 2010) with two purposes: educating general communities and archiving their history and culture. Johanson and Olsen (2010) argue possible contradictions between the traditional ideology of museums and modern tourism and demonstrate how the museum is involved in a tourism system. Over the years, museums have become tourist attractions, showcasing a destination's culture, history, artifacts to visitors and supporting tourist expenditure through sale of tickets, souvenirs, food, and beverages (Johanson & Olsen, 2010).

As a cultural and heritage tourist attraction, museums are a cornerstone of a destination's tourism offer. Capstick (1985) stated that tourists visit museums not in pursuit of education, but as part of a general holiday programme in which they derive 'enjoyment … in direct relation to their recognition of familiar or well-known objects' (Capstick, 1985). McKercher and Du Cros (2002) frequently refer to museums in their book on cultural tourism. They note that amongst different types of tourists' purposeful cultural tourists (i.e. those tourists for whom culture is the main motive for travel and who seek deep cultural experiences) were the greatest consumers of museum experiences in Hong Kong. The importance of museums as tourist attractions is further highlighted by visitor statistics.

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For example, a survey done by the Museums and Galleries of New South Wales (NSW) between August 2014 and March 2015 reported that 59 per cent of visitors were locals and 41 per cent were tourists (not differentiating between International and Interstate). Evidently, museums play a prominent role in tourism, especially since the late twentieth century (DE CAMPOS, 2021). Tourism is a worldwide sociocultural phenomenon& nbsp;(Bhandari, 2008) that has especially shaped museums, wherein Herreman (1998) argues that museums are going through a 'crisis of institutional identity and a crisis of concept'. The connection between the effects of tourism and museums is important as museums are undergoing a constant change of their role and function in society (Hakamies, 2019), which is why this review is relevant to tourism academics and practitioners to understand the effects of digitalisation and digitisation in tourist attractions, namely museums.

With ongoing change in museums' roles in society in contemporary times, it is worth noting that the term 'edutainment' has become more prominent; Balloffet et al. (2014) argue traditionally museum visitors had deemed museums to be very unwelcoming. Subsequently, this made museum professionals adopt edutainment in museums by incorporating user-friendly and interactive experiences to museum visitors to make them play a more active role during their visit in order to create an experience more intune with the visitors' sensory and emotional state (Balloffet et al., 2014). Other reasons for museums' evolving past their traditional role is because of external and internal influences such as museum's resilience to stay relevant in contemporary times, its place in the tourism, and advancement in technology.

Advancement in technology determined a common trend in museums: digital transformation (Agostino & Costantini, 2022; Esposito et al., 2023; Fischer et al., 2020; Fissi et al., 2022). This is defined as a 'process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication and connectivity technologies' (Tim et al., 2020). Digital transformation can be segmented into two concepts: digitalisation and digitisation. Digitalisation refers to using technology such as virtual reality, augmented reality and artificial intelligence to promote visitor engagement, increase quality of experience and knowledge in museums (Choi & Kim, 2021). Digitisation refers to conversion of physical catalogues (such as artefacts and books) to digital for storage, accessibility, or general use (Stauffer, 2012). Arguably, one common trait digitalisation and digitisation share is their capability to influence memory-making in museums (Brown & Davis-Brown, 1998; Meehan, 2022).

Museums have become important institutions contributing to personal and collective memory-making. Collective memory is knowledge or experience of a common past event that individuals, groups, and communities share (Bar-Tal et al., 2014; Blakkisrud & Kuziev, 2019; Combs, 2021). The ability to recreate memories in museums is said to be influenced through digital transformation using sensory cues (Manzuch, 2020). Collective memory has been discussed in museums and cultural heritage literature widely (Autry, 2013; Combs, 2021; Dias & César, 2014; Haddad & Fakhoury, 2016; Josias, 2011; Stainforth, 2022), validating its importance. However, very few studies point out the impact of digital transformation on memory making (Esposito et al., 2023; Fischer et al., 2020).

This paper examines existing knowledge regarding digitalisation and digitisation in museums by exploring practices in the use of digitalisation and digitisation and memory studies to determine how technology is affecting memory-making in museums using existing literature. Museum's role in recognising and officialising memories (Misztal, 2003) and the increasing digital transformation, speculation of relevancy, and capability of memory-making in museums needs further studies to understand the ever-changing role of museums and its future trajectory. For example, Agostino and Costantini's (2022) assessment of digital readiness in cultural institutions overlooked the level or amount of digitalisation and digitisation in museums, highlighting another gap; are there links between how digitalisation and digitisation affect memory-making in museums given that they are referred to as memory institutions? This systematic review helps answer this question, identifies existing gaps in knowledge and proposes avenues for future research.

First, digitalisation and digitisation exert influences in enhancing educational values of museum content and the memory-making aspect of museums based on the works of some authors (Charitonos et al., 2012; Palumbo, 2022; Stauffer & Horstmann, 2021). Second, digitisation made accessing

museum content easier for the public though with some challenges (Stauffer, 2012). Third, the utilisation of digitalisation and digitisation changed museum relationship with its visitors causing this 'relationship' to become more complicated and additionally, expectations of museum visitors have risen due to innovative uses of digitalisation (Fanea-Ivanovici & Pana, 2020; Marty, 2008). Fourth, the evolution of museums has made 'reasons people visit museums' blurred, leading to the role of museums being questioned (Ayala et al., 2021; Earle, 2013; Fan & Wang, 2020; Hakamies, 2019; Quinones Vila, 2020; Palumbo, 2022).

Finally, we ascertain 'memory making', and 'collective memory' are concepts highly relevant in museums. Museums and cultural heritages hold great influential powers in representing themselves to the public; narrations portrayed through digitalisation and digitisation may heavily influence collective memory, historical and political knowledge of individuals and communities, due to the enhanced learning aspect while consuming information through technology with higher engagement awareness (Borges, 2017; Farmaki & Antoniou, 2017; Helmbrecht, 2019; Hidalgo, 2009; Hopes, 2014; Jordan, 2010; Sik, 2015; Stauffer & Horstmann, 2021).

The remainder of this paper proceeds as follows: Section 2 presents the methodology for systematic review, in particular the search strategy, data sources and screening process. Section 3 analyses the bibliometric of the publications such as trends, publication outlets, publication types and empirical contexts. Section 4 follows with detailed thematic analyses conducted with the selected publications. A discussion follows in Section 5, while Section 6 concludes.

2. Methodology

A systematic review was carried out with the PRISMA statement, a widely acknowledged guideline for conducting systematic reviews and meta-analyses (Moher et al., 2009). PRISMA statement offers a standardised checklist to guarantee the reporting of all pertinent information and to ensure this review is conducted in a clear and reproducible way.

2.1. Search strategy

The importance of keyword selection was considered when selecting appropriate keywords for electronic database searches (Burt & Davies, 2010). Keywords associated with museums and other culture/ knowledge/ heritage preserving institutions were searched alongside keywords associated with digitalisation, digitisation and memory making as seen in Figure 1.

The keywords were combined with Boolean operators (AND, OR, NOT) to refine relevant searches (Coombes & Nicholson, 2013; Moher et al., 2009) such as 'museum*' AND 'digital transformation' AND 'Digitisation' AND 'Online'. The use of asterisks (*) was included in the searching process as the asterisk

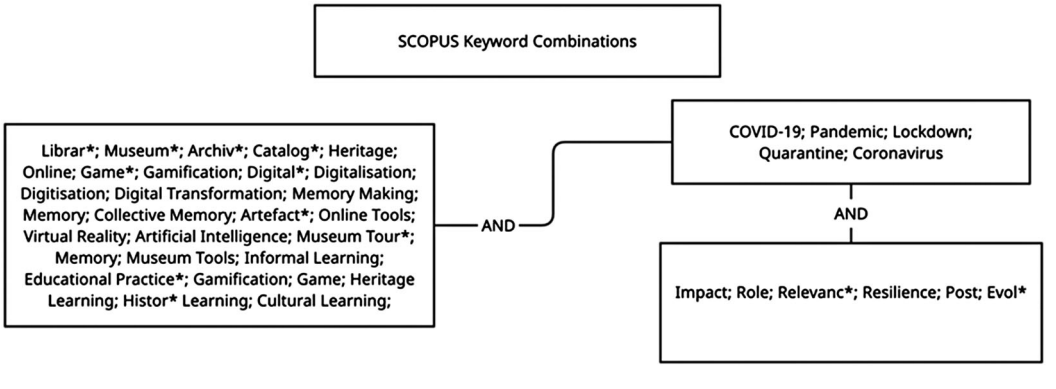

Figure 1. Keyword search.

enabled the databases to search different variants of the words like 'digital*' and 'digitally' being included in the search. The use of both UK and US spelling variants were used, for example digitisation and digitization, however, did not bear much difference in terms of the results. The keywords such as COVID-19; Pandemic; Lockdown; Quarantine; and Coronavirus were used because COVID-19 has accelerated the use of technology (Choi & Kim, 2021; Ebbrecht-Hartmann, 2021), and some researchers have reported on how businesses and society have pivoted from their old ways of conducting their lives and businesses due to technology in the aftermath of COVID-19 (Kuah & Dillon, 2021).

2.2. Data source and timeframe

The main database used was Scopus and searches were conducted on 2nd November 2023 to identify studies relevant to the scope of this study. Scopus was used as the main data source as several studies (Mongeon & Paul-Hus, 2016; Singh et al. (2021)) found that journal articles that are indexed in the Web of Science (WoS) are also indexed in Scopus. Scopus also had more unique titles as compared to WoS (Mongeon & Paul-Hus, 2016; Singh et al., 2021). Some studies (Wilson et al., 2020; Yung & Khoo-Lattimore, 2019) made use of Scopus because Scopus was found to be more powerful in its advanced search capabilities exceeding those of the other databases (Yung & Khoo-Lattimore, 2019).

Articles published on digitalisation and digitisation in museums, as well as its role for memory-making, over the last 15 years (2007–2022) were reviewed for several reasons. Firstly, the rise of digitalisation and digitisation is a relatively new phenomenon, especially the use of technology such as virtual reality, augmented reality, and artificial intelligence. Furthermore, the increased availability of online databases and search engines made it easier accessing scholarly articles, allowing the literature review to take advantage of many digital resources available to researchers (Lecheler & Kruikemeier, 2016). A systematic review identifies gaps in literature where further research may be needed (Gernsheimer et al., 2021; Snyder, 2019).

2.3. Screening process

The authors screened and excluded duplicates (Kalandadze, 2022; Moher et al., 2009). This resulted in a reduction from 12,663 records to 8095 records. Using EndNotes automation tool, 1030 records were further excluded if the document type was neither a journal article, conference paper, book chapter nor in English. The second screening was done manually where inclusion criteria were that study must revolve around museums, libraries, or cultural heritage as its focus. This was done through reading the title, abstract and keywords. As a result, 6942 records were excluded. The third screening found some studies did not concern digital transformation, digitalisation, and/or digitisation in museums (n = 36), or don't have the full text available (n = 4). The final number of papers included in this review further reduced to 83. The PRISMA approach helps minimise bias and ensures relevant and high-quality studies are included in the review (Moher et al., 2009). Figure 2 shows the process.

3. Descriptive analysis

Descriptive analysis provides insights into a research topic's nature and future evolution (Ye et al., 2021). We conducted the descriptive analysis to provide an overview of the literature in terms of year of publication, journal of publication, method, and empirical contexts.

3.1. Publication trend

The publication trend of refereed journal articles on digitalisation and digitisation in museums between 2007 and 2022 shows that the number of publications per year has steadily risen since the first paper in 2008. The trend of the graph suggests that the COVID-19 pandemic may have made digitalisation and digitisation in museums even more significant (Figure 3).

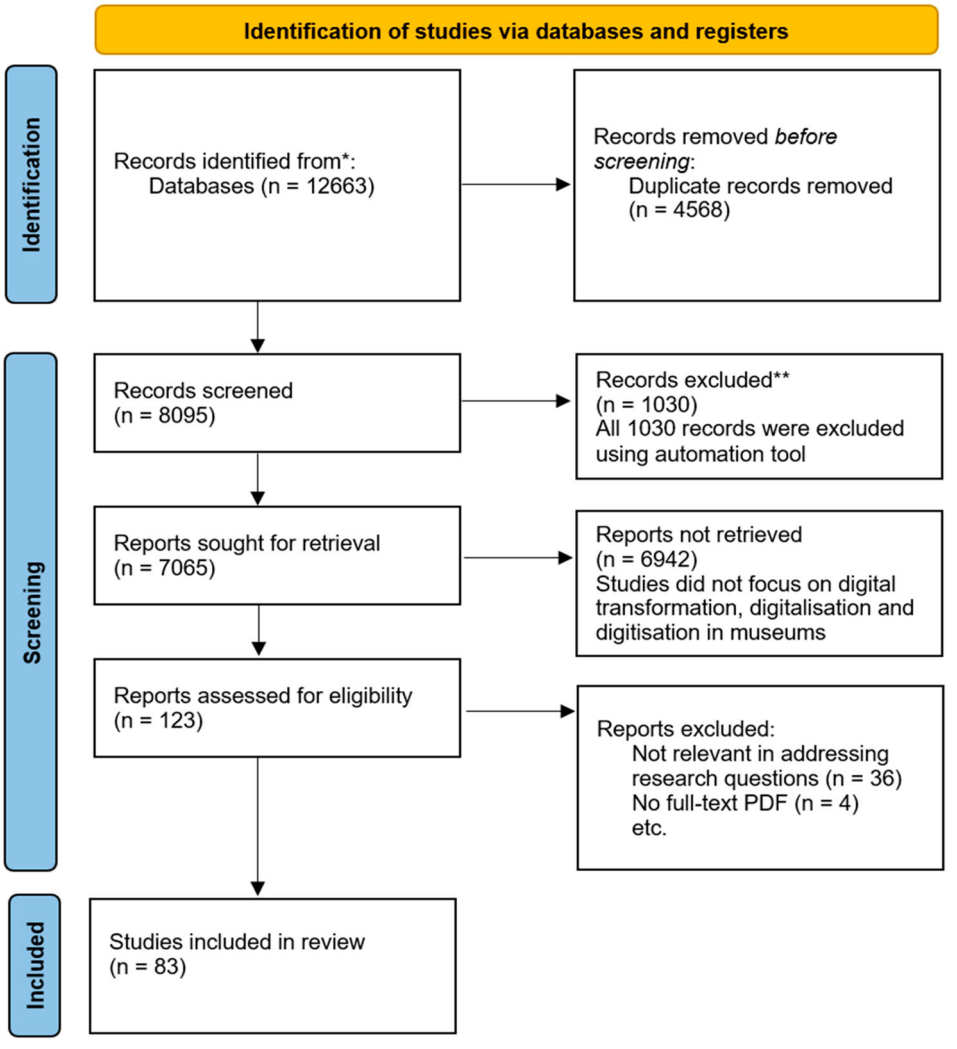

Figure 2. PRISMA process.

3.2. Publication outlets

The 83 journals articles around this topic were found in 69 different journals. Concentration was found in *Museum Curatorship and Management* (n = 6) followed by *International Journal of Heritage Studies* (n = 3) and *Media, Culture and Society* (n = 3) (see Appendix 1 for the full list of journals). Other journals such as *Memory Studies and Archival Science* have at least two articles on the topic of digitalisation and digitisation in museums and memory-making, demonstrating a growing interest in other disciplines.

3.3. Publication types

Different types of studies were included in the sample, among them: literature review (n = 41), empirical research (n = 28), case study research (n = 8), conceptual research (n = 3), theoretical research (n = 1), an analysis paper (n = 1) and an interview transcript (n = 1) as seen in Figure 4.

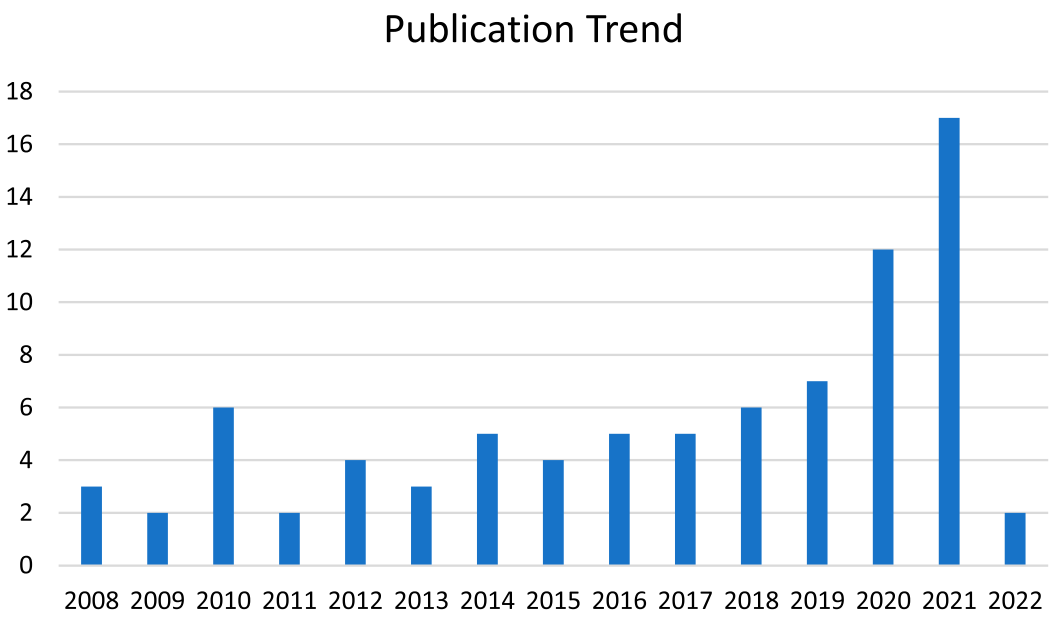

Figure 3. Publication trend.

3.4. Empirical context

Figure 5 shows that most studies were conducted in Europe (n = 23), followed by Asia (n = 10), Oceania (n = 3), Africa (n = 4), North America (n = 3), South America (n = 2) and other on multiple locations (n = 38). We focus on 17 significant empirical studies that were conducted in related areas. A total of 3082 adults and children participated in these studies. The data is graphically represented in Figure 6.

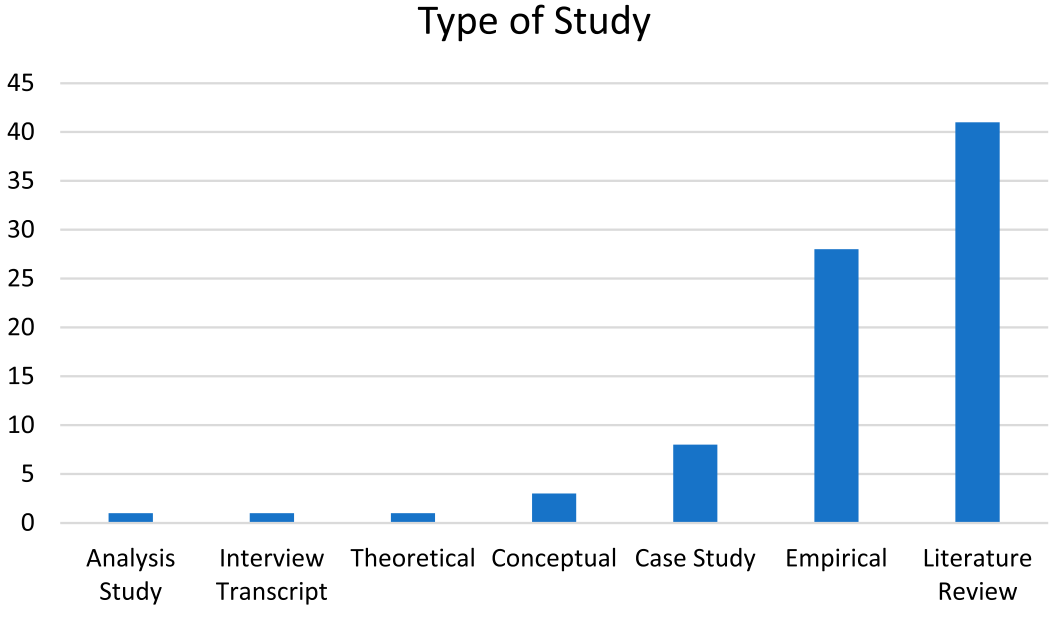

Figure 4. Publication types.

4. Thematic analysis

Thematic analysis was conducted to extract, examine, and report overarching themes from the dataset (Braun & Clarke, 2006; Ye et al., 2021). We followed four stages Riboldazzi et al. (2021) outlined in the thematic analysis. Firstly, open coding was used to code articles independently based on concepts emerging from the text. Secondly, the main themes were divided into smaller sub-themes based on similarities between codes. Axial coding was next used to organise sub-themes into themes based on their connections (Langham et al., 2015). Finally, fundamental concepts were identified through affinity analysis combining themes into overarching themes. To ensure reliability, the authors carried out open coding independently and then collaborated throughout Steps 2–4 to discuss, revise, and finalise identified sub-themes and overarching themes.

The factors investigated in previous studies can be broadly categorised into four categories: (1) memory studies in museums, (2) the role of museums, (3) digitalisation and digitisation in museums and (4) the impact of digitalisation and digitisation on museum visitors.

4.1. Memory-studies in museums

Memory is defined as the 'constructed nature of people's knowledge of history' which derives from educational contexts 'rather than remembering centuries of events and processes' (Blakkisrud & Kuziev, 2019). In museums and cultural heritage, 'collective memory' is often discussed in literature (Angeli et al., 2021; Dias & César, 2014; Ekim et al., 2017; Guichard-Marneur, 2018; Hartmann, 2016; Khlevnyuk, 2023; Kim, 2020; Krmpotich, 2010; Robinson, 2012 and Wróblewska, 2019).

4.1.1. Collective memory

The term 'collective memory' has a myriad of definitions dependent on circumstances but often reliant on social frameworks such as language, social class, and religion (Ekim et al., 2017; Josias, 2011; Stainforth, 2022). Scholars defined collective memory as 'where social identities are constructed, contested and politicised' (Angeli et al., 2021; Autry, 2013; Matsumoto, 2017; Sakki, 2016; Ultav & Savaşır, 2012; Yung et al., 2014); a representation of past events that individuals, groups

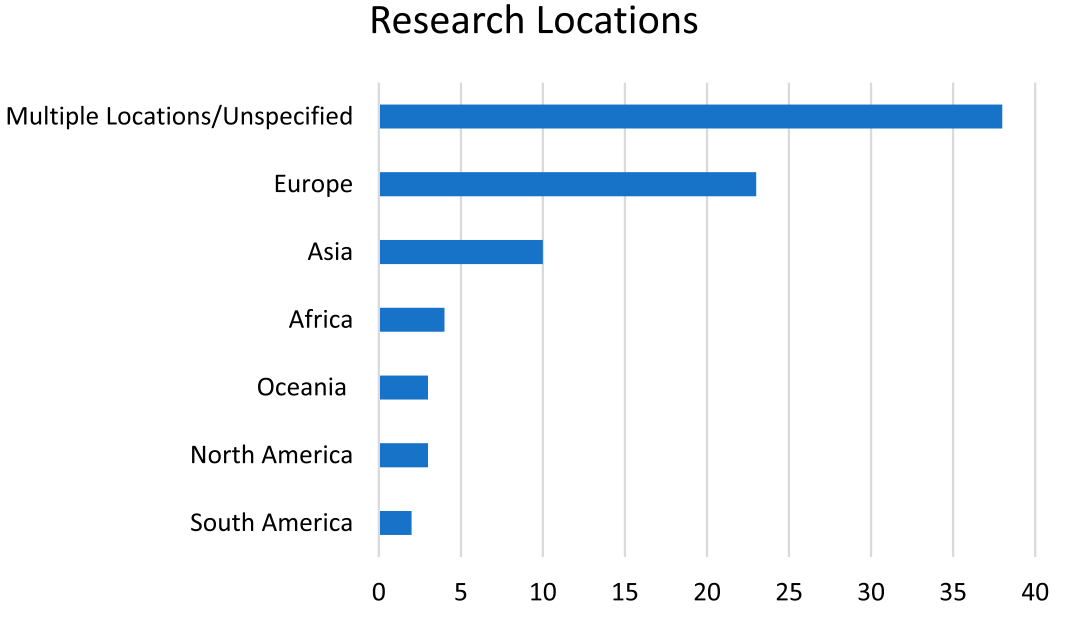

Figure 5. Research locations.

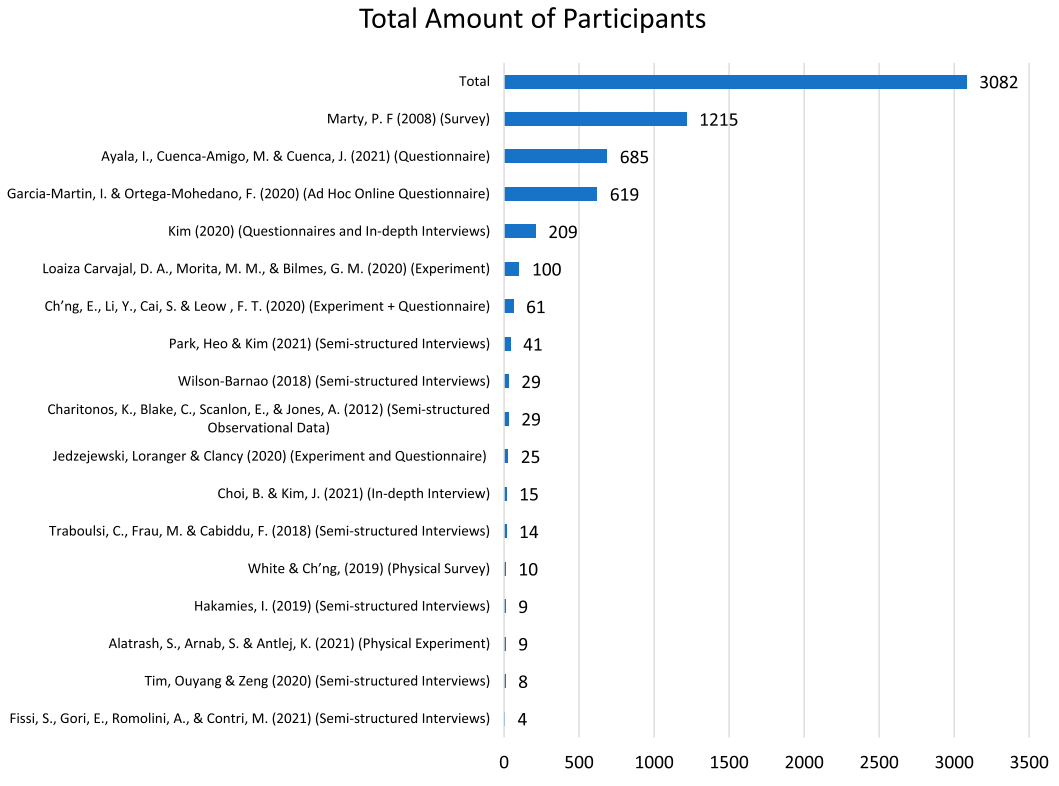

Figure 6. Number of participants.

and communities recognise as important knowledge and information that can be 'shared, passed on and (re)constructed' (Bar-Tal et al., 2014; Blakkisrud & Kuziev, 2019). In tourism, Farmaki and Antoniou (2017) stated collective memory discerns a societies' past involving memorial narratives being communicated as cultural heritage consumed by tourists (Farmaki & Antoniou, 2017). It is interesting to note that there is an increasing rate of commodification of memory of various cultures (Narvselius, 2015).

Collective memory, however, is present in everyday acts such as 'eating meals together and simply being co-present during times of scarcity or mundane occasions' (Krmpotich, 2010). It can be viewed as a sceptic concept and a 'myth' comparable to 'social stereotypes' in memory studies, which can be argued that collective memory is only justified metaphorically; the term 'collective' can also be quite problematic as they are only actualised on an individual level and not 'collectively' (Josias, 2011). Through the ambiguity of how collective memory is defined, collective memory scholarship includes more blurry distinctions with other 'memory' terms such as 'lived experience, collective remembrance, and prosthetic' (Helmbrecht, 2019; Josias, 2011; Khlevnyuk, 2023; Kim, 2020; Synenko, 2018). Prosthetic memory refers to a type of remembrance through the interaction between an individual and historical narrative(s) (Jordan, 2010). The ambiguity of collective memory terminology has created an extensive range of interpretations resulting in collective memory being referred to as both abstract and literal (Josias, 2011), as well as being interlinked with memory institutions.

4.1.2. Memory institutions

'Memory institutions' refer to museums, libraries and archives (Reynolds, 2010; Robinson, 2012; Stainforth, 2022); literature referring and discussing memory institutions often oversimplifies the concept

of memory and 'marginalises domain-specific approaches to the cataloguing, description, interpretation and deployment of collections' that allows 'memory institutes' to develop a relationship between the interactions of the public and how memory institutes engage with history, meaning and recollections (Robinson, 2012). Memory itself is already 'commonly oversimplified and undertheorised in archaeology and elsewhere, particularly through the conflation of individual memory with social or collective memory' (Robertson, 2009). The idea of memory institutions was to preserve and organise 'intellectual record of their society' for future references not restricted with institutional or national boundaries (Robinson, 2012).

The concept 'memory institutions' became prominent and relevant in the digital age (Robinson, 2012) which has driven restructuring of memory via digital platforms. Visitors experiencing collective memory has become both personal and social enhancing the complexity of memory practices of memory-making (Liew et al., 2014; Stainforth, 2022). Digital photography allowed both personal and social memory to happen (Adams & Kopelman, 2022) and can be considered as contemporary memory practice. In the context of museums, museologist Susan Crane argues that how museums stage their objects 'trigger the mental activity of recollection … of that which are absent' which can be interpreted as 'museums performing the externalised function' of how a visitor makes sense of museums (Robinson, 2012). Although from a neutral perspective, museums are just places where objects and their information are displayed, yet, museums are much more than spaces of storage and displays; in the psychological perspective, it is responsible for the mental stimuli of associating, recollection and the museum objects to produce meaningful narratives to visitors, demonstrating the capabilities of museums to rectify memories and knowledge as well as produce meanings and histories through their collections (Robinson, 2012). One of the important aspect of museums is its ability to 'contextualise collection objects within broader thematic and narrative groupings' (Robinson, 2012) allowing museum visitors to understand the more complex ideologies, meanings and narratives of history and reminiscence, which consecutively gives museums this intrinsic and distinctive values.

4.1.3. Memory studies in the digital age

Over time, scholars of memory studies noticed that the use of digitalisation and digitisation (Meehan, 2022) had led to a rapid increase in the use of digital images. This created an easier process of gaining more understanding and shifting attitudes towards not only certain museum objects but also certain moments in history, as well as how influential mass media is to influence the production of memory (Hansen-Glucklich, 2010). Evidently, the transitioning of digital-memory cultures also plays a prominent role in constructing 'socially inherited memories within public spaces', which could change 'novel memory-making practices' (Adams & Kopelman, 2022). Taking note of how the increased use of digital image has shifted attitudes towards particular moments in history, as well as to gain a better understanding of them, the influence of digital image has also, unintentionally, led to digital images being able to 'constitute, replicate, and propagate current events' (Meehan, 2022). Understanding this as the context, the byproduct of this has created a change in the photography aspect of contents within a museum context (Henkel, 2014). Henkel (2014) argues that photography in museums does help museum visitors remember museum content slightly better, however, this also comes with a new finding called 'photo-taking impairment effect'. It is also important to note that the interactivity between museum visitors and museum objects holds great importance in understanding what the museum object is about and 'memory' associated with it (Kregar, 2014). Kregar (2014) argues that the importance of interactivity between museum visitors and museum objects indicates an aspect of 'reminiscence and remembrance' through an individual's memory when interacting with the museum content, however, the interactivity between museum objects whilst drawing on past memories and going through the cognitive process of reminiscence, this creates 'new memories' based on the specific museum visit and what was interacted with between the museum visitor and museum itself, however, this is only possible when museum visitors associate their interactivity with their own past memories (Kregar, 2014).

In the experiment done by Henkel (2014), participants were asked to take photos of certain museum artefacts and to only observe certain artefacts throughout their museum tour – the results of this experiment founded that visitors tend to remember more details in the artefacts that they had observed rather than the ones that the participants had photographed. Interestingly, the objects that were photographed by zooming in on one part proved to have the same memory accuracy as to when the participants only observed the artefacts which could be depicted as zooming in to focus on a specific detail of an artefact helps participants remember more by focusing on a specific detail of the artefact rather than the whole. The same can be said when it comes to how technology can shape memory; if a certain artefact or image is taken out of its original context, then this would shift museum visitors remembrance from event-focused to image-focused, meaning that museum visitors would most likely remember the images themselves rather than remembering that the whole event that has happened (Hansen-Glucklich, 2010). There are instances where photographs are 'wrongly labelled, and credits vanished' (Hansen-Glucklich, 2010) which causes an issue of credibility and potentially a loss of information; the loss of complexity with remembrance through photography has also changed the central focus of remembrance and objects; 'the representations of themselves become the object of remembrance, instead of vehicles for the remembrance of the represented event' (Hansen-Glucklich, 2010).

4.1.4. Technology and memory studies

The argument and experiment that Hansen-Glucklich (2010) has presented aligns with their previous notion and understanding of how 'mass technologies' influences memory; photography, as well as film holds influential power to be able to 'create collective memory and social cohesion' with individuals who are not in the same social spaces, or do not have the same practices or beliefs which shows that mass technology can bring communities together with almost nothing in common (Hansen-Glucklich, 2010). The power that technology holds in influencing or changing memory is endless, and it transcends the boundaries and challenges of the traditional understanding of memory, which allows new knowledge and perceptions of memory (Hansen-Glucklich, 2010). In another experiment done by Alelis (2013), participants were given an A5-sized booklet that is designed to capture their emotions when interacting with the artefacts in the museum, which yielded interesting results showing that when the participants were aware that they needed to 'log' their emotional responses towards artefacts, it made the participants be more wary and curious as to why they felt these 'meaningful and personal connections' (Alelis, 2013). The results that Alelis (2013) had allowed insight into this 'curiosity' to understand why participants feel a certain connection or way towards different artefacts 'transcend age and gender' (Alelis, 2013). This study also had analysed previous studies that had used a similar instrument for measurement, which shed light on how museums should be cautious on the types of technology they can utilise; certain technology such as using biometrics sensor glove to measure the participants heart rate and skin conductance which some participants found intrusive, and the use of this technology is also very costly.

If the museum is able to be cost-efficient, and utilise technology to the best of their ability, then this would be a very good thing for museums. For example, in an experiment done by Ch'Ng et al. (2020) where they used a Virtual Reality (VR) system to recreate a simulation of the 800-year-old Yuan Dynasty site Sanjiangkou; the results from this experiment showed a positive response towards the use of VR in museums because of the experience that VR can bring into museums and to the museum visitors, which deemed VR to be an important type of technology especially for cultural heritages (Ch'Ng et al., 2020).

Nevertheless, despite the increase in academic literature in memory studies, there are fewer studies that focus on analysing cultural differences in how individuals and societies remember collective memory (Marschall, 2013).

4.1.5. Evolution of collective memory

Collective memory is an illustration of different social and cultural groups existing (Dias & César, 2014) where common pasts, tradition, and culture (Marschall, 2013) are collectively put together creating a shared memory amongst different social and cultural groups (Josias, 2011).

In recent years, increasing attention was placed on collective memory and its power to shape social ideals through political discussion (Farmaki & Antoniou, 2017; Sik, 2015). In the political sense, collective memory can be used as a 'tool of manipulation' whereby it reinforces prejudiced ideology masked as a 'strategy of unification' (Borges, 2017).

In tourism, Helmbrecht (2019) argues that when tourists visit destinations with historical or cultural value, they expect these places to have rare and unique relics to learn about 'significant people or events'. Therefore, collective memory in tourism has changed how memory works; once a piece of 'memory' has been placed upon an ordinary consumer product, this product interlinks with the piece of 'memory' given to it, which then creates new interpretations and meanings that are not essentially true or original (Marschall, 2013).

Generally, memory could take over actual history which could be problematic as collective memory does not equate to historical truth in many circumstances (Helmbrecht, 2019). Such discussion poses questions on how memory is eventually conceived when produced and mediated through technologies and mass media (Hansen-Glucklich, 2010; Stainforth, 2022; van Dijck, 2011).

Nevertheless, the notions behind memory, identity, and cultures are constantly going through redefinition, transition and interpenetration, hence why collective memory slowly changes over time (Agius et al., 2016; Dias & César, 2014). Museums as institutions are responsible for heritage preservation, and need to revise on their engagement with their exhibits, audiences, and their strategies (Wróblewska, 2019). Hence, the role of museums needs to be discussed in greater detail.

4.2. The role of museums

Compared to the initial role of museums where museums had only stored private collections of scholars and nobles, museums started expanding their collection to new objects such as art and artefacts from around the world if it contributed to scientific and historical knowledge (Earle, 2013). The expansion of new objects led museums to extend their fields to other categories such as industrial technology, sports, religion and more (Fan & Wang, 2020). Museum collections are defined as 'physical embodiments of the collective memory of the nation (or region, or locality)' under the ideology of museums as a storage place for 'memories' (Bristow, 2010; Merriman, 2008) along with museums being a 'living memory' contributing to 'sustainable and harmonious development of civilisation' (Simbirtseva et al., 2020).

Emphasising museums as a public institution for education, museums take a leading role in guiding the *cultural development* and *economic regeneration* for different fields such as art, tourism, and education (Earle, 2013). The reason for museums to partake in a leading role would be to extend the knowledge within museums and the museum's democracy through social inclusivity and supporting cultural literacy (Earle, 2013). Emphasising on education, museum collections are viewed primarily as sources of information. The educational aspect of museums, however, varies depending on individuals; García-Martín and Ortega-Mohedano (2020) stated that education in museums relies on an individual's past museum experiences and collective memory which includes physical, personal, and social contexts. Through this notion, museums can be seen as an important and fundamental educational resource that promotes learning and socialisation (García-Martín & Ortega-Mohedano, 2020). However, over the years, museums have evolved.

4.2.1. Evolution of the role of museums

Certain museum visitors regard museums as a leisure activity, however, in the empirical research conducted by Ayala et al. (2021) in Spain, museum visitors are not positively encouraging the

thought of museums heading towards the role of leisure as the older generation often associates leisure with idleness and laziness.

The emphasis of educating contributed to museum's placing prominent efforts on narration over knowledge (Earle, 2013). Orthodoxy of museums should implement a relaxation of control on the interpretation of museum content as people should be able to tell their own stories while considering the needs and interests of museum visitors who visit museums to learn (Earle, 2013). The accentuation of narration in museums may pose a concern to museums that extend their field towards the political and social activism side (Stauffer & Horstmann, 2021).

In an interview conducted by Stauffer and Horstmann (2021), with Volker Mosbrugger (Director General of Senckenberg Society for Natural Research) and Kirk Johnson (Sant Director of the Smithsonian's National Museum of Natural History), Mosbrugger stated that in Europe, the engagement around discourse in political topics are done intentionally. As museums are venturing towards political and social activism, they are no longer a public institution for education for history and culture (Stauffer & Horstmann, 2021). The involvement with political discourse in museums raises concerns the current role of museums currently and its future.

Over the course of time, museums have undergone considerable changes which influenced how museums are defined (Hakamies, 2019). Museums are constantly undergoing various stages of rebuilding their role and function as a public institute in society (Hakamies, 2019).

Some museums are built in accordance with social missions, as they expand into different fields, the question of the role of museums is justified; there is a need for a clearer definition of museums (Quinones Vila, 2020). According to Simone et al. (2021), the use of digital technologies is re-ontologising museums from analogue to digital. The 're-ontologisation' of museums also creates new realities, which slowly blurred the lines of offline (physical) and online (digital). Nevertheless, two concepts need to be discussed: digitalisation and digitisation.

4.3. Digitalisation and digitisation practices in museums

Digitalisation and digitisation started in the 1970s when technological revolution came to dawn, however, the use of technology was already in motion during the late 1960s albeit only used for collection recording and management (Kamariotou et al., 2021). Digitalisation is the processing of digitised content with the use of digital technology which promotes the quality of experience for visitors (Choi & Kim, 2021). Museums started advancing plans for digitalisation by incorporating virtual reality, augmented reality, and artificial intelligence (Alony et al., 2020). Digital transformations occur in museums with three purposes. First, digitising artefacts protects and preserves physical artefacts by visually representing them through online means easing the natural degradation of physical artefacts (Alony et al., 2020). Second, digitisation enables accessibility to museum contents that transcends 'location, mobility states, and to a large extent, resource' (Alony et al., 2020). Third, it encompasses 'information, computing, communication and connectivity technologies' which influence and change how businesses operate (Tim et al., 2020).

Fissi et al. (2022) identified three categories of technologies used: online tools, onsite tools, and miscellaneous tools. First, online tools refer to the use of websites and virtual tours so that users can access museum contents and influence them to physically visit the museum. Secondly, onsite tools refer to the use of technology such as virtual and augmented realities to enhance visitor experience. Third, miscellaneous tools refer to tools that help museums in their overall functionality such as 3D printing to make museums more aesthetically pleasing while providing a more engaged learning (Jędrzejewski et al., 2020). Two digital tools commonly used in museums are virtual reality and mobile application (Charitonos et al., 2012; Fissi et al., 2022; García-Martín & Ortega-Mohedano, 2020; Loaiza Carvajal et al., 2020).

4.3.1. Digitalisation

Loaiza Carvajal et al. (2020) argue that definitions of virtual reality are interconnected to concepts of simulation, interaction, and immersion. Virtual reality is defined as an interactive virtual environment simulation which 'generates a sense of immersion so realistic' that users using virtual reality feel that they are in that world (Loaiza Carvajal et al., 2020). The starting point of virtual reality was arguably the use of a traditional computer screen, which was the window to the virtual world and the use of a keyboard and mouse was the medium to interact in this 'virtual world', or in the context of museums, 'virtual museums' (Brumana et al., 2018; Loaiza Carvajal et al., 2020; Park et al., 2021). The advancement of technology provided a 'second level' of immersion; users must put on a virtual reality headset to immerse into the virtual environment while holding a joystick to facilitate movement and interactions within the virtual environment (Loaiza Carvajal et al., 2020). Such practices in museums prove to be a powerful medium to educate the public. The use of virtual reality, however, comes with an issue; the complexity of physical artefacts compared to when being converted digitally (Schweibenz, 2018), causes slight differences in authenticity, accuracy and representation to its physical form.

While virtual reality is effective in museums, so are mobile applications (Charitonos et al., 2012; García-Martín & Ortega-Mohedano, 2020). The implementations of mobile applications within museums have various purposes: to facilitate visitors in an educational context; to explore, search for information; and to communicate with the museum (Charitonos et al., 2012; García-Martín & Ortega-Mohedano, 2020). Mobile applications also serve as a tool for interactivity and leisure; the context behind interactivity and leisure is to provide different functionalities within mobile applications such as providing a gaming element (García-Martín & Ortega-Mohedano, 2020). Other than mobile applications for gaming, augmented reality has been used with handheld devices to facilitate the visualisation of a mixed reality (Hammady et al., 2016). Unlike virtual reality, augmented reality is a mixed reality that utilises on visualisation through handheld devices with acoustical tools while virtual reality is a complete immersive experience to a virtual environment through typically a virtual reality headset for the visual component and virtual reality joysticks to facilitate movement and to interact.

It is also important to discuss the role of digitisation in museums as it is argued to serve as a virtual bridge between the general communities and museums (Palumbo, 2022).

4.3.2. Digitisation

Digitisation is the conversion of analogue information using devices such as scanners for digital consumption (Enhuber, 2015; Stauffer, 2012). Digitisation allowed museums to reframe the relationship between museum visitors and museum content by giving context of the displayed objects and providing knowledge of the museum's collection (Fan & Wang, 2020; Palumbo, 2022). Digitisation acts as a catalyst for museum to engage with visitors, whether for entertainment, education or even in political discourse (Stauffer & Horstmann, 2021). It allows museum to make information and assets accessible to everyone (Stauffer & Horstmann, 2021) as part as a public service and enables museums to highlight cultural and scientific heritage for innovative and new content (Pesce et al., 2019).

Museums as a space for memory-making have also been influenced through digitisation; the very concept of memory and how the past is portrayed have changed due to digitisation, as well as how the source material is interpreted or viewed upon (Ebbrecht-Hartmann, 2021; White & Ch'ng, 2020). The information being communicated to visitors through social media environments has enabled museum visitors to change the concept of commemoration; museums, depending on content, are spaces for silence to commemorate but through digitisation. Digital commemoration is often practiced through sharing the post or commenting (Ebbrecht-Hartmann, 2021). In digitisation, a mass conversion of physical cultural heritage items through digitisation is costly, thus it is important for museums to carefully choose what tools they can incorporate through digitisation (Santagati

et al., 2017). Nevertheless, with digitisation, access to museum content became 'widespread, open and universal available through the internet' (Conway, 2015), making digitisation have the power to create, distribute and manage digital substitutes to transform lives.

Although digitisation has proven useful in many ways, it may not be always the case; Stauffer (2012) argues that the process of digitisation may result in the loss of information. Creating digital copies is a good way to preserve information and serves as a way that the information can still be accessed even if the physical artefacts are damaged; however, processing physical to digital still has risks of information not being transferred. Digitisation may be necessary due to unforeseen circumstances like the COVID-19 pandemic.

4.3.3. Digital transformation

Many museums closed during the pandemic and relied towards digital transformation; the pandemic accelerated digital transformations across museums (Choi & Kim, 2021; Raimo et al., 2022) by intensifying the development of using social media and as a way of memory-making (Ebbrecht-Hartmann, 2021).

Many museums faced challenges in response to new restrictions that COVID-19 had brought (Ebbrecht-Hartmann, 2021). The acceleration of digital transformation allowed technology to improve the roles of museum partners, staff, service providers and the learning aspect of museums (Choi & Kim, 2021), as well as an inclusive space (Arrigoni et al., 2020). With the use of both digitalisation and digitisation, the very nature of museums has been influenced.

Digital and virtual spaces have merged with the museum's physical space creating a new digital 'eco-system' promoting concepts like diversity, inclusion, and culture (Giannini & Bowen, 2019). Digital transformation, however, entailing the change from physical to digital has affected traditional means and practices which made museums no longer 'just a space' but a functional integration having many variables and factors to how museums display themselves (Marty, 2008; Tim et al., 2020). This functional integration indirectly affects expectations of museum visitors to what information should be presented online and physically (Marty, 2008). For example, deciding what information should be included when converting physical audio tours towards handheld computing platforms (Wilson-Barnao, 2018).

Agostino and Costantini (2022) created a framework to assess and measure the digital readiness of cultural organisations with five dimensions: people, technology, process, customer & strategy, and investment. The first-dimension measures how capable and what digital skills of the staff hold, while the second dimension examines how digital technology is being applied and made available to visitors. The third dimension refers to how internal processes are being digitised and the fourth dimension looks the organisation's efforts to engage with the customer. Lastly, strategy and investment look at the organisation's long-term digital strategy and investment in digital resources (Agostino & Costantini, 2022).

4.4. The impact of digitalisation and digitisation on museum visitors

Museums as a learning space is not a new concept (García-Martín & Ortega-Mohedano, 2020), however, digitalisation and digitisation has influenced how museums function as a learning space. Two concepts had emerged from visiting museums that incorporated digitalisation: a space of opinions and an 'interconnected space'. It was found that using social media platforms (e.g. Twitter) provided an 'opinion space' for users to comment on pictures creating a platform for communicating opinion (Charitonos et al., 2012). The use of Twitter allows the emergence of an 'interconnected space' albeit the respondents are in different places in the museum (Charitonos et al., 2012). These two concepts are providing new experiences which was only made possible due to digital technology (Choi & Kim, 2021).

There are two key challenges that museums must tackle whilst utilising digitalisation and digitisation. One challenge is the democratisation of information (Enhuber, 2015). As digitisation relies on

digital sources online for the accessibility of museum assets, democratising distribution and accessibility online poses a credibility issue (Enhuber, 2015). The democratising effect of distribution and worldwide accessibility has enabled information of museum assets to be made available at anywhere and at any place (Park et al., 2021). Another challenge that museums face is the consideration of how the information or context is set for the museum visitors. Depending on whether the person is consuming the information of the artefact in museum physically or virtually, the delivery of information and context should be carefully considered to minimise misinformation (Brown, 2008).

Digitalisation and digitisation influence and enrich museums' visitor experiences in many ways. The use of virtual reality systems in museums created a more surreal experience of different virtual environments about the content of the museums, allowing visitors to experience the museum's content in a more engaging way. The first factor allowing visitors to enjoy the museums more is nostalgia (Ch'Ng et al., 2020). Recollection of museum visitor's memories of different past experiences they have had, for example, TV shows they have watched or games they have played allows museum visitors to relate and connect to museum content more (Ch'Ng et al., 2020). Second, digitalisation enables the promotion and wider spread of museum assets to a wider audience making museums more accessible (Choi & Kim, 2021; Hopes, 2014). A study done by Alatrash et al. (2021) on virtual reality concluded that the complexity of the virtual reality, like the joystick controllers, is a factor to whether museum visitors can fully engage and utilise its educational function.

While digitisation led to improvements in museum experiences and well-being (Fanea-Ivanovici & Pana, 2020), the process and utilisation of digitisation created some changes with museum visitors, most notably, the rise of museum visitor expectations. Marty (2008) stated that museum visitors 'are no longer satisfied with limited access to information about museum collections, and many desire 24-hour access to museum data, no matter where these data are located, or how the data are organised'. This notion indicates diminishing relevancy of physical museums, and many are relying on the digitisation of museums for easy access to museum assets, wherever and whenever. More museums are now offering digital resources online which has increased the number of online museum visitors by at least ten times which questions the relevancy of physical museums (Marty, 2008).

The extent of digitalisation and digitisation varies amongst museum visitors as compatibility with technology differ. Traboulsi et al. (2018) find that senior citizens favour simple and user-friendly technology. The use of technology could be strategised in accordance with the primary museum visitors in order to fully utilise digitalisation and digitisation. With the rise of digitisation in museums, the role of museums is inevitably questioned as well as the use of digitalisation in museums to 'enrich' museum experience.

5. Discussion

We found the use of digitalisation in museums led to museums innovating the way they present artefacts to engage with museum visitors. One problem that was evident in two empirical studies (Alatrash et al., 2021; Traboulsi et al., 2018) was the complexity of virtual reality systems heavily affected the educational aspect of museum visitors, thus the user-friendliness of operating the virtual reality system is important when deploying such systems.

We also found the use of digitisation in museums mostly related to developing a 'relationship' between the museums and their visitors (Palumbo, 2022; Stauffer & Horstmann, 2021). Digitisation has enabled museums to become a space allowing different museum communities and visitors from around the world to interact and exchange views using social media as a space for opinions and interconnection (Charitonos et al., 2012). The use of social media platforms to create interconnectedness allows museum communities to strengthen the education aspect for museum visitors despite geographical differences making digitisation a powerful tool for museums.

Digitisation, however, comes with several challenges. Firstly, the loss of information during the process of converting physical catalogues to digital can occur as technology has a chance of malfunctioning thus certain information may not be transferred through digitally (Stauffer, 2012). For example, albeit that textual data has been digitised through high-quality digital photographs,

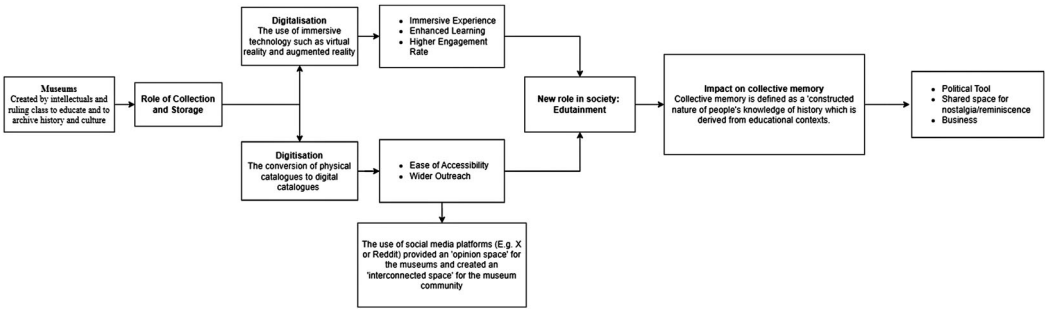

Figure 7. Conceptual framework.

there are errors with hand-written documents because technology is unable to decipher some handwriting (Sporleder, 2010). Secondly, the democratisation of information poses a problem of reliability, authenticity, and credibility.

The evolving part of museums and what museums are in fact preserving poses a question on the role of museums both current and future. The term 'museums' has become unclear due to the evolving nature of museums and it's venturing out to different fields beyond the initial role and scope (Hakamies, 2019; Quinones Vila, 2020).

As museums display artefacts of history, culture, and heritage for education purposes (Arnaboldi & Diaz Lema, 2022; Merriman, 2008; Earle, 2013; Sajarwo et al., 2018), there is a need for narration to let museum visitors be informed of what the artefacts are about (Earle, 2013; Farmaki & Antoniou, 2017; Helmbrecht, 2019; Jordan, 2010).

This systematic review identified clear links between digitalisation and digitisation activities and their effect on memory-making in museums. The influence that digitalisation and digitisation have on certain collective memory and historical/cultural knowledge of individuals are more prominent using virtual reality where the scenario that was virtually presented contributes to a sense of nostalgia (Ch'Ng et al., 2020). The use of digitalisation also promoted accessibility of visitors to museum and cultural heritage content (Choi & Kim, 2021; Hopes, 2014), hence, the outreach of how influential narration portrayed through digitalisation and digitisation can influence collective memory of individuals and different community groups. The above discussion has been categorised into a table (see Appendix 2) and visualised into a conceptual framework (see Figure 7).

This paper holds some limitations. Firstly, the use of only one database (SCOPUS) limits the searching scope to provide more details about digitalisation and digitisation in museums pertaining to the role, relevancy, and memory-making. Secondly, the case studies for museums are mostly based in Europe (n = 34) which could affect the generalisability of this systematic review.

Further studies could include expanding the searching process to other databases, together with other grey literature to get more information. Secondly, a framework assessing what levels of digitalisation and digitisation would be useful. Thirdly, further studies can include assessing the relevancy of physical museum spaces; the use of digitalisation and digitisation in museums have eased the accessibility for museum contents which means that anyone who has access to technology and digital devices are able to access museum contents regardless of location or time. Lastly, further studies can include exploring the extent of digitalisation and digitisation in museums contributing and tackling technological inequality so that museums can be a space of inclusivity and accessible to everyone.

6. Conclusion

Digitalisation and digitisation in museums have been an increasing trend since museums were coined out as a public institution for preserving collections and artefacts for the future and to

serve as an educational medium. The innovative and strategic use of digitalisation and digitisation in museums led to the enhancement of overall museum experiences for visitors. Museums have become an interconnected space where different museum communities from around the world can come together and communicate with each other as a form of learning regardless of location and time; the interconnected space was only made possible through museums utilising digitisation. Despite the effort of museums to stay relevant in contemporary times using digitalisation and digitisation, there have been several challenges; through the systematic review conducted, we shed light on four challenges. First, the expansion of museum collections and purposes has blurred the definition of museums and the role of museums in contemporary age. Second, the use of digitalisation and digitisation has contributed to technological inequality and digital device accessibility. Third, the relevancy of physical space as museums is questioned due to its adapting and relying on digitisation. Fourth, the study of memory and collective memory making in museums and cultural heritage is important due to its relevancy; collective memory is heavily present at almost all museums and cultural heritage sites, with the potential to influence through the narration of past historical stories and memories of individuals, and communities. Digitalisation and digitisation have the potential to influence and impact how memory is formed and shaped in museums, however, more empirical data is needed to understand this phenomenon better. Future studies should consider empirical research on the various stakeholders' perspectives such as museum curators and museum visitors to understand how digitalisation and digitisation in museums impacts memory making. The empirical data can then be used to identify the contributing factors towards technological inequality and digital device accessibility to work towards a solution that creates museums as an inclusive space for everyone.

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Appendices

Appendix 1. Full list of journal publications

Museum Management and Curatorship	6
International Journal of Heritage Studies	3
Media, Culture and Society	3
Archival Science	2
ISPRS	2
Journal of Computing and Cultural Heritage	2
Meditari Accountancy Research	2
Memory Studies	2
Advances in Engineering Education	1
Advances in Experimental Medicine and Biology	1
Archnet-IJAR	1
Australian Academic and Research Libraries	1
British Journal of Educational Technology	1
Changing Societies and Personalities	1
Critical Arts	1
Cultural Trends	1
Culture and Computing. Interactive Cultural Heritage and Arts	1
Current Issues in Tourism	1
Digital Creativity	1
Ethnic and Racial Studies	1
Euro-Mediterranean Conference	1
European Conference on Games Based Learning	1
Ethnologia Fennica	1
European Planning Studies	1
European Romantic Review	1
Financial Accountability and Management	1
History and Memory	1
Heritage	1
IEEE Access	1
Information and Management	1
Interiors: Design, Architecture, Culture	1
International Journal of Entrepreneurial Behaviour and Research	1
International Journal of the Inclusive Museum	1
International Journal of Tourism Research	1
International Journal of Urban and Regional Research	1
Joint International Conference on Serious Games	1
Journal of Arts Management Law and Society	1
Journal of Contemporary European Studies	1
Journal of Cultural Heritage	1
Journal of Heritage Tourism	1
Journal of Maritime Archaeology	1
Journal of Material Culture	1
Journal of Modern Jewish Studies	1
Journal of Museum Education	1
Journal of Open Innovation: Technology Market and Complexity	1
Journal of Peace Research	1
Journal of Social and Political Psychology	1
Linguistics and Language Compass	1
Museum International	1
Nations and Nationalism	1
Popular Communications	1
Problems of Post-Communism	1
Proceedings of the Institutional of Civil Engineers	1
Psychology in Russia: State of the Art	1
Rhetoric Society Quaterly	1
Safundi	1
Santander Art and Culture Law Review	1
Sociological Review	1
Sociology Compass	1
Springer Series on Cultural Computing	1
Sustainable Development	1
Technological Ecosystems for Enhancing Multiculturality	1

The Routledge International Handbook of New Digital Practices in Galleries, Libraries, Archives, Museums and Heritage Sites	1
Theory and Society	1
TQM Journal	1
Vestnik Sankt-Peterburgskogo Universiteta, Prikladnaya Matematika, Informatika, Protsessy Upravleniya	1
Visual Resources	1
Western Journal of Communication	1
Worldwide Hospitality and Tourism Themes	1

Appendix 2. (Theme categorisation)

Theme 1: Memory studies	***Study***
Collective Memory	Stainforth (2022); Combs (2021); Khlevnyuk (2023); Angeli et al. (2021); Kim (2020); Blakkisrud and Kuziev (2019); Wróblewska (2019); Guichard-Marneur (2018); Matsumoto (2017); Ekim et al. (2017); Farmaki and Antoniou (2017); Agius et al. (2016); Sakki (2016); Bar-Tal et al. (2014); Dias and César (2014); Yung et al. (2014); Autry (2013); Robinson (2012); Josias (2011); Krmpotich (2010)
Collective Memory used as a tool in politics	Borges (2017); Farmaki and Antoniou (2017); Sik (2015); Josias (2011); Hidalgo (2009)
Collective Memory used in business	Stainforth (2022); Helmbrecht (2019); Farmaki and Antoniou (2017); Marschall (2013); van Dijck (2011); Hansen-Glucklich (2010)
Extensive Types of Memories	Khlevnyuk (2023); Kim (2020); Helmbrecht (2019); Synenko (2018); Josias (2011); Jordan (2010)
Memory Institutions	Adams and Kopelman (2022); Stainforth (2022); Liew et al. (2014); Marschall (2013); Robinson (2012); Reynolds (2010); Robertson (2009)
Theme 2: Role of Museums	***Study***
Education	Arnaboldi and Diaz Lema (2022); Ayala et al. (2021); García-Martín and Ortega-Mohedano (2020); Simbirtseva et al. (2020); Sajarwo et al. (2018); Earle (2013); Charitonos et al. (2012); Bristow (2010); Merriman (2008)
Edutainment	Fan and Wang (2020); Alony et al. (2020)
Political Role	Stauffer and Horstmann (2021)
Constant Change of Role	Simone et al. (2021); Quinones Vila (2020); Hakamies (2019)
Theme 3: Digitalisation and Digitisation	***Study***
Used as a Tool for Business	Agostino and Costantini (2022); Choi and Kim (2021); Ebbrecht-Hartmann (2021); Jędrzejewski et al. (2020); Tim et al. (2020); Giannini and Bowen (2019); Pesce et al. (2019); Conway (2015); Hopes (2014); Marty (2008)
Internal Management Use	Kamariotou et al. (2021)
Use of VR, AR and AI	Palumbo (2022); Choi and Kim (2021); Fissi et al. (2022); Angeli et al. (2021); Ch'Ng et al. (2020); García-Martín and Ortega-Mohedano (2020); Loaiza Carvajal et al. (2020); Santagati et al. (2017); Hammady et al. (2016); Charitonos et al. (2012)
Conversion of Physical to Digital Catalogues	Schweibenz (2018); Stauffer (2012)
Rush of Digital Transformation due to COVID-19	Choi and Kim (2021); Raimo et al. (2022)
Theme 4: Effects on Museum Visitors	***Study***
Enhanced Learning	Fanea-Ivanovici and Pana (2020); García-Martín and Ortega-Mohedano (2020); Traboulsi et al. (2018); Charitonos et al. (2012)
Increased Engagement Rate	Alatrash et al. (2021); Choi and Kim (2021); Marty (2008)
Feeling of Nostalgia	Ch'Ng et al. (2020)
Increased Accessibility	Choi and Kim (2021); Park et al. (2021); Hopes (2014)
Democratisation of Information	Enhuber (2015); Brown (2008)