Digital memory construction in Lijiang

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Abstract

Purpose – The ancient town of Lijiang is a representative place of ethnic minorities in China's southwest border area jointly built by many ethnic groups. Its rich and diversified history, culture and architecture as well as its artistic and spiritual values need to be better retained and explored.

Design/methodology/approach – The protection and inheritance of Lijiang's cultural heritage will be improved through the construction of digital memory resources. To guide Lijiang's digital memory construction, this study explores strategies of digital memory construction by analyzing four case studies of well-known memory projects from China and America.

Findings – From the case studies analysis, factors of digital memory construction were identified and compared. Factors led to the discussion of strategies for constructing the digital memory of Lijiang within its design, construction and service phases.

Originality/value – The ancient town of Lijiang is a famous historical and cultural city in China, and it is also a representative place of ethnic minorities in the border area jointly built by many ethnic groups. The rich culture should be preserved and digitalized to offer better use for the whole nation.

Keywords Lijiang ancient town, Digital memory, Strategies of digital memory construction in Lijiang, Case study of memory projects in China, Case study of memory projects in America

Paper type Research paper

1. Introduction

The Ancient Town of Lijiang is a special and unique border place located in Yunnan, China. Its total area is 20,600 square kilometers, with a total population of 160,680. It is also a fantastically diverse place which has been inhabited by thirty-nine ethnic groups for generations. Within these groups, the Naxi ethnic group has the largest population, with 94,247 people, accounting for 58.7% of the total population. The second largest is the Han ethnic group, with 33,643 people, accounting for 20.9%. The third largest is the Bai ethnic group, with 22,303 people, accounting for 13.9%. The total number of the above three nationalities is 150,193 people, accounting for 93.5% and constituting the overwhelming majority of the population in Lijiang. The diversity that residents have brought to Lijiang from their splendid cultures has sprouted so that Lijiang has bloomed with distinctive contributions from each group of people. Both the tangible and intangible cultural heritages which reflect the local memory of Lijiang are masterpieces resulting from the creativity and imagination of the local residents' ancestors.

Considering the uniqueness of the Lijiang ancient Town, on December 4, 1997, it was included in the World Cultural Heritage List due to its splendid ethnic culture and its ancient architecture. Additionally, Lijiang is known internationally due to the local use of the Dongba Manuscript which was listed in the World Memory Project in 2003. The Dongba Manuscript is the famous encyclopedia of the ethnic Naxi written in Naxi pictographs which was created by the Dongba who are known as sages among the local ethnic groups; it is used for celebration and worship. As a famous and unique town with valuable history and culture, Lijiang comprises towns, villages, historic cities, historic sites and ethnic minority settlements. The content of its trackable memory has a long time span, rich forms and high variety, reflecting not only China's national culture, social changes, excellent architecture and cultural prosperity but also connotations of national unity, social ethics and ecological civilization. As a part of Chinese historical and cultural heritage, the Ancient Town of Lijiang provides valuable information for academic research in the areas of urban construction, human development, heritage protection, language and character evolution, ethnic religion and many others.

Unfortunately, while the inclusion of the Ancient Town of Lijiang in the World Cultural Heritage List led to a dramatic increase in the number of tourists, it also led to increased commercialization, and a large number of ancient memories there have begun to fade or even disappear. The ecology of the town has been under enormous pressure, leading to its being given a yellow card by UNESCO in 2007. The imbalance between protection and development urgently needs to be reversed from its root cause by establishing methods for its protection, especially through the construction of digital memory. Thus, the research questions that this paper will address are the following: what are the necessary factors of digital memory construction, and how can the strategies which were inspired by those factors be applied to the Ancient Town of Lijiang? Considering the endangerment of the Ancient Town of Lijiang's cultural heritage, the need for this research is great.

2. Literature review
In recent years, theoretical and practical research on cultural heritage, urban memory, and digital memory in China and abroad has been increasingly enthusiastic, and this research has been followed by social memory research and in-depth research on the digital construction of cultural heritage. It is necessary to summarize the previous literature to learn from their academic opinions and useful experiences, as well as to select the most appropriate methodology for this study. Considering the diversity of culture, tradition and architecture of the Ancient Town of Lijiang, this paper's search of previous literature starts with cultural heritage protection.

There have been several key findings which have emerged in literature on cultural heritage protection in China as well as internationally. Since the launch of the World Memory Project and the World Memory Heritage List by UNESCO in 1992, regions around the world have begun to pay attention to cultural heritage protection. In recent years, the improvement of cultural heritage protection technology has also been increasing along with the increased attention on cultural heritage protection. The author searched relevant literature on the China National Knowledge Infrastructure (CNKI) for the themes of "cultural heritage protection," "historical conservation" and "city protection." The results of these searches are described below.

(1) Current academic research on cultural heritage protection mainly focuses on protection models, development paths and development plans. For instance, Huang Peng and others proposed paths for the protection and dissemination of Chinese intangible cultural heritage from the perspectives of knowledge management,

innovation and entrepreneurship, technological revitalization, cultural protection, cultural exchange, and integration of industry and education (Peng, Huirong, Biao, & Jingyu, 2023). Putting theory into practice, the "Digital Dunhuang" project team has conducted comprehensive digital collection, processing and storage of the tangible heritage of the Dunhuang Grottoes and has used internet technology to build the "Digital Dunhuang" resource library, material library and digital scripture collection cave for online visual sharing (Jielin & Xiaoxia, 2020). Additionally, Zhang Zhidong has analyzed and explored the circular economy ideas and ecological values contained in the agricultural cultural heritage of various regions of the Ningxia Hui Autonomous Region located in the Northwest of China, taking into account the historical background of accelerating the construction of a model area for comprehensive rural revitalization in Ningxia (Zhidong, 2023).

(2) From the perspective of historical conservation, many scholars recommend to base planning on the background and initiation of the historical town, as well as applying protection to the town with the full understanding of and respect for its reality. For instance, You Yihui proposed three suggestions for the concept and methods of heritage protection, solving the problems of population displacement and construction funding (Yihui, 2019).

(3) Based on his study of urban spatial structure and case studies of famous city protection, Wang Yifeng proposed the principle of "adjusting the urban layout, maintaining the vitality of the old city, and organically unifying the new and old urban areas." He also proposed a protection method that combines "points," "lines," and "surfaces" according to the spatial form of the protection content (Yifeng, 2018). Some scholars have paid attention to the experience and lessons learned from the development of ancient cities, such as Yuan Yue who proposed the overall ideas, basic principles and specific measures for the protection and construction of Beijing's historical and cultural city (Yue, 2019). Chen Haiyu has also constructed a knowledge graph of folk historical literature to enhance society's understanding and recognition of folk history and culture, and to further the inheritance and promotion of local folk culture (Haiyu, Cong, Yu, Qibing, & Jing, 2022).

(4) Outside of China, foreign scholars have mainly focused on exploring empirical research on the application of technology to protect specific cultural heritage projects. For example, the research achievements of the French National Center for the Protection of Records and Literature in the field of heritage protection, such as "Saving and Protecting Photos, Pictures, Prints and Manuscripts" and "Environment and Protection of Documents, Audiovisual Materials," have practical application value in research on heritage protection technology. Some scholars have studied topics such as multi-channel funding for cultural heritage and comprehensive professional talent development.

Additionally, there is some literature introducing digital memory projects which are good examples to know in China as well as internationally. There are many similarities which can be found within each cultural heritage protection project, the commonalities of which can inspire this study in many ways. The literature below relates to the case study projects of "American Memory," "Chinese Memory," "Florida Memory" and "Beijing Memory." which are analyzed in this paper.

At present, in order to better build digital memory projects in various regions of the world, multiple scholars have analyzed memory project cases, obtained impressive construction experiences and proposed relevant digital strategies. For example, two scholars used

descriptive research methods to elaborate on the current development status of memory practice, classify memory practice, introduce typical cases and point out that the future trend of memory practice is digital memory which has many advantages in transforming social memory into digital content resources (Xiaoshuang & Yongjun, 2019). In a comparative analysis of oral resources in the China and America memory projects, Gao Mian pointed out that "American Memory" collects a variety of resources and has significant advantages in terms of fields and quantities compared to "Chinese Memory." "American Memory" places more emphasis on cooperative collection and social solicitation, and the oral historical metadata description and data management during network platform construction are more mature. Based on the comparative analysis results, Gao Mian further proposed that the construction of China's Memory Engineering and Oral History Resources should expand their themes, strengthen collaborative collection and social solicitation, improve the Memory Engineering website, enrich online oral history resources, develop fundraising strategies, expand funding channels, enrich training types and content, and continuously improve the professional level of staff (Mian, 2020). Additionally, Zhenzhen elaborated on the reasons for the stable and sustainable development of "American Memory" through the study of its characteristics, key technical solutions and quality standards, including cataloging metadata schemes, retrieval assistance tools, text SGML encoding, index retrieval engines and system structures (Zhen, 2001). Furthermore, Wang Miao and Zhu Qingxuan found through their research on the "Florida Memory" resource that it has the characteristics of the multidimensional display, participatory memory construction and emphasis on protecting the copyright of collection resources. Based on this, they proposed relevant suggestions for the information collection mode, digital technology and new media applications, and archive website construction of the "China Memory" project (Miao & Qingxuan, 2019). Li Guannan summarized the significance and characteristics of local literature digitization through the practice of the "Beijing Memory" local literature digitization work, listed the ongoing projects of "Memory Engineering" worldwide, analyzed the current situation of local literature digitization work at home and abroad, reflected on and summarized the general principles of local literature digitization, and proposed local literature digitization strategies (Guannan, 2013). Foreign scholars such as Keitumetse (2009) and Burns (2009) conducted case studies on the need for a broad public awareness of cultural heritage protection, preferential policy support and reasonable harmonious win-win mechanisms.

Scholars in China and abroad have established a foundation for research paradigms on historical preservation, strategies for promoting urban memory and mechanisms for digital memory to participate in cultural heritage protection. Using digital technology as a means to protect cultural heritage projects has become commonplace. Furthermore, research has gradually begun to move toward cross-industry integration of cultural heritage and technology in a multidisciplinary context by case study analysis; however, insufficient attention has been paid to issues related to ethnic groups, poverty and border areas. Compared to other regions, Lijiang's region has more diverse cultural traditions, poorer software and hardware conditions, and a more complex external environment. Its uniqueness and representativeness make previous theories, methods, and measures not necessarily applicable to this type of region. Therefore, constructing digital memory suitable for cultural heritage in such regions through analyzing appropriate cases is a research topic with strong necessity. Building digital memory from both theoretical and practical dimensions is a new issue that needs to be discussed in depth.

3. Methodology
A case study, or case analysis method or typical analysis method, is a scientific analysis method that thoroughly and carefully studies representative things (phenomena) in order to

obtain an overall understanding (Qinzhen, 1999). With these regular understandings, inspiration can be deduced and applied to research. The specific case study steps could be structured with at least five steps as follows: (1) select representative events as the analysis and research objects based on the analysis purpose; (2) collect comprehensive information about the selected object, including both direct and indirect information; (3) systematically organize and collect data; (4) arrange and conduct information summed up from the data according to the required analysis content; and (5) comprehensively study the results of various analysis and explore the regularity of cases.

In recent years, with the Chinese government has vigorously promoted the construction of a "cultural power," and various memory projects and revitalization plans have been widely implemented nationwide. Related research has also increased year by year based on the perspective of digital memory protection, and such in-depth theoretical research on the construction of complex and multi-type cultural heritage memories has been rarely seen before. Considering the un-producibility, diversity, vividness and unique culture of the heritage in Lijiang, this paper selected the case study method as the most appropriate research method in order to summarize the digital construction experiences of four well-known and representative cases from China and the United States. The author will analyze the cases' commonalities and differences to uncover the culminating factors which could serve as guidelines in the Lijiang study.

Since the launch of the World Memory Project by UNESCO in 1992, more and more countries and regions have implemented various memory projects. According to the content and scope of memory protection and inheritance, memory projects can be divided into two categories. The first is a national memory project that focuses on a country and includes memory resources related to its history and the evolution of its civilization. The other is an urban memory project that focuses on regions or cities and includes memory resources focusing on local characteristics and history.

The memory of the Ancient Town of Lijiang not only has local cultural characteristics but is also an important part of Chinese history. With a thousand years of cultural heritage history, it is a source of spiritual power and cultural support for building a modern socialist country. This article selected representative national memory projects and urban memory projects for case analysis, described below in Table 1, with the "American Memory" Project and the "Chinese Memory" Project as representatives of national memory projects and the "Florida Memory" Project and the "Beijing Memory" Project as representatives of urban memory projects.

The author chose these four projects in China and America as the study cases for the following three reasons: (1) The contents of the four cases could be found and studied in previous literature and would serve as good sources for the study; (2) The four cases have been occurring in the long term and may still be in progress, and changes have been made during their life-cycles which led to the accumulation of many experiences; and (3) The two national cases will serve as proper representatives on behalf of an ancient country and a young country, while the two regional cases can be studied as examples of an ancient imperial city with traditional culture and sophisticated architecture and a famous tourist destination with diverse culture and entertainment industries. These four cases each possess several characteristics of cultural heritage simultaneously. The author believes the diversification and socialization of the national memory projects can provide new and leading ideas for the construction of digital memory in the Ancient Town of Lijiang with an international perspective, while the characteristics and standardization of the urban memory projects can provide practical guiding ideas for the construction of digital memory in the Ancient Town of Lijiang to form a memory project with distinctive local characteristics.

Project name	Project location	Project content Host unit	Content	Project time
American Memory (National Project) https://www.loc.gov/collections/ https://memory.loc.gov/ammem/about/index.html	The United States	The Library of Congress	"American Memory is a gateway to the Library of Congress's vast resources of digitized American historical materials. Comprising more than 9 million items that document U.S. history and culture, American Memory is organized into more than 100 thematic collections based on their original format, their subject matter, or who first created, assembled, or donated them to the Library."	1990-Present
Chinese Memory (National Project) http://memory.nlc.cn/index/index.html	China	The National Library	The China Memory Project is a document construction and service project of the National Library, which focuses on the traditional cultural heritage of China, major contemporary events and important figures, and relies on the traditional literature system to systematically and rescue the construction of new types of literature such as oral historical materials and image materials, ultimately forming a distinctive thematic resource system. It is an important component of the National Library and is the collection, organization and service of library resources The new expansion of social education and cultural dissemination functions. The achievements of the China Memory Project are provided to readers through borrowing and website publishing, and are displayed and disseminated in the form of "China Memory Series", exhibitions, lectures, documentaries, etc., providing comprehensive services to society	2012-Present
Florida Memory (Regional project) https://www.floridamemory.com/learn/about/	The United States	The State Library and Archives of Florida	"The mission of the Florida Memory Program is to provide free online access to select archival resources from the collections of the State Library and Archives of Florida. Florida Memory chooses materials for digitization that illuminate significant events and individuals in the state's history, and help educate Floridians and millions of other people around the world about Florida history and culture."	2000-Present

Table 1.
The four Memory Projects from China and the United States

(*continued*)

Project name	Project location	Project content Host unit	Content	Project time
Beijing Memory (Regional project) https://bjmemory.clcn. net.cn/#/	China	The Capital Library	"Beijing Memory" belongs to the Capital Library and is a Beijing historical and cultural resource website based on nearly a century of collection. Construction began in 2003 and was opened to the public in 2007. The website includes documentation, books and classics, inscriptions on ancient bronzes and stone tablets, maps, newspaper and more, which protects Beijing's cultural heritage through applicable technological means, making it accessible to the international public and raising awareness of local cultural heritage, especially those with global significance	2003-Present

Source(s): Table by authors

Table 1.

4. Results

The research was conducted to summarize the construction experiences of the four memory projects by searching and collecting specific information from their official websites and literature databases. Each project contains many specific tasks over its lifespan. Arranging and dividing the projects into distinct sections is necessary to study the projects; therefore, the lifespan of the projects is viewed chronologically in three phases: Design Phase, Implementation Phase and Service Phase. Based on the identification of activities during these three phases, the commonalities and differences of the four cases were comprehensively analyzed. Then, a follow-up analysis was conducted to discover culminating factors in digital memory construction which would inform the digital memory construction of Lijiang by highlighting which factors are most important for its digital memory construction.

4.1 Commonalities

The author analyzed the four memory projects described in the methodology above to uncover the following common factors in construction, as shown in Table 2.

Common factors	Content and characteristics	Specific phases
Content	National history and culture, folk life culture, traditional cultural heritage, major national events, important representatives, oral history and urban construction	Implementation phase
Resource types	Literature, photos, audio, videos, manuscripts, books, maps and newspapers	Implementation phase
Technology	Metadata design, retrieval system design, digital scanning technology and online Memory Engineering website	Implementation phase
Access	Physical collection, digital collection and oral interviews	Service phase
Maintenance	Technical supports, daily backups, etc.	Implementation phase

Source(s): Table by authors

Table 2.
Common factors in
Memory Project
Construction in China
and America

From Table 2 above, the main points can be summarized as follows.

4.1.1 Content. The four memory projects are constructed based on plentiful contents, which were collected during the construction phase of the whole project and include various digital resources on themes such as folk culture, geographical environment, major historical events, famous celebrities, traditional architecture, oral history and others. For instance, the resources of "Florida Memory" make available for research the records of the state of Florida, as well as private manuscripts, local government records, photographs and other materials that complement official state records. Similarly, the "Beijing Memory" project presents a multidimensional panorama of Beijing culture through a thematic outline structure with diverse contents such as palace gardens, temples, alleys and mansions, ancient books and paintings, human stories, festival etiquette and more. The more ample the collective resources are, the better services the projects can offer.

4.1.2 Resource types. The memory of any country is diverse and multidimensional, requiring the construction of different types of resources together. Although the content covered by each memory project varies, most of the resource collection sources are literature, photos, audio, videos, manuscripts, books, maps and newspapers. These resources are directly provided by relevant departments such as local archives and libraries or voluntarily donated by residents, and the diversification of resource collection not only helps to enrich the national cultural system and national memory but also enables people to deeply and directly experience local culture in various ways. With clear planning of each memory project, the collected literature resources are then screened and classified. For instance, "American Memory" divided its collections into different classes such as Chronicling America, Farm Security Information, Cities and Towns, Civil War Maps and Country Studies. Each class includes diverse types of information. Similarly, "Chinese Memory" organizes and collects information carriers such as manuscripts, letters, photos and physical objects, and forms a collection of thematic literature resources with multiple carriers and types to provide services to the public through forms such as library borrowing, online browsing, multimedia exhibitions and special lectures. The selected resources should meet national digital standards, laying a sustainable foundation for the construction of subsequent digital memory platforms.

4.1.3 Technology. For various types of cultural heritage resources, updated technical research and development work should be done to meet modern needs. The four memory projects have searched for the most suitable digital means and methods; issued a series of digital standards on collecting, organizing and constructing online resources; transferred their memory contents into complete and systematic digital cultural resource databases; and offered various literature resources free to the public. For example, the Florida Archives has established norms and standards for digitizing collected photos, recordings, videos and other resources in digital scanning work and only accepts TIFF, JPEG and digital negative (DNG) image file formats; files without a size of two million or higher pixels will be excluded from "Florida Memory." The Library of Congress of the United States has issued technical standards such as the "Coding Archive Description Standard" and the "Outline of Library of Congress Image Quality Standards Based on Document Types and Expected Results" to regulate the digital resources which might enter the digital library. From this, it can be seen that in the construction and implementation process of memory projects, rigorous technical research and development work can be a guarantee to create a secure environment to preserve memories, as well as to offer better services which meet the various needs of users.

4.1.4 Access. The four memory projects have achieved similar results in the development and utilization of cultural resources, all involving both traditional and modern access to experiences. Each resource website has search channels, allowing users to quickly obtain and browse the desired information based on keyword searches. For instance, the collections of "American Memory" and "Florida Memory" adopt cooperative collection and social collection

methods, such as the oral history collection work in "American Memory" in which the public is encouraged to participate in oral history interviews or submit works to the platform, and then staff reviews and incorporates submissions into the collection. The "Florida Memory" project not only allows the sharing of personal stories, where people can identify photos and tell the stories behind them, but also provides digital guides that teach users how to use digital technology to protect personal or family files. The "Beijing Memory" project has also released a method for collecting archives, which facilitates users to upload privately saved archive resources.

4.1.5 Maintenance. From the analysis of the above cases, it can be seen that in addition to the construction preparation and implementation methods, the four memory projects have also done a good job in maintaining their resource databases after construction, updating resources on the digital platform in a timely and effective manner, and taking into consideration the real-world situation to continuously expand and advance in response to the development of new technologies. Each memory project team has introduced relevant development plans and technical measures to protect and maintain the resource databases they have built. For example, the "Chinese Memory" and "Beijing Memory" projects both proposed plans on how to effectively maintain and develop memory projects. While strengthening the long-term preservation of digital resources, they actively cooperate with social institutions to continuously expand the literature resources of the resource databases. The databases of the "American Memory" and "Florida Memory" projects are also protected and maintained through continuous updates of technical standards, cloud storage and government department backups to ensure their long-term operation.

4.2 Differences
In addition to studying the four memory projects' similarities, the unique characteristics of each are also of note. Table 3 below provides factors in differences between the four memory projects.

4.2.1 Host unit. Each memory project carried out resource construction work in a collaborative manner with local libraries, archives or other organizations. However, most implementation must be organized and carried out by a host unit which is in charge of the whole process from determining the resources and types of memory to clarifying the content and managing the work. The host units vary according to the orientation and characteristics of each project. For instance, the "American Memory" project was created to represent the culture of the whole nation, setting the country as its integral object, so the collections from the National Library or archives can serve as the official reflection of the various cultural memory resources related to the evolution of the country's civilization and the development of the nation. Therefore, the Library of Congress is the responsible unit of the "American Memory" project. Similarly, the "Beijing Memory" project conducted by the capital library of

Different factors	Content and characteristics	Specific phases
Host unit	National Library, Local Library, Archives, etc.	Design phase
Funding	Government, Corporate, Charitable Organization, etc.	Design phase
Construction planning	Integral Unit and Staged Unit	Design phase
Formation	Separate Existence and Subordinate Existence	Design phase
Public accessibility	Disabled-Friendly and Ordinary Accessibility	Service phase
Propagation mode	Active Propagation and Passive Propagation	Service phase
Source(s): Table by authors		

China has been launched as a pilot project, to show how a local library can give the public a social service experience with a professional background and technology.

4.2.2 Funding. The whole process of the memory projects' implementation are huge programs which require many conditions, funding being the most vital condition of all. No matter the kind of memory project, representing a national or local image, sustainable funding is not enough if only appropriated by the central government, and better and more funding channels are required. For instance, the "Chinese Memory" project is affiliated with the National Library, with its policy and institutional support, and has established the National Library Foundation to coordinate, receive, and manage social donations, providing support and services for the project's progress.

4.2.3 Construction planning. The initiation time of each project depended on the varied historical and cultural heritage of each country and region, as well as the varied themes and content of resources. Considering the diverse and multidimensional units as well as the funding and technological conditions of each memory project, it is more practical and reasonable to have different construction planning based on reality before implementation (Mian, 2020). For instance, the "American Memory" project has been divided into at least three stages such as "The American Memory Test Project" as its first stage from 1990 to 1994, "The Digital Library Program in the United States" as its second stage from 1995 to 2000, and "Digital Future Initiative" as its third stage from 2001 to 2004 with each stage having a main theme with a different work focus. The "Chinese Memory" project began conceptualization and planning in March 2011, after preliminary research and design, with the National Library designating it as a key project in 2012 and recommending it to enter the experimental stage according to the theme classification without further defining its time period.

4.2.4 Formation. The four projects' different host units have led to their distinctive expressions reflected on their accessible websites. The different display formations of each project originated from their official and administrative ownership. For instance, the "American Memory" project belongs to the Library of Congress, and its visual resources can be found as a subordinate website inside the collections of the official Library of Congress website without any independent terminal. The "Beijing Memory" project belongs to the capital library of China, and its separate website and linked databases can be easily searched online without any extra login or registration, which increases the speed of information dissemination.

4.2.5 Public accessibility. No matter the kind of memory project, their purpose in offering a cultural service is always the same. However, it is obvious that each has their own cultural needs, and their preparation needed to offer different services to different people based on the same resources. For instance, able-bodied people are not the only target audience for the projects; disabled people are part of their target audience. Compared with on-site exhibitions with accessible-friendly circumstances, an online service could be more accessible for some. An example of this is that the contents in "American Memory" have been uploaded with two versions of information, one for non-visually impaired users to read, and another for visually impaired users to listen to. The author believes more trials will be done with thoughtful accessibility so that different groups have equal access.

4.2.6 Propagation mode. Cultural organizations such as libraries, museums or archives have the natural capability of serving the public. Recently, the propagation methods of these services have become more reliable with digital technology and digital modernization; however, traditional on-site education and communication should not be neglected. For instance, seldom offered in a modern visual online exhibition, the "Chinese Memory" project collected new types of sources such as oral and visual historical materials; acquired information carriers and carried out resource construction for more than 20 topics; and compiled resources to the public through active ways with various forms such as

publications, lectures, feature films and experiential activities. The author believes both active and passive propagation has its advantages, although given the popularity of digitalization in recent times, it is brave to insist on traditional means of propagation which would be to actively pass on information to the public.

4.3 Culminating factors in memory project construction
Each of the four memory projects has similar commonalities and unique differences. Table 4 below brings these together to develop recommendations in regularity and inspiration for the construction of Lijiang's digital memory. Generally, memory project construction worldwide can be implemented in chronological order; thus, the following findings show the ratio of commonalities and differences in each memory project construction phase.

4.3.1 Common factors concentrated in the construction phase. Four out of the five common factors above were concentrated in the construction phase, revealing that all the work inside this phase has been standardized and routinized already. No matter the kind of memory project, the content, type, technology and maintenance experiences could be shared. As for the digital memory construction in Lijiang, the specific references during the construction phase would be applied to practice as a template.

4.3.2 Wide distribution of factors in the design and service phases. All of the factors in the design phase belong to the differences category as well as three of the four factors in the service phase. This shows that work in these two phases is quite changeable and elastic. It would be worthwhile to explore these differences further and to bond the differences between the cases and the real conditions of the Lijiang project together for the development and practice of reasonable construction strategies.

4.3.3 Design and service phase strategies. Based on the above findings, strategies for the construction of digital memory for Lijiang should be concentrated in the design and services phases, ensuring that factors such as planning, host units, funding, formation, content, access and propagation are key discussion points.

5. Discussion
The factors which have been analyzed above are the most essential elements for the digital memory construction of Lijiang, necessary for avoiding detours during digital memory construction. Considering the real situation in Lijiang, reasonable and practical strategies can be developed by analyzing these facts.

Factors mentioned	Commonalities/Differences		Specific phases
Host unit	☐ Commonalities	☑ Differences	Design Phase
Funding	☐ Commonalities	☑ Differences	(Differences > Commonalities)
Construction planning	☐ Commonalities	☑ Differences	
Content	☑ Commonalities	☐ Differences	Construction Phase
Resources type	☑ Commonalities	☐ Differences	(Differences < Commonalities)
Technology	☑ Commonalities	☐ Differences	
Maintenance	☑ Commonalities	☐ Differences	
Formation	☐ Commonalities	☑ Differences	Service Phase
Public accessibility	☐ Commonalities	☑ Differences	(Differences > Commonalities)
Propagation mode	☐ Commonalities	☑ Differences	
Access	☑ Commonalities	☐ Differences	
Source(s): Table by authors			

Table 4.
Culminating factors in
Memory Project
Construction in China
and American

5.1 Essential factors of digital memory construction in Lijiang

The commonalities and differences classified within the four cases above can be reflected and shown by more studies in the related academic fields and through practical work. Table 5 below summarizes the essential factors' principles and the inspiration from each that will be applied to the Lijiang study.

The principles of digital memory construction and inspirations for the Lijiang study can be summarized and extracted from the eleven essential factors in the table above, and the table can be interpreted from left to right as follows:

(1) The host units should be established before the project's implementation. As for the digital memory construction in Lijiang, the author recommends the use of one host unit with multiple participants which represents the local library or archives as the host unit due to their professional background and ample collections, alongside the support from other participants such as local cultural institutes, research organizations, museums and others.

(2) The funding should be diversified and sustainable. In the Lijiang study, most of the well-known memory resources have been collected and kept in official departments. Considering the present funding channels of public repositories, it might be better for funding to be raised mainly by the government. However, in addition to this, the funding pool should be expanded widely by using various channels such as local corporations, charitable organizations and other non-government institutes.

(3) The construction planning should be pre-organized in order to solve actual problems or barricades. In the Lijiang study, the author suggests the whole project could be divided into at least three stages: short-term, mid-term and long-term in accordance with the reality of the Lijiang situation such as various collections being scattered across many different repositories. The exact implementation of the three terms will be discussed in the following sections.

(4) The content of collections should be abundant including mostly all relevant materials such as spiritual, architectural, managerial and tribal chief documents as

Specific phases	Essential factors	Principles from cases	Inspirations to Lijiang study
Design phase	Host unit	Should be established	One host unit with multiple participants
	Funding	Should be diversified	Official-oriented with civil supports
	Construction planning	Should be pre-planned	Divided into short and long term
Implementation phase	Content	Should be abundant	Included with tangible and intangible contents
	Resources type	Should be thorough	Consisting of traditional and modern types
	Technology	Should be creative and standardized	Sustained by new techniques with general standards
	Maintenance	Should be updated	Managed routinely with feedback
Service phase	Formation	Should be cleared	Independent existence to access
	Public accessibility	Should be varied	Services for different users
	Propagation mode	Should be multi-formed	With active propagation
	Access	Should be flexible	With online and offline ways

Table 5.
Essential factors of digital memory construction in Lijiang

Source(s): Table by authors

well as others. As for the Lijiang study, both the ancient town and its aged manuscripts have been listed in the World Heritage List already, and the relevant heritages represented in the ancient town's memory are huge. It is integral and necessary to make reasonable classifications based on scientific standards, such as intangible and tangible contents.

(5) The resource types should be varied and plentiful, with paper information carriers as important as modern information carriers such as audiovisual or digital types. In the Lijiang study, the diversity of resource types would be decided by the contents' quantity. The larger the contents are, the richer the types will be.

(6) The technology used to build the digital memory should be creative and cutting-edge under the general standards. For the Lijiang study, the contents and resource types mentioned above would form a decisive basis for selecting specific technology. Additionally, the general standards can be structured in terms of the technology.

(7) Maintenance plays an important role in the construction, considering that digital access has been the main channel for offering cultural services to the public, the channel needs updating and maintaining to be in a reliable condition. Feedback could be responded to much swifter and the connection between the service and the public could be much easier. For the Lijiang study, a routine maintenance mechanism and timely feedback system should be established in order to serve the public better.

(8) The formation could be varied, such as separated or subordinate existence, and each formation has its own advantage. In the Lijiang study, considering users' various educational backgrounds, independent existence without belonging to any organization may be better and more balanced for its sustainable development according to the one host unit with multiple participants principle.

(9) Public accessibility should meet different groups' actual needs, and it is necessary to understand their various requirements. In the Lijiang study, the ample contents and diverse types of resources offer the public more chances to experience this ancient town with unique perspectives. Lijiang's memory could be narrated in innumerable ways. In order to make different narrations of Lijiang's memory clear and logical, an understanding of different users should be gained.

(10) The propagation mode and access could be modeled in both traditional and modern ways. Generally, most of the cases prefer to propagate their information through technological support, which has made on-site activities rarely utilized. For the Lijiang study, the author recommends that access to both online activities and on-site activities be similar. The online activities such as accessible databases and visual exhibitions for the public around the world will be based on Lijiang's world heritage status, and the on-site activities such as lectures and public displays for tourists from everywhere will be based on its renown for tourism.

5.2 Conceptual design and practical application of digital memory in Lijiang
This section reveals the situation and status of digital memory construction in Lijiang through its conceptual design and practical application. Based on the experiences extracted from the four case studies, and considering Lijiang's conceptual design and practical application, the strategies for Lijiang's digital memory construction are explored below.

5.2.1 Conceptual design of digital memory in Lijiang. Since the essential factors which would play a fundamental role in construction have been analyzed above, before discussing

the practice of construction for the Lijiang project, the concept of digital memory in Lijiang should be provided prior to the rest of the discussion.

The digital memory of Lijiang is unique to the Chinese nation, reflecting local customs, national culture, ancient city buildings, social changes and other related historical cultures. Based on geographical analysis, this paper considers Lijiang as being composed of Dayan Town (including Black Dragon Pond), Baisha Residential Complex and Shuhe Residential Complex. The digital memory of Lijiang can be divided into tangible memory and intangible memory according to the type of memory resource. Lijiang's intangible memory is inherited in the form of conventions, referring to folk culture passed on orally and in psychology and behavior, including spiritual culture, social norms of the ancient city, folk beliefs, folk art, traditional techniques, and language and writing. Lijiang's tangible memory has a large number of historical archives as records, including ancient city architecture such as celebrity residences and Mu's Mansion, as well as the natural environment and other tangible resources.

This paper discusses Lijiang's digital memory based on the above division between intangible and tangible culture, as shown in Figure 1 below, created by the author for this study. On the one hand, the content of digital memory in Lijiang is extremely rich, and intangible memory has penetrated into all aspects of the life of the ancient city. At the same time, intangible memory relies on tangible carriers for its inheritance and development. Therefore, a digital memory resource database established with both tangible and intangible divisions can promote cultural communication with the public. The combination of the direct perception of intangible memory and the verbal persuasion of tangible memory can help people feel the history and culture of Lijiang more deeply.

5.2.2 Practical application of digital memory construction in Lijiang. In the real-world practice of Lijiang's digital memory construction, the preservation of the ancient building complex and streets should be the highest priority of all, as their iconic cultural heritage is the most indispensable component of protection has not been given sufficient attention. What
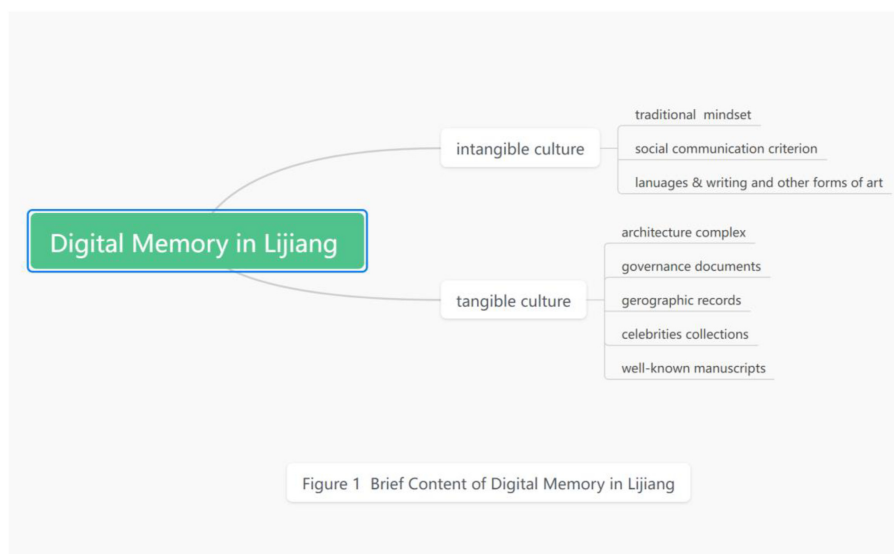

Figure 1 Brief Content of Digital Memory in Lijiang

Figure 1.
Brief content of Digital Memory in Lijiang

Source(s): Figure by authors

subjects should be involved in digital memory construction have not been studied or discussed yet, as well as how to collect resources or how to support the education of professional talents. The following descriptions provide the realities of memory construction practice in Lijiang:

1. The subjects involved in memory construction are enormous with different numerical standards.

At present, the construction of digital memory in Lijiang is slow, with several competent departments working independently as well as separately. The Dongba Cultural Research Institute has digitized 29 volumes of Dongba manuscripts, filmed a Dongba religious ceremony, and some staff members have recited and recorded the Dongba manuscripts in the museum. The Yulong County Library has digitally scanned the existing 4,010 volumes of Dongba manuscripts in the library and built a Dongba manuscripts database. The Lijiang Conservation Administration Bureau has used multimedia digital visualization technology to display the history and culture of the town, recreating the cultural courtyard of the whole town through 3D data restoration technology, and has additionally used digital modeling technology to display the panorama of ancient buildings as well as establishing an online digital museum. The author learned through on-site investigation that there is no main department of digital memory construction in Lijiang. Although various departments have gradually carried out digital work, at this time there is no centralized and unified competent department, and the implementation standards and directions of each unit are different.

2. The collection channels for memory resources are few with incomplete cultural content.

The collection of memory resources in Lijiang mainly focuses on patriotism, model reconstruction of ancient buildings, scanning of Dongba manuscripts and audiovisual recordings. Memory resource collection comes from the official collection and preservation of Dongba manuscripts, photos and the descendants of Dongba culture. The content of memory resources is not complete and systematic, and only the tangible memory of Lijiang is collected and displayed, lacking the cultural content of overall memory. In addition, most of the current memory construction work is carried out independently by different units, and there are few ways for the public to contribute resources. The public's contribution mainly manifests in the recording of Dongba religious ceremonies and the collection of Dongba manuscripts, which are mostly obtained through purchase, and the sustainability of the collection is poor.

3. The professional talents in this field are rare with insufficient technology development.

The construction of memory resources in Lijiang is mainly focused on protection and development through scanning, exhibition, and audio and video recording, not to mention the in-depth excavation and protection of Lijiang's culture. Through the on-site survey, the author learned that after scanning 4,010 Dongba volumes, the Yulong County Library still needs to establish a database for their development and utilization. A management team composed of three people was selected according to the actual requirements for building this database. However, due to a lack of technical expertise and Dongba language talents, it is difficult to smoothly translate the original documents. Thus, the creation of the database and interpretation of manuscripts has been lagging behind. It can be seen that the construction of the digital memory of Lijiang not only needs the support of financial policies but also needs to form a professional talent team.

5.3 Digital memory construction strategies
Based on the analysis of the four case studies and the conceptual design and practice of digital memory construction in Lijiang, the following strategies can be applied to Lijiang.

5.3.1 One host unit with multiple participants. Based on the conceptual design and practical application of digital memory construction in Lijiang and the four case studies, the author believes that the idea of one core with multiple participants should be adopted in Lijiang, with the Lijiang Library or Museum as the core responsible unit in charge of the whole construction alongside other official units such as other culture bureaus, museums, research institutes and cultural heritage protection centers working together as participants. The core responsible unit and multiple participating units will jointly formulate the digital memory construction plan and digital standards of memory in Lijiang. This method is beneficial for the participating units, who will play an active role in planning and designing, for a more conducive, decisive and efficient digital memory construction. Additionally, the use of one core with multiple participants will not only broaden the funding channel but will also construct the plan with more professional perspectives which will bring a more stable start to the whole project.

5.3.2 Resource integration. The digital memory of Lijiang mainly includes the historical culture which reflects local conditions and customs, national culture, ancient city buildings, social changes and other aspects of culture. This project is an urban memory project with distinctive ethnic characteristics. Unfortunately, at this time the cultural resources of the ancient town are scattered. After investigation, it was found that most of the archival literature resources and other folk cultural relics in the ancient town are preserved in the Lijiang Museum, Lijiang Library, Yulong County Library, Naxi Dongba Ancient Literature Museum, Lijiang Archives and other institutions. Therefore, it is necessary and crucial to integrate all these memory resources in a digital way, which will be reflected in the following two aspects:

(1) Maintain a complete and comprehensive collection of the memory resources of Lijiang and restore their original appearance with digital technology. The purpose of the memory project construction is to reproduce the pure memory of the ancient town and preserve the historical literature heritage of China for a long time. Therefore, the integration of resources will remerge the scattered memory resources as well as restore the original appearance of Lijiang, protecting the integrity of Lijiang's memory to the greatest extent possible.

(2) The ample contents and diverse types of this digital memory project should be reflected and propagated by a series of solid and stable databases with different themes. The construction of the databases will be based on the step of integrating the resources. The higher the level of resource integration, the richer the database construction. In addition, the results of resource integration not only offer more approaches to serving the public such as publishing a series of compilations or holding various exhibitions, but also can build the reputation to circulate cultural heritage protection projects scientifically.

5.3.3 Multiple cooperation. During the construction of digital memory in Lijiang, socialized cooperation should be used and the participants in cooperation should be broadened. This will mainly impact resource sharing and target the quality of service, such as cultural publishing, art curation and others. Cooperation among departments should be formed through legal agreements. While strengthening the cooperation between official institutions and various social organizations, we should also encourage the public to participate more actively in sharing their memory resources. This will enrich the digital memory of Lijiang through multiple cooperation and also increase ways to propagate the information to the public, increasing access to all.

5.3.4 General technologies application. Based on the analysis of the four case studies, the digital memory of Lijiang should be integrated with advanced technologies including

metadata, data association, AI, blockchain, virtual reality and others. These technologies should be applied together within one platform to exist sustainably with the following four steps: (1) Build a digital memory platform with appropriate technologies. The digital platform of Lijiang memory shall comply with international general standards and will select a metadata framework and system that is the most qualified and suitable for the long-term protection of digital memory in Lijiang. Professional staff will conduct trials to conform to domestic and international internet operating environments before officially launching; (2) The relevant systems and standardized storage standards should be formulated by the core units. The core units and cooperating participant units will jointly develop unified digital standards, screen digital resources according to the standards, and prepare for long-term preservation; (3) The service awareness of staff will be improved to serve users in different ways. This will be done especially in accordance with the concept of openness, which is not only providing free and open access but also providing appropriate channels to meet the requirements of the public. The staff will respond to and answer questions about the platform in a timely manner on the platform, especially through the platform's hotline; and (4) The back-end of the platform should be run by a technologically savvy team. If the platform encounters a network interruption or data damage and disappearance, the back-end team will repair and process issues to restore operations as soon as possible and maintain normal operations of the platform.

5.3.5 Sustainable maintenance. In order to effectively operate and maintain the digital memory resource database of Lijiang's digital memory for a long time, relevant maintenance measures should be developed during the construction of the memory project to ensure the smooth implementation of subsequent tasks, such as database resource updates. In the maintenance of digital memory, the core units will establish an operating group to do this routine work. At the same time, cooperating participant units should improve the security mechanisms for the construction of the memory project and issue relevant policy documents. This will not only be conducive to the coordination of the Lijiang digital memory platform and the secure protection of local culture but will also assist with increasing funding support from public donations to create a positive environment and achieve the goal of long-term preservation of local memory and national cultural heritage.

5.3.6 Talent team cultivation. The talent team of digital memory construction in Lijiang mainly includes professionals in digital technology, philology, archival science, ethnology, journalism and communication, and linguistics. In addition to the collection, organization, identification and management of resources, the construction of digital memory also includes data development, oral history collection, minority history research, text translation and other activities. All relevant units should strengthen the professional development of staff, as well as cooperate with universities to cultivate relevant talents which will improve the identification and research abilities of archival personnel for ethnic minority archives and the quality of oral history collection as well as strengthen the understanding of digital technology archival skills. For the sustainable development of professional talents, the local government should introduce a series of talent reward plans for the establishment of specialized teams.

6. Conclusion

This paper analyzed four digital memory projects in China and the United States to explore their digital memory construction experiences. These experiences should be applied to the digital memory of Lijiang, taking into consideration the real-world situation in Lijiang through the conceptual design and practical applications related to its digital memory. The discussion in this study suggests feasible strategies for Lijiang to launch a pilot project on its digital memory construction and start short-term planning for the project with relatively low risk and low cost. Through the summarized practices and experiences which have led to these

suggested strategies, this study is significant as it sets a reasonable example for other cultural heritage digital memory construction. This study will enrich and innovate the research on digital cultural memory, filling a literature gap on the theory and practice of digital memory construction for ethnic cultural heritage, as well as improving the inheritance of traditional Chinese culture and serving as a reference for the development of China's cultural digitalization.

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