

Construction of Digital Inheritance System of Traditional Villages in Kangba Area, Sichuan Province China

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Abstract: Digital is used in traditional villages to protect and pass on village culture in a long-term and effective way. The traditional villages in Kangba region have distinctive national characteristics, unique historical and cultural and scientific and artistic values. This paper uses digitalization to inherit the traditional villages in the Kamba region, and builds out a digital inheritance system for the traditional villages in the Kamba region, which contains data collection and integration methods, data sharing system, and provides professional technical methods for it to achieve the purpose of long-term protection of the traditional villages and innovation of cultural inheritance.

Keywords: Kamba Region; Traditional Villages; Digital Heritage; Inheritance System

1. Introduction

As an important part of the protection and development of historical and cultural heritage, the protection and sustainable development of traditional villages has become an important issue at present. Traditional villages (formerly known as "ancient villages") are villages with high historical, cultural, scientific, artistic, social and economic value, and have a very rich bearing of tangible and intangible cultural heritage. It has retained a large historical evolution, that is, the architectural environment, architectural style, and village location have not changed significantly, and it has unique folk customs, although it has experienced a long time, but it is still a village that serves people. It has a valuable historical memory, which is not only the source and foundation of the traditional culture of the Chinese nation, but also an important carrier for rural revitalization and sustainable development of old revolutionary areas [1].

The Kham region was once the birthplace of Gesar, the protagonist of the heroic epic "Gesar", and is a multi-ethnic area dominated by Tibetans. In the geographical concept of Tibetan tradition in China, it is customary to divide the entire Tibetan residential area into three parts, namely "Weizang", "Amdo" and "Kang (Ba)", and the "Kang" area is called "Kham Pa area" or "Kham Tibetan area". According to Qing Dynasty documents and traditional customs, 'Kang' generally refers to the southeastern region of the Qinghai-Tibet Plateau east of the Lugongla Mountains, west of the Dadu River, south of the Bayan Kara Mountains, and north of the Gaoligong Mountains, which includes Kardze Prefecture in present-day Sichuan Province, parts of Aba Prefecture and Liangshan Prefecture, Qamdo Prefecture in Tibet, Yushu Prefecture in Qinghai Province and Diqing Prefecture in Yunnan Province". Taken together, these areas are what is today called the Kham or Kham Tibet region, or the Xikang region. The Tibetans living in these areas are the "Kangbas". In the process of Sichuan's long-term historical development, Ganzi Tibetan Autonomous Prefecture has become the main body of "Kangba", located in the west of Sichuan Province, on the southeast edge of the Qinghai-Tibet Plateau, connecting Aba and Ya'an in Sichuan to the east, and Liangshan in Sichuan and Diqing in Yunnan in the south. It is bordered by the Jinsha River and Qamdo in Tibet in the west, and Aba in Sichuan, Yushu and Guoluo in Qinghai in the north. Adjacent. With a total area of 153,000 square kilometers, the prefecture belongs to the transition zone between the Sichuan Basin and the Yunnan-Guizhou Plateau, with the characteristics of high terrain, high north and low south, central protrusion, deep cut southeast edge, parallel mountains and rivers, modern glacial development, and significant regional differences. It is the political center and

cultural birthplace of the Kham region, also commonly known as Kham or Kham District, and is an important part of the second largest Tibetan area in China. It has always been regarded as the "support for governing Tibet", and it has always been said that "governing Tibet must first be healthy"[2]. All ethnic groups here have lived together and influenced each other for a long time, forming the characteristics of multicultural coexistence with Tibetan culture as the main body. Due to the different regional environment, customs and religious beliefs of various ethnic groups, ethnic cultures and residential cultures with their own characteristics have been formed.

This paper takes the Tibetan traditional villages listed in the national list of traditional villages in Ganzi Tibetan Autonomous Prefecture, a typical representative region in the Kangba area. In Kardze Prefecture, a traditional Tibetan village listed in the National List of Traditional Villages was the object of study. Up to now, of the 333 state-level traditional villages in Sichuan, Ganzi Prefecture accounts for 71, ranking first in the province. Of the 1,050 provincial-level traditional villages in Sichuan, 214 are in Kardze Prefecture, accounting for more than 20%. On the whole, the regional cultural color and ethnic characteristics of the Ganzi area are rich and the pattern is complete, forming a relatively complete cultural area, with traditional literature, folk handicrafts, snow mountains and seas, etc., including: Gesar Cultural Area, Jiarong Cultural Area, Central Shangri-La Cultural Area; Traditional villages have a variety of architectural types and are scarce in the world, including Kangba "Bangkong", Jiarong "Qionglong" and Liangzhu Frame are the three major building types of traditional villages in Kardze Prefecture, known as the Danba Ancient Diaoyu Group, Daofu Residence, and Township White Tibetan House known as the "Three Exceptions" of plateau traditional architecture. Danba Zangzhai Diaolou is also a national key cultural relic protection unit and a world cultural heritage list of China.

The lack of infrastructure construction, the low level of institutional guarantee, and the lack of people's awareness of protection have led to the loss of economic functions and labor losses in traditional villages, showing a trend of decay. In 2020, Kardze Prefecture earnestly

implemented the central government's important instruction of "building traditional villages well", with the general goal of "creating a demonstration model for the concentrated continuous protection and utilization of traditional villages in ethnic poverty-stricken areas", and "strengthening the protection and utilization of ancient villages, ancient houses, and ancient trees and famous trees" as one of the important measures to promote the high-quality development of the prefecture. The "Ganzi Prefecture Tourism Development Plan (2016-2025)" was compiled, which put forward the key restoration of traditional buildings concentrated and contiguous areas, and carried out the declaration, filing, listing and protection of cultural relics protection units in accordance with the plan. The protection and utilization of traditional villages has played a positive role in promoting tourism, poverty alleviation and rural revitalization in the prefecture. Therefore, the protection and rational development and utilization of traditional villages is urgent, and research on the sustainable development of traditional villages needs to be carried out urgently.

The traditional villages in Kangba area with their unique natural environment, historical style and ethnic characteristics, rich historical, cultural and scientific and artistic values, are an important part of China's excellent traditional cultural heritage, digitizing the traditional villages in Kangba area, can effectively protect and archive the information of traditional villages in Kangba area, reproduce the parts that are easy to be lost or lost, and enhance the modern protection and management level of traditional villages; Improve the cultural dissemination form and display coverage of traditional villages in Kangba area, give traditional villages in Kangba area stronger cultural influence and vitality, form a trinity development model of culture, industry and natural ecology, and promote the sustainable development of traditional villages in Kangba. Therefore, this topic has the value of protecting the historical relics of traditional villages and traditional culture in Kham Ba, the educational function value of promoting traditional culture and the economic value of developing cultural tourism industry, which is of great significance in cultural protection and inheritance and

promoting the economic development of Kham Ba.

2. Digital Inheritance

With the advent of the digital age, many countries have realized that digital technology is an effective way to promote the protection of cultural heritage such as traditional villages, and "digital inheritance" takes digital technology as an important means of support, through digital preservation, digital monitoring, digital dissemination and digital restoration, the core content and information of cultural heritage can be objectively, truthfully and comprehensively recorded and preserved, and designed with appropriate structure to make it a data resource that can be retrieved, learned, disseminated and used[3]. It integrates many disciplines such as architecture, cultural relics, remote sensing and mapping, information, communication, ecology, geography, fine arts, sociology, history and geographic information science, etc., providing a strong data foundation and decision-making support for traditional village protection planning and restoration design.

At present, a digital protection and inheritance system has been formed, which is a complete sharing and service platform from the collection, storage, management, production, dissemination and consumption of digital resources of tangible and intangible cultural heritage, through which cultural heritage is digitally transformed, restored and reproduced in new formats that can be shared, displayed and disseminated, and cultural heritage protection workers, educators, Knowledge sharing, dissemination and exchange for groups such as cultural heritage enthusiasts.

2.1 Digital Heritage of Traditional Villages in China

In 2017, the General Office of the Ministry of Housing and Urban-Rural Development of China issued the Notice on Doing a Good Job in the Construction of Excellent Villages of Digital Museums in Traditional Chinese Villages, officially launching the construction of digital museums in traditional Chinese villages. The digital platform built by using new technologies such as multimedia, virtual reality, big data, and mobile Internet is used to enter and display the values and characteristics of traditional Chinese villages in terms of

history, culture, art, science and society. In 2018, the first phase of the development and construction of the digital museum and the construction of 165 villages were completed. In March 2020, the second batch of 211 villages in the Digital Museum of Traditional Chinese Villages was launched, with a total of 376 villages. In 2023, the Ganzi Prefecture Government proposed the Master Plan for the Protection and Utilization of Traditional Villages in Kardze Prefecture and the Demonstration Work Plan for the Concentrated and Continuous Protection and Utilization of Traditional Villages in Kardze Prefecture to build a high-standard digital museum of traditional villages in Kardze Prefecture. The digitization of cultural heritage has promoted the progress of related technologies, and soon transformed from a single means to multi-technology integration, and the integration of related disciplines has been continuously deepened, which is the only way out for the "immortality" of cultural heritage, and it is also one of the most effective ways to maintain the vitality of a country's cultural heritage [4].

In recent years, with the rapid development of computer technology and information technology, the use of digital technology for the protection of cultural heritage has formed a new trend. Early research began around 2010 on cultural heritage; In 2013, digital technology really appeared in the research process of traditional village protection; Since 2015, the number of related research has surged, and digital technology has gradually become a research hotspot in the protection of traditional villages, and the research direction has begun to show a diversified trend. In terms of research topics, including cultural inheritance, cultural protection, digital protection, digital village construction, etc.; In terms of specific technologies, including data platforms, 3D technologies, human-computer interaction, virtual reality (VR), augmented reality (AR), etc [5].

In terms of digital traditional village inheritance: it is reflected in the virtual restoration and archiving of traditional village spatial data and cultural information, and then protected and monitored through technical means, including remote sensing technology, UAV aerial photography, 3D scanning, digital photography, and 3D modeling, graphics processing and artificial intelligence and other

technologies provide strong data support and technical support for the planning and design of physical protection [6]. Digital cultural inheritance: embodied in the dissemination of cultural information through virtual reality and display, forming an interactive experience system, including panoramic traditional village digital museum, virtual exhibition system, digital service platform, digital creative products, etc., the technology used includes three-dimensional digitization and plane digitization, virtual reality technology, etc., technology application from single to multi-technology integration direction[7].

2.2 Digital Inheritance of Traditional Villages in Khampa Area

In 2014, the "Kham Traditional Tibetan Village Cultural and Historical Survey Project" began, which conducted a comprehensive fieldwork on the Kham traditional Tibetan villages, and systematically investigated and recorded the cultural and historical work of Kham traditional villages by means of text, charts, pictures and videos. In addition, there are few studies on the protection and cultural inheritance of traditional villages in the Kham region.

Most of them are based on the site selection, layout, and village plan form of traditional villages in the Kham region, and put forward relevant suggestions for the conservation and development of traditional villages from the perspective of spatial and environmental adaptability. GIS is used to analyse the characteristics of the spatial distribution pattern of traditional villages in Ganzi Tibetan Autonomous Prefecture, and to propose strategies for the development and protection of traditional villages in Ganzi Tibetan Autonomous Prefecture based on different types[8]. Or put forward countermeasures and suggestions for the protection of traditional villages in Ganzi Tibetan Autonomous Prefecture, enhance the

awareness of protection, strengthen the planning leadership, focus on effective protection, increase investment, and establish a legal system for the protection of traditional villages in Ganzi Tibetan Autonomous Prefecture [9].

The rest is mainly on the research of its traditional settlements, traditional dwellings and architecture, including the relevant research on the residential architecture and settlement landscape of the Jiajun Tibetan area in western Sichuan. Including the interpretation of Tibetan national structure culture, traditional residential architecture culture and protection and development strategy research, residential ecological adaptive design strategy research, the digital use of only digital simulation simulation and parametric modelling analysis of the Jiajung Tibetan traditional settlements, including the simulation of the natural environment in which the settlements and buildings are situated, to explore the relationship between the settlement morphology and spatial layout and the natural elements[10]. There is no relevant research in the field of digital conservation and cultural inheritance of traditional villages in the Kangba region.

3. Digital System Construction

In the traditional villages, the digital protection path is designed to build a data collection-data integration-data sharing system for traditional villages. Through fieldwork, the digital collection of standards and specifications is carried out to obtain the relevant content of various ontology of traditional village protection, and the three-dimensional model reproduction and knowledge graph construction are carried out accordingly, and the data is integrated and sorted out by means of literature, images, audio and video, three-dimensional models, etc., to form a data foundation to build an inheritance system [11] (Figure 1).

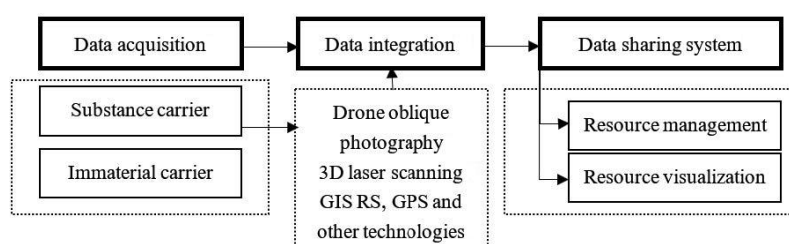


Figure 1. Digital System Construction

3.1 Data Collection

Traditional village data information collection: It is the basis for building a digital protection system, and the data information can be divided into two categories: material carrier information and non-material carrier information according to the form of the carrier. Material carrier information is physical content, including spatial pattern and building shape, etc., through UAV oblique photography and three-dimensional laser scanning technology, point cloud data collection of small and medium-scale buildings, courtyards, landscapes and other information, while large-scale villages and other information collection need to be combined with geographic information system (GIS), remote sensing system (RS) and global positioning system (GPS) and other technical assistance. For intangible carrier information such as history, culture, social relations, clan religious activities, emotional memory, etc., it is necessary to combine historical documents, audio and video, ethnography and oral history to construct a knowledge graph [12].

3.2 Data Integration

Traditional village data and information integration: Convert the collected material carrier information and non-material carrier information data into digital information and digital models. Use Autodesk Revit, CAD, GIS, 3DMAX, etc. to build 3D models and scenes; At the same time, comprehensive processing is carried out in combination with immaterial information, and recognition software and editing technology are used to convert the original text and picture data into digital information, and the connection with the material carrier is established to finally complete the integration of data.

3.3 Data Sharing System

The digital inheritance system builds a digital inheritance and sharing system for traditional villages from the perspective of smart city. The platform consists of two systems, namely digital resource management system and digital resource visualization system, to promote knowledge sharing, dissemination and exchange in traditional villages.

3.3.1 Digital resource management system

A traditional village information management system is established using WEBGIS as the software and hardware platform. WEBGIS, a computer information system designed for use in the internet or intranet environment, enables compatibility, storage, processing, analysis, display, and application of data [13]. It offers excellent capabilities for integrating multi-source data, accessing massive amounts of data, and employing server clusters.

The system consists of three functional modules. Firstly, the data management and query module handles operations, updates, and maintenance of geographic basic data and thematic data. It provides functions such as basic zoom-in, zoom-out, roaming, map layer control, graphic editing, map printout, geographic basic data query, and inquiry into traditional village data. This module also includes comprehensive thematic inquiries that consider various factors, such as the number of historical environmental elements, the number and length of historical streets and alleys (rivers), and the land area of core protected areas.

Secondly, the system maintenance module focuses on tasks such as adding and deleting system users, modifying user roles, adding and deleting system roles, and modifying role permissions.

Thirdly, the evaluation of the characteristics and value of traditional villages: according to the evaluation index system of Chinese famous historical and cultural towns (villages) (2010), select the earliest building age of the existing cultural relics protection units, the highest grade of the cultural relics protection units, the preservation of the places where the historical events took place and the celebrities' living areas, the scale of the historical buildings and the cultural relics protection units, the typicality of the historical buildings (clusters), the number of historical environmental factors, the scale of the historical streets and lanes (rivers), the morphological integrity of the core protection area, the historical authenticity, the characteristic function of the spatial pattern, the continuity of life in the core protection area and the intangible cultural heritage. scale, wind integrity of core protection areas, historical authenticity, spatial pattern characteristic function, continuity of life in core protection areas, intangible cultural heritage and other

indicators. Audit scores are calculated based on these indicators to evaluate special traditional villages. The results are stored in a database for easy extraction, inspection, correction, and sorting.

Overall, this WEBGIS-based traditional village information management system facilitates effective data management, querying, system maintenance, and evaluation processes, supporting the preservation and assessment of traditional villages.

3.3.2 Digital resource visualization system

The digital inheritance system of traditional villages in the Kangba area of Sichuan has a focus on the visual expression of tangible and intangible cultural heritage.

Tangible cultural heritage can be represented through various mediums such as text, pictures, videos, and three-dimensional animation. This is achieved through the creation of digital virtual museums, digital simulations, reproductions, and digital experiences. On the other hand, intangible cultural heritage is primarily expressed through knowledge visualization, digital display, and digital dissemination.

In addition to the aforementioned forms, the digital inheritance system also covers three aspects of digital resource visualization: digital evolution, handicraft auxiliary design, and digital story arrangement and narration. These aspects facilitate the transformation of cultural inheritance from static to dynamic, from single media to multiple media, and from two-dimensional plane to three-dimensional representation, which maximizes the public's ability to explore and appreciate traditional village culture [14].

The technology involved in this system can be broadly categorized into scenario modelling and behaviour control technology, which employs character generation, virtual human technology, action binding, multi-agent group control, and scene generation to create three-dimensional scenes, characters, and interactions. It also includes visualization technology that utilizes 3D animation, virtual reality, semantic web, and knowledge visualization to build a cultural heritage visualization system for sharing and collaboration [15] (Figure 2).



Figure 2. Visualization System

Two main approaches are used:

(1) Digital virtual museum: Resources such as village architecture, environment, cultural relics, and folk activities are virtually modelled and designed for human-computer interaction on the internet. Through simulation construction, audio descriptions, animations, and other forms, the relics and cultural products of ancient villages are displayed and promoted. This allows visitors to gain a comprehensive understanding of the village's current situation, history, and related knowledge, vividly displaying both the overall image and specific details of the ancient village.

(2) Digital experience: Interactive technologies such as touch screen interaction, VR, or AR devices are used to combine virtual reality with different temporal and spatial data. This

enables visitors to immerse themselves in virtual spaces and have diverse experiences related to the cultural heritage.

For intangible cultural heritage, the following approaches are employed:

(1) Digital evolution and storytelling: Using scenario modelling and behaviour control technology, three-dimensional scenes, characters, and actions are swiftly generated to depict various aspects of intangible cultural heritage, such as performances, folklore, music, traditional oral literature, calligraphy, music, dance, drama, opera, acrobatics, etc. The aim is to transform and reproduce these elements into a shareable and renewable digital format. This is achieved through three-dimensional story reinterpretation, digital display design, digital interactive experience presentation, and creating an immersive experience that

promotes knowledge dissemination and attracts visitors.

(2) Auxiliary design of handicrafts: For traditional crafts, interactive experiences are used to enhance the sense of engagement. This can include multimedia virtual tutorials and physical production experiences of crafts. Additionally, traditional skills and works of intangible cultural heritage can be reproduced, leading to the development of cultural tourism products.

By employing these visualization techniques, the digital inheritance system enriches the understanding and appreciation of both tangible and intangible cultural heritage, enabling wider access and participation in the preservation of traditional village culture.

4. Conclusions

Digital cultural heritage is an important trend, which can protect and inherit traditional village culture in a long-term and effective way. The traditional villages in Kangba region occupy an important proportion in the traditional villages, with distinctive national characteristics, unique historical and cultural and scientific and artistic values. The use of digital ways to protect and inherit the traditional villages in the Kangba region, and the construction of a digital inheritance system of the traditional villages in the Kangba region, can provide practical technical methods, application methods and model system, to achieve the purpose of long-term protection mechanism and innovative cultural inheritance. It provides a new direction for the protection and cultural inheritance of traditional villages in Kangba region, and also provides reference for the protection and development of other traditional villages and other types of cultural heritage. It can also provide reference for the protection and development of other traditional villages and other types of cultural heritage. It can drive and promote the digital protection and cultural dissemination of traditional villages in China, and is also in line with the current stage of the "integration of science and technology and culture", "rural revitalisation" and other strategic development directions. In terms of digital inheritance, at present, there is no detailed description of the application process, accuracy requirements, quality control and other aspects of village digital technology, let alone the formation of standards and norms

for village data collection and processing. The future still requires the joint efforts of many disciplines and scholars: first, to build feasible standards and norms, including traditional village digital registration standards, data use standards, monitoring and early warning standards, etc.; The second is to break through the barriers between technologies, especially the barriers of data connectivity between platforms, and reduce the technical and time costs brought about by data conversion; Third, vigorously develop existing technologies. At present, there are still many difficulties in digital technologies such as machine learning, machine vision, and real-time monitoring, which need to be further studied, and the protection path will be continuously supplemented and revised with the development of existing technologies.

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