Progress of Digitization of Dong's Traditional Architecture under the Trend of Information Standardization

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Abstract

Theoretical research and practical application of digital, standardized and sustainable traditional architecture in intangible cultural heritage conservation. Through the study and analysis of domestic and Foreign Research Literature on Digital Protection of traditional buildings, this paper summarizes the multidisciplinary communication, database construction standards, information technology development and the construction of human-based protection system in the process of digital protection of traditional architecture in Dong people, the future development trend of digital protection research field is analyzed. In the process of digital protection and development, the importance of interdisciplinary system, standardized construction of data information, people-oriented concept and diversified forms of expression is discussed, it is pointed out that the digital protection of Ich requires multi-disciplinary knowledge cross-domain, which is a demand-driven multi-disciplinary knowledge fusion process. In view of the digital protection idea and the practical application, this paper puts forward that the participation proportion of the inheritors should be increased in the process of digitalization, which not only needs to meet the digitalization demand, but also needs to realize the real demands of the native people, in the process of database construction, we should pay more attention to the standardization in the information collection, classification standards and other low-level structures.

Keywords

Information standardization; Dong architecture protection; Participatory Development; Standardized data construction

Introduction

In order to promote the systematic protection of China’s intangible cultural heritage, the Party Cen-

tral Committee, the State Council and other state organs constantly emphasize the need to strengthen the inheritance and protection of traditional culture. According to the report of the 19th CPC National Congress, the strategy of rural revitalization and development should be implemented to "strengthen the protection and utilization of cultural relics and the protection and inheritance of cultural heritage." The protection and development of traditional villages should be based on the systematic and complete integration of material culture and intangible cultural heritage inherited from generations of traditional villages. How to achieve the inheritance and protection of the systematic and integrity of traditional villages has gradually become the core issue concerned by all circles. The author in recent years our country on intangible generalizes the digital protection research literature, hopes for both the dong traditional timber frame construction digitization and standardization documents, make systemic analysis to the development direction, and in are reviewed on the basis of existing theoretical research and practical results, the paper points out the future development.

Analysis and Collation of Literature Data

Literature Data Sources

With the key words "Dong, architecture and protection", 1048 literatures were retrieved. Then, through screening and cleaning, 720 effective literatures were obtained by removing the catalogs, contributions and photographic works. There were 552 journals (76%), 150 master's theses (20%) and 18 doctoral theses (4%). Exporting data formats that can be used in CiteSpace through CNKI for related co-occurrence data analysis.

Literature Publication Trend Analysis

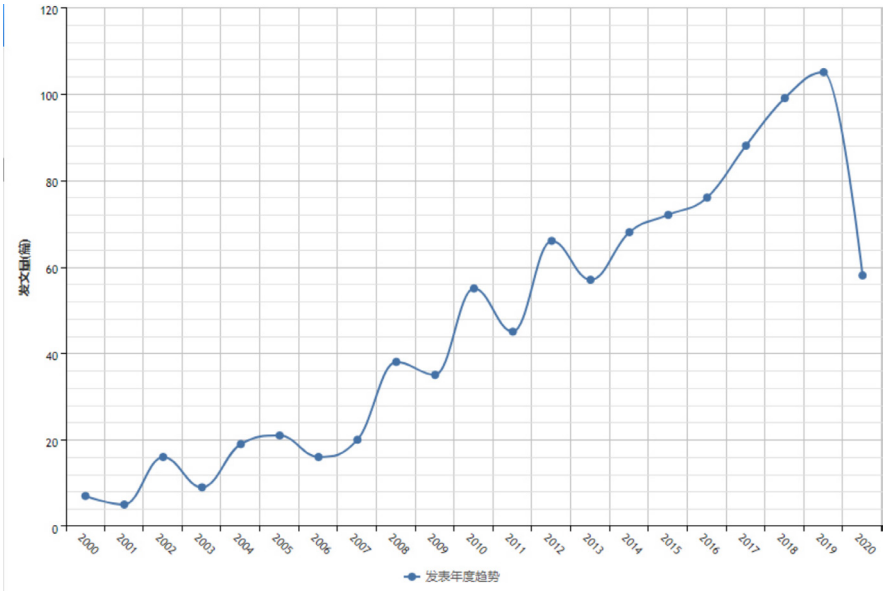


Figure 1. Number and time of documents

According to the broken line chart of the statistical table of years and number of published papers shown in Figure 1, from 2000 to 2020, the number of published papers showed an overall upward trend. In 2002, 2008, 2010 and 2012, there was a significant increase. From 2016 to 2019, there was an explosive rise, and from 2019 to 2020, there was a significant decline. This indicates that the period from 2016 to 2019 is a rising period for the research on the protection of Dong traditional architecture. During this period, a large number of scholars conducted research in this field and the number of published papers continued to grow. But in 2019–2020, or due to external factors, the number of published papers will drop sharply.

Research Hotspots and Dynamic Analysis

The frequent connection between keywords indicates that this word is the focus and core of the research in this field. Based on the analysis of key word data, it is concluded that Dong dwellings, Dong villages, stilted buildings, drum towers and other words have been the core topic of Dong traditional architecture research since 2000. Since 2004, research sites have been gradually enriched, including southeast Guizhou, Zhaoxing Town, Sanjiang County, Tongdao County, etc., which indicates that the sampling scope of Dong research has been gradually expanded. From 2008 to 2017, key words such as construction technique, wooden frame architecture and dry-column architecture have become new hot spots. Since 2017, key words such as intangible cultural heritage, BIM technology and digitization have frequently appeared, reflecting the promotion of the intangible cultural heritage policy vigorously advocated by the state in recent years and the rapid development of information digitization technology, as shown in Figure 2.

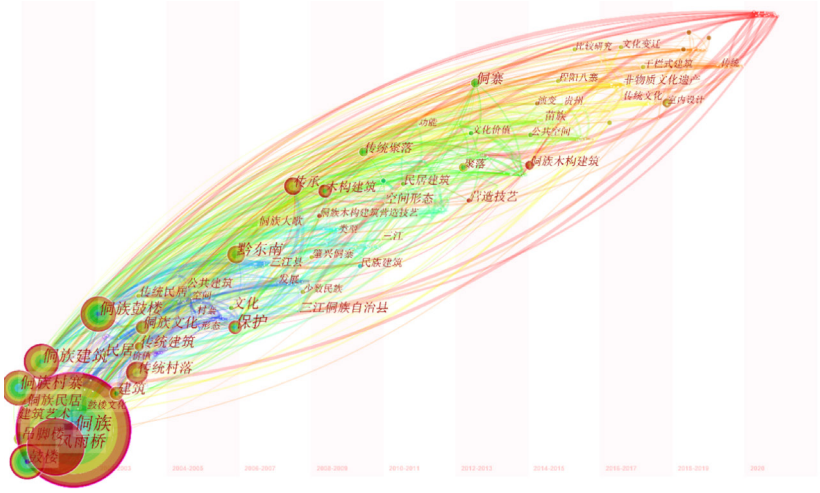


Figure 2. Keywords co-occurrence Time Zone Atlas

Author and Institutional Analysis

By analyzing the co-occurrence data of authors and institutions in more than 720 literatures, the

co-occurrence chart of authors and institutions was obtained. According to the graph phenomenon in Figure 3 and Figure 4, there is little connection between different institutions and authors, which indicates that there is a lack of extensive cooperation and contact in the field of Dong architectural protection. Meanwhile, the publications of papers related to Dong traditional architectural protection are uneven, mainly concentrated in colleges and universities, and a few are published by construction companies or research institutes. According to the analysis of the co-occurrence map of institutions, Liuzhou City Vocational College, Guangxi University of the Arts, Kaili University and other colleges and universities have a high degree of activity, as shown in Figure 4. According to the map of co-authors, scholars with high active degrees in the field of Dong architectural protection from 2000 to 2020 mainly include Zhao Xiaomei, Cai Ling, Liu Hongbo, Wu Zhengguang and so on.

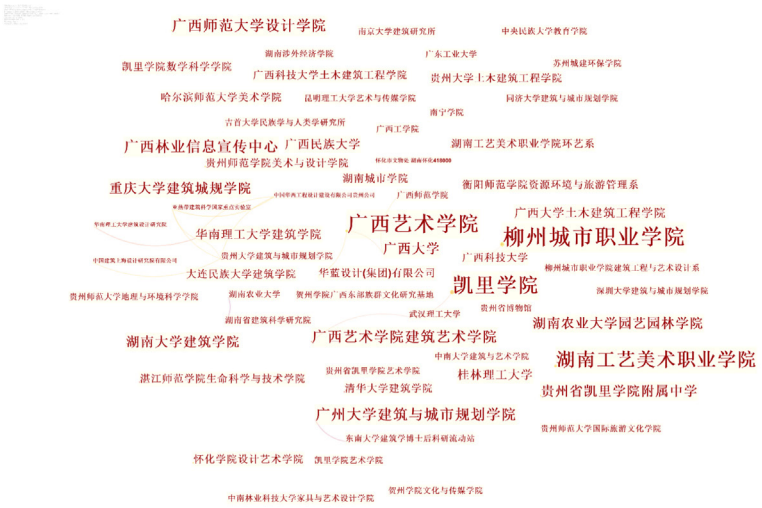


Figure 3. Co-occurrence Atlas of institutions



Figure 4. Author co-occurrence Atlas

Theoretical and Practical Research on Digital Protection of Traditional Buildings

Digital technology has significant advantages over traditional protection means in the systematic, authentic and sustainable protection of intangible cultural heritage. It is convenient for the construction, use and iterative development of shared digital database, and greatly speeds up the efficiency of intangible cultural heritage protection. At the same time, it is conducive to the diversity and accuracy of theoretical and applied research, macro decision making and control of future trends faced in the exploration of digital protection of intangible cultural heritage.

Digital Transformation of Traditional Dong Architecture

As a representative dwelling form of dong people in hunan, guangxi and guizhou, dong people's ganlan-style architecture belongs to the structure of wooden structure and interludes, with its own system of building skills. The traditional conservation of ancient buildings is mainly based on text records, The "Record of Traditional Ethnic Architectures in Guangxi" summarizes the traditional architectural paradigms of all ethnic groups in Guangxi, including the Dong ethnic group, The book comprehensively records the digital protection of Dong architecture with the traditional architectural style of Dong in the form of horizontal, vertical and section illustrations, which is to realize the comprehensive digital protection of Dong architecture from appearance to internal structure (Editorial Board, 1991). Although the "Dong Culture Dictionary" does not independently set the entry of Dong traditional architecture, it elaborates on the architectural composition, providing reference for the study of Dong architecture (Ou & Jiang, 2002).

With the deepening of digital technology and standardization concept in the field of traditional architectural conservation, scholars in this field are also conducting research and practice in the direction of digital transformation. Cai Ling (2020) took Tongdao County, Hunan Province as the sampling area, explored the construction characteristics of Dong traditional residential houses from three aspects of plane layout, structural form and structural practice, and summarized the general laws by folding, so as to find out the basic plane and standard structure of Dong traditional residential buildings.

In addition, the construction process of Dong traditional architecture has formed its own unique system of weights and measures and construction methods, which also need to be theoretical integration and digital transformation. Li Xuemei (2013) discusses the intangible cultural connotation in the construction of traditional architecture with the tool used by the ink masters of the Dong nationality as the starting point. The craftsmen of the Dong ethnic group construct measuring sticks based on body measurements, and then judge the scales of good or bad in accordance with the num-

bers in geomantic omen; Peter Blundell Jones etc (2013) summarized the oral construction technology, ceremony and process of architectural craftsmen, For Dong craftsmen without written records or drawings, oral construction technology is extremely important in the social history and culture of the Dong people; Zhang Yuyu (2017) to delve into artisans used when building pattern, the pattern in the form of commonness and individuality can be summed up in the role and function, and to emphasize the size of the pattern marker is the transformation of oral data to directly use the tools and the key to scale standard, and make the craftsman between individual intentions and team building efficiency level through with minimal transmission; Qiao Xunxiang (2014) extracted the core skills of Dong people, such as the generation of dog-frame, scale control, tenon and mortise technology, summarized the rules of Dong people's dog-frame generation, analyzed the principle of fixed point positioning of rod and stick, and explained the application rules of tenon and mortise technology, such as tenon and mortise technology and bamboo stick method.

Theoretical Research on the Digital Technology of Traditional Architecture

China has the largest number of existing ancient buildings in the world, but most of them are wooden structures, which are easily damaged by environmental or human factors and difficult to be preserved for a long time. The research and development of digital modeling forms is of great significance to the protection of digital cultural heritage in China. Wang Yaoxi's (2009) "Digitization of National Cultural Heritage" defines the concept of digital protection of intangible cultural heritage as: "ake the digital collection, storage, processing, display and transmission technologies such as transform cultural heritage, reproduce, recovery into digital form, can be Shared and regeneration and interpreted in another perspective, new ways to save, to take advantage of new demand". "Digital Protection: A New Approach to the Protection of Intangible Cultural Heritage" compiled by Li Xin (2011) systematically analyzes the theory and application of digital protection of intangible cultural heritage, In addition to discussing the digital protection theory of intangible cultural heritage, it also interprets the architectural form and development mode of the intangible cultural heritage protection system, combined with the example of digital map of intangible cultural heritage distribution, the design specification and development method of database, classification configuration and retrieval engine are explained.

The feasibility of digital standardization of traditional buildings of the Dong nationality can not only be referred to in the construction experience of ancient buildings such as "Construction French", but also be reflected in the modular construction system and digital development process of modern buildings (Le, 2018).

Li Ziyang (2020) referred to the component classification system in "Construction French". Based on the analysis of the structural characteristics of Hakka ancient buildings, the ancient buildings are

divided into several building elements, using CGA rules of City Engine to build three-dimensional components and combine them, a systematic digital model of architecture is obtained; Huang Nenglang (2018) applies BIM technology to the digital standardization construction of traditional buildings, realizes the protection and preservation of information of traditional building components, and verifies the feasibility of the protection of traditional buildings through informatization and standardization, in this paper, the ancient building component information is quantitatively extracted and adapted to specific functions to achieve the digital standardization of traditional buildings, and the consistent classification of ancient building component information and the construction of classification standard library are realized.

Zong Licheng (2020) used computer-aided design and informationization to carry out the digital transformation of intangible cultural heritage, discussed the digital technology in detail, set up the clear idea and technical route of cultural relic digitization, and studied the feasibility of key technologies such as data acquisition, processing and model reconstruction.

Application Exploration of Digital Protection Technology

For the digital protection of traditional buildings, information collection and collation is a difficult point in the application practice. How to achieve the integrity, accuracy and organization of data collection is a common concern of scholars in many disciplines.

Cai Ling (2020) put forward the basic research ideas of Dong traditional architecture and its protection and development: Through field investigation, measurement and investigation, the rules and identification characteristics of architectural settlements in Dong villages are summarized and integrated, The basic information data of ancient buildings are constructed, and the hierarchical protection strategy and scientific evaluation system are implemented according to the scale, so as to provide data and theoretical basis for customized protection planning.

Based on the ground-based 3D laser scanning technology and aerial photography modeling and measurement technology, Sun Baoyan and Jiang Pengzhou etc (2019) analyzed their respective advantages from the three stages of operation mode, data acquisition and information processing, and discussed the model construction framework of the fusion of the two modeling technologies. Through the complementary advantages of the two technologies, the modeling problem of the complex roof and roof structure of ancient buildings is solved; Zhang Hongji (2016) developed laser scanning technology for point cloud information collection based on ground and hand-held laser scanners, with its advantages of fast data acquisition speed, high accuracy and non-contact, he provided an effective path for the digital protection of ancient buildings, and described the technical route, data collection and processing, and model building techniques; Based on the mainstream

modeling software, Li Shanglin and Xie Wenjun (2019) discussed the characteristics and application background of digital modeling methods from different disciplines and technologies and made a comprehensive comprehensive survey. Finally, they analyzed the problems and challenges existing in the modeling technology and made predictions for the future development.

In addition to the basic purpose of protection, it is also the key task of digital protection to radiate the new vitality of intangible cultural heritage and drive the revival and prosperity of ethnic minority villages through digital technology. After the protection of ancient buildings through digital technology, it is necessary to transform the achievements, so as to promote the development of related industries. Zhou Wei (2017) focused on the influence of digital technology on the design of Dong's green standard building, commented on digitization and Dong's green standard building, and explained the denotation meaning of digital protection of traditional buildings.

Sun Yongqing and Zhang Yan (2019) proposes raster data and vector database of ancient cultural heritage and building information modeling system, and for the analysis of large data and rural settlements planning, traditional culture education, 3D model in the field of virtual reality in the field of building provided the underlying data, further highlighting ancient culture, promote the traditional culture for the mass display.

Based on the advantages of 3D digital technology in wood design and the research and development of wood structure, He Chen (2019) summarized the digital design methods and processes of wood components through digital modeling, modular design and finite element analysis optimization of wood components, and improved them by 3D drawing, so as to improve production efficiency and promote the development of the industry.

The Digital Informatization Process of Traditional Architecture

China's ancient architectural heritage is the crystallization and symbol of national wisdom, and digital technology has creative significance for the protection of traditional architectural heritage by virtue of its innate advantages. Digital standardized information technology has developed and been applied to research and construction in related fields, it is practical and innovative in the inheritance of ancient architectural cultural heritage, and has obtained rich experience and achievements, so that endangered traditional ancient buildings can be retained in the form of digital.

However, due to the current digital protection technology is still in the development stage and the lack of perfect norms and management mechanism in the application process, some deficiencies have been exposed in the actual promotion process. It still needs continuous improvement and perfection to integrate digital technology into the protection of intangible cultural heritage in a com-

prehensive way.

Difficulties and Misunderstandings in the Process of Digital Protection

Liu Peilin pointed out the lack of comprehensive application of technology integration, unified standards and technical specifications in the process of digital protection of traditional villages. There are some misunderstandings such as "attaching importance to protection rather than utilization", insufficient innovation of digital technology and less digital standards related to traditional villages. Based on this conclusion, the main solutions and future development directions are proposed, including the transformation of understanding and cognition, interdisciplinary integration, theoretical norms and standards, and coordination and cooperation between relevant department (Liu & Li, 2018); He Chengzhan etc (2017) analyzed the practical significance of constructing the digital platform of Dong architecture, and believed that the construction of the platform could not only standardize the form and connotation of Dong architectural art, but also provide guidance and help for the construction of new Dong architecture, so as to facilitate the preservation of Dong culture. The construction process should not be divorced from the architectural aesthetic significance, architectural technical characteristics and traditional customs of the Dong nationality.

After analyzing the research and practice status quo of the digitization of intangible cultural heritage in China, Song Junhua and Wang Mingyue etc (2015) believe that the construction of database, digital application and big data analysis can provide technical support for the digitization of intangible cultural heritage. However, at present, there exists the phenomenon of "emphasizing form over meaning", neglecting localities and failing to show the dynamic nature, the concept of "participatory protection" should be formed to integrate both inheritors and users into digital protection and extend it to the daily life of the public.

Song Junhua (2015) in another paper in the legalization of non-material cultural heritage in the process of digital protection and sustainability, this paper discusses the heritage in the process of digital internalization and improve the active integration of digital technology and the intangible, real play to the role of the catalytic intangible vitality, is the future developing trend of digital heritage protection; Song Lihua, Li Wanshe and others (2015) made an in-depth analysis of the construction of intangible cultural heritage digital platform, it points out three major difficulties in the reconstruction of intangible cultural heritage with complex contents: the lack of systematic protection awareness, the inability to form the standard and norms of information expression, and the difficulty in selecting the information integration mode.

Strategies for Digital Protection

According to Liu Peilin, five basic concepts should be followed to get rid of the misunderstanding: digital preservation, digital monitoring, digital dissemination, digital restoration and digital utilization. Three changes: the change of understanding of digital protection, the change of thinking of interdisciplinary collaboration, the change of emphasizing theory, paradigm and standard; addressing two core issues: the system sorting and applicability evaluation of digital record and preservation methods, the technical specification and data standard of traditional village comprehensive database (Liu & Li, 2018); Yang Hong (2013) proposed five models for the digital integration of intangible cultural heritage resources: portal integration, database integration, system integration, protocol standard integration, retrieval mode integration, the application of different ways have their own advantages and disadvantages, should be verified by practice, according to the actual needs of the combination of use; Zhang Saijuan (2017) believes that in order to protect and update the wooden construction skills of the Dong ethnic group, it is necessary to deeply explore the deep cultural connotation contained in the traditional architecture of the Dong ethnic group, not only to build a modern inheritance system, but also to create a fusion space that not only contains the Dong tradition but also fits the modern context.

Wu Zhendong (2016) believes that the digital protection of architectural heritage should start from the aspects of information needs, digital functions and standards, and digital management comprehensive authenticity is the basic requirement of digital protection, multi-function is the specific need of digital protection, unified standard is the necessary prerequisite of digital protection, and scientific management is the effective guarantee of digital protection.

Song Lihua and Li Wanshe (2015) proposed on the integration of digital platform: Multi-party cooperation under the guidance of reasonable literature view, standardized classification of database resource information, using knowledge ontology theory to abstract and summarize, using metadata model to express conceptualized knowledge,the integration mode needs to consider the relevance of the implementation function and the integration purpose.

Research Review and Prospect

Digital means, database architecture model, augmented reality technology and data visualization form technology, digital protection and application of intangible cultural heritage from a unique perspective. However, there are still problems in data collection, database construction, update mechanism, and the connection between theory and practice, which need to be further solved in the study.

Research Review

Dong traditional wooden construction is a materialized national culture. It is of far-reaching significance to study and practice the digital protection. Research on Dong traditional architecture has made achievements in research methods, objects, theoretical expansion and other aspects, mainly manifested as the following characteristics:

(1) Full coverage of the research horizon and paradigm. Buildings are not isolated individuals, but an inseparable part of traditional Dong culture inheritance, the protection of buildings is also the protection of intangible culture and the comprehensive protection of ethnic minority culture.

(2) Multi-dimensional integration of interdisciplinary communication and research methods, existing studies are interpreted from different perspectives, including architecture, folklore, geography, history and other disciplines, by means of literature analysis, field investigation, and local Chronicles investigation.

(3) Promote the systematic and standardized integration of digital information. The research on Dong traditional architecture has gradually constituted a system, and the standard of information integration has been gradually clear, which directly improves the theoretical depth and practical value of the research.

Future Prospects

(1) Emphasize the systematization of research and strengthen interdisciplinary integration. At present, although the research horizon is diversified, the communication between disciplines is not smooth. Architecture focuses on building technology, history and data acquisition; folklore interprets architecture as a materialized form of folk culture.

(2) Strengthen the human-based standpoint of research and realize participatory development. The human-based stance plays a catalytic role in realizing sustainable inheritance, the current research does not consider sufficiently the participation and interest demands of the Dong people, nor does it construct a systematic and efficient renewal system.

(3) Promote database construction in the context of standardization. The classification system of digital intangible cultural heritage resources for ethnic minorities in northern Guangxi shall be established, the data collection standards shall be formulated, the visualization and interaction of intangible cultural heritage data information shall be improved, and the multimedia interactive platform of Dong intangible cultural heritage shall be constructed.

(4) Improve the updating mechanism and enrich the digital forms. The protection of intangible cultural heritage should take advantage of diversified media such as virtual reality (VR), augmented reality (AR) and auditory enhancement, under the guidance of integrity, the intangible cultural heritage should be recorded comprehensively to facilitate the construction of information files and databases.

Conclusion

Carry out interdisciplinary, multi-perspective, systematic and digitalized comprehensive research on the traditional architecture of the Dong nationality, will bring more evidence to explain the cultural logic behind the material and immaterial forms of architecture, it is also an inevitable way to understand the formation and inheritance of Dong traditional architecture in an all-round way.

At the same time, under the attention of local design and regional construction, its value is not limited to the secular significance, but also exists in the transmission of traditional architectural culture. The excavation of information and data of ancient buildings provides an effective means for the overall unity and harmony of digital protection of ancient buildings. Through the construction of digital inheritance system from the perspective of standardization, the intangible cultural heritage in Guangxi can be effectively inherited and protected, and promoted and disseminated in the form of visualization. Therefore, it is of great application value and social significance to think and explore the information recording and digital protection of the traditional construction methods of the ethnic minorities including the construction skills of the Dong area. It is of far-reaching significance to further inherit and carry forward the material culture and national culture of the Dong nationality, and to improve the national self-esteem and centripetal force.

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