Preservation and Inheritance of the Historical and Cultural Heritage of the River Corridor in the Age of Digital Intelligence

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Abstract: In the digital age, the Hexi Corridor, a significant hub for historical and cultural heritage in Northwest China, is confronted with both novel prospects and formidable obstacles in safeguarding and perpetuating its cultural legacy. This study meticulously examines the present utilization of digital techniques for the preservation and continuation of the Hexi Corridor's cultural heritage, dissects the existing issues and their underlying causes, and puts forward pertinent remedies. The findings of the research indicate that while digital technology offers novel approaches and methodologies for the safeguarding and perpetuation of cultural heritage, the exorbitant costs associated with these technologies, the scarcity of specialized personnel, and the deficiency of legal and regulatory frameworks continue to impede the comprehensive advancement of such endeavors. By strengthening technological research and development and innovation, cultivating and introducing professional talents, improving the legal and regulatory support system, and expanding the channels for the dissemination and utilization of cultural heritage, we are capable of effectively addressing these challenges and facilitating the sustainable development of the cultural heritage in the Hexi Corridor.
Keywords: Hexi Corridor; Digital Age; Cultural Heritage ; Protection And Inheritance

1. INTRODUCTION

In today's era of rapid digitalization and intelligence, digital intelligence technology is profoundly changing the way cultural heritage is protected and inherited (Li, 2021). With the widespread application of technologies such as big data, artificial intelligence, and virtual reality, the protection and inheritance of cultural heritage has ushered in unprecedented opportunities. These technologies are not only capable of offering more scientific and precise methods for the protection of cultural heritage, but also have the potential to amplify the reach of cultural heritage and boost public engagement via digital communication and presentation (Guo,

2020). Nevertheless, the application of digital intelligence technology has also introduced new challenges, including high technical costs, a shortage of professional talents, and inadequate legal and policy support. These problems have, to a certain extent, restricted the profound advancement of cultural heritage conservation and inheritance.

As a historical and cultural treasure of Northwest China, the Hexi Corridor has a rich tangible cultural heritage, including ancient buildings, grottoes, and the Great Wall, as well as numerous intangible cultural heritages, such as traditional skills and folk culture. These cultural legacies carry deep historiographic and economic valorization, and are also an embodiment of the cultural self-confidence of the Chinese nation. However, with the changes of the times, the cultural heritage of the Hexi Corridor faces many challenges, such as natural erosion, human destruction, and inheritance faults (Corfield, 2007). The emergence of digital intelligence for the conservation and transmission of visual heritage has provided new opportunities, but it has also presented additional issues and challenges. This study is designed to investigate the current application of digital intelligence technology in the protection and inheritance of the Hexi Corridor's cultural heritage, identify the existing problems and their underlying causes, and suggest appropriate solutions and strategies.

The goal is to offer theoretical support and practical guidance for the sustainable development of cultural heritage. In the context of the digital age , the practice of preservation and perpetuation of cultural heritage has gradually shifted from traditional physical protection and manual restoration to digitalization and intelligence. This shift has resulted mainly in increased transparency and sophistication in the safeguarding of these properties, but has also enabled cultural heritage to transcend the limitations of time and space and to reach a wider audience through innovative means of dissemination (ZUO, 2020). However, this process has also exposed some problems that need to be solved urgently. The application of digital technology requires a large amount of capital investment, including equipment purchase, technology research and development, and maintenance, which is a major challenge for the Hexi Corridor region.

At the same time, digital technology is developing rapidly, and the Hexi Corridor region may lag behind in technology updates, affecting the effectiveness of chemical fertilizers, and the preservation and transmission

of cultural heritage. In addition, the intersection of digital technology and cultural heritage protection requires professionals with interdisciplinary knowledge, but there is a large gap in this regard in the Hexi Corridor region, and the difficulty in talent training and introduction has further restricted the development of related work. Existing laws and regulations lack clear regulations on the utilizing microtechnology in the preservation of genetic properties and inheritance, and insufficient policy support has also affected the promotion and implementation of related projects.

2. CURRENT APPLICATION STATUS OF DIGITAL INTELLIGENCE TECHNOLOGY IN THE PROTECTION AND INHERITANCE OF THE HEXI CORRIDOR'S CULTURAL HERITAGE

In recent years, as digital intelligence technology has developed rapidly, the protection and inheritance of the cultural heritage of the Hexi Corridor has made significant progress. The implementation of digital information management technology not only provides a more science-based and accurate approach to cultural heritage preservation, but also provides a more accurate approach to sustainable, but also expands the influence of cultural heritage and enhances public participation through innovative communication methods. The following details the specific application status of digital intelligence technology in the protection and inheritance of the cultural heritage of the Hexi Corridor.

2.1 Application of Digital Protection Technology

2.1.1 Utilization of Remote Sensing and Geographic Information System (GIS) in Cultural Heritage Monitoring

The use of remote sensing technology and geographic information systems (GIS) in cultural heritage monitoring has offered significant technical support for the protection of the Hexi Corridor's cultural heritage. By leveraging high-precision remote sensing images and geographic information systems, it is possible to conduct dynamic monitoring and precise management of cultural heritage (Xu & Zou, 2022).

The Dunhuang Academy used GIS technology to conduct long-term monitoring of weathering damage in the Mogao Grottoes. By collecting and analyzing the microenvironmental data of murals and colored sculptures in real time , it provided a scientific basis for protection work. The application of this technology not only improved monitoring

efficiency, but also enabled the timely detection of potential damage and the early adoption of protective measures, effectively avoiding further damage to cultural heritage.

2.1.2 Utilization of 3D Laser Scanning and Modeling Techniques in the Preservation of Ancient Structures

The use of 3D laser scanning and modeling technology in the preservation of ancient buildings has offered a novel approach to safeguarding ancient structures in the Hexi Corridor (Li et al., 2023). This technology is capable of conducting high-precision 3D modeling of ancient buildings, thereby enabling digital archiving and restoration.

The Jiayuguan Great Wall used 3D laser scanning technology to record the structure of the wall in detail, providing important data for subsequent restoration work. The application of this technology can not only accurately record the current status of ancient buildings, but also provide a scientific basis for restoration work, ensuring the accuracy and scientificity of the restoration work.

2.1.3 Application of Big Data Analysis in the Prediction of Cultural Heritage Damage

The application of big data analytics in predicting cultural heritage damage has significantly bolstered the protection efforts for the Hexi Corridor's cultural heritage (Yan & Li, 2023). By analyzing the monitoring data of cultural heritage, potential damage can be predicted and protective measures can be taken in advance.

The Gansu Provincial Cultural Relics Bureau used big data analysis technology to analyze the damage data of cultural heritage in the province and formulated targeted protection plans. The application of this technology not only improves the accuracy of damage prediction, but also effectively prevents the damage of cultural heritage.

2.2 Digital Communication and Display

2.2.1 Construction of Virtual Museums and Online Exhibition Platforms

The construction of virtual museums and online exhibition platforms has provided a new way to disseminate the cultural heritage of the Hexi Corridor. Through virtual museums and online exhibition platforms, the digital display of cultural heritage has been realized, expanding the scope of dissemination. The Gansu Provincial Museum has launched a virtual exhibition platform, which allows the public to visit various exhibitions in

the museum through the Internet. The application of this technology not only enhances the visibility of cultural heritage, but also draws greater public attention and involvement in cultural heritage protection efforts (Xu & Sun, 2016).

2.2.2 Utilization of Augmented Reality (AR) and Virtual Reality (VR) Technologies in Cultural Heritage Presentation

The use of augmented reality (AR) and virtual reality (VR) technologies in cultural heritage display has offered a novel approach to presenting the cultural heritage of the Hexi Corridor (Wei & Xin, 2024). Through AR and VR technologies, the display effect of cultural heritage has been enhanced, and the public's participation and experience have been improved. Zhangye Dafo Temple uses VR technology to allow visitors to experience the history and culture of the Dafo Temple in an immersive way. The application of this technology can not only enhance the public's understanding of cultural heritage, but also increase the public's participation and interest (Wu et al., 2021).

2.3 Education and Public Participation

2.3.1 Construction and Application of Digital Education Platform

The development and utilization of digital educational platforms have provided a new means for the education of cultural heritage in the Hexi Corridor. Through the digital education platform, cultural heritage education activities have been carried out, which has improved the comprehension and recognition of the preservation of the national heritage by the general public (Dang & Wang, 2021). Hexi University has established a cultural heritage digital education platform to carry out cultural heritage protection education for students and the public. The application of this technology can not only enhance the public's understanding of cultural heritage, but also foster a sense of protection among the public and create a positive environment for the participation of the entire society.

2.3.2 Construction and Advancement of Public Participation Platforms

The establishment and promotion of the public participation platform provides a new way to protect the psychological consequences of the crisis of the Hexi Corridor. Through the public participation platform, the public is encouraged to participate in cultural heritage protection and inheritance activities, forming a good atmosphere for the participation of the whole society (Qier et al., 2023). Wuwei City has established a cultural heritage

protection volunteer platform, which has attracted a large number of volunteers to involve in the maintenance of the archaeological patrimony. The deployment of this particular technology may not only increase the public's participation, but also form a good atmosphere for the participation of the whole society and promote the in-depth development of cultural heritage protection work.

3. CHALLENGES OF DIGITAL INTELLIGENCE TECHNOLOGY IN THE PRESERVATION AND PASSING ON OF CHINESE CULTURAL HERITAGE IN THE HEXI CORRIDOR

3.1 Limitations of Technology Application

3.1.1 High Technical Cost

Digital intelligence technology requires a large amount of capital investment, including equipment purchase, technology research and development, and maintenance. The economic development of the Hexi Corridor region is relatively lagging behind, and the local government's capital investment in cultural heritage protection and inheritance is limited, poor to address the demands of DSM applications. Virtual reality technology has a high operating cost and requires more operation from the user than traditional video images (Guo et al., 2024; Lan et al., 2025). Cultural relic digitization is an important part of the construction of Digital China. It is recommended that a unified cultural relic digitization standard be formulated and issued as soon as possible at the national level, and the entire process of collection, sorting, storage, processing, and use be included in the standard specifications.

3.1.2 Rapid Technological Updates

Digital intelligence technology is developing rapidly, and the Hexi Corridor region may lag behind in terms of technological updates, which will affect the safeguarding and continuation of the cultural inheritance. The current digital intelligence technology still has problems in terms of creativity, such as popularization, homogeneity of narrative mode, and poor modeling, which need to be further improved (Liu et al., 2023).

3.2 Talent Shortage

3.2.1 Lack of Professional Talents

Digital technology and cultural heritage protection requires professionals with interdisciplinary knowledge, and there is a large gap in this area in the

Hexi Corridor region. At present, cross-disciplinary compound talents who can truly combine technology and art are extremely rare, and digital art requires compound talents who understand both technology and art (Şmuleac et al., 2020).

3.2.2 Difficulties in Training and Introducing Talents

Due to the limitations of regional economic development and employment opportunities, it is difficult to attract and retain professional talents. How to achieve interdisciplinary talent training, create talents who are proficient in digital intelligence technology and have artistic thinking, promote the rational layout of technical talents, encourage technical talents to innovate boldly, and realize the linkage of production, learning, research and practical application in an unconventional way depends on the overall coordination of enterprises, universities, art groups and government departments (Yongxin & Xiaohan, 2022).

3.3 Insufficient Legal and Policy Support

3.3.1 Imperfect Laws and Regulations

Existing laws and regulations lack clear stipulations on the application of digital intelligence technology in the safeguarding and continuation of cultural heritage. Li Liusan, member of the National Committee of the Chinese People's Political Consultative Conference and president of the Chinese Academy of Cultural Heritage, suggested that we should focus on the prominent problems and challenges facing the field of cultural heritage, continue to enhance fundamental research, and address the "bottleneck" issues in the key core technology fields of cultural relics security as soon as possible.

3.3.2 Insufficient Policy Support

The lack of policy support specifically for the utilization of digital smart skills affects the promotion and implementation of related projects. Wang Wanfu, deputy to the National People's Congress and deputy director of the Dunhuang Academy's Conservation and Research Department, proposed that the digitization of cultural relics is an important part of the construction of Digital China, and suggested that a unified cultural relic digitization standard be formulated and issued at the national level as soon as possible, incorporating the entire process of collection, sorting, storage, processing, and use into standard specifications. Digital intelligence technology has introduced new opportunities for the protection and

inheritance of the Hexi Corridor's cultural heritage, it also faces challenges such as high technology costs, rapid technology updates, lack of professional talents, difficulties in talent training and introduction, and insufficient legal and policy support (Zhang et al., 2024). The presence of these issues has impeded the in-depth development of the protection and inheritance of the Hexi Corridor's cultural heritage, and effective solutions and countermeasures need to be implemented to address them.

4. ROOT CAUSE ANALYSIS OF THE PROBLEM

The challenges faced by digital intelligence technology in safeguarding and perpetuating the Hexi Corridor's cultural heritage are mainly rooted in the three aspects of economy, society and policy. These problems are intertwined and jointly restrict the effective utilization of digital intelligence technology in the safeguarding and continuation of the cultural inheritance.

4.1 Economic Factors

4.1.1 Insufficient Capital Investment

The economic development of the Hexi Corridor region is relatively backward, and the local government has limited financial investment in the safeguarding and continuation of the cultural inheritance. The utilization of digital intelligence technology requires a large amount of capital investment, including equipment purchase, technology research and development, and maintenance, which is a major challenge for the Hexi Corridor region (Xia et al., 2024). The operating cost of virtual reality technology is relatively high, and the operation requirements for the experiencer are also higher than those of traditional video images. In addition, the digitization of cultural relics is an important part of the construction of Digital China. It is recommended that a unified cultural relic digitization standard be formulated and issued as soon as possible at the national level, and the entire process of collection, sorting, storage, processing, and use be included in the standard specifications.

4.1.2 Insufficient Industrial Drive

The development of industries related to the safeguarding and continuation of the cultural inheritance, such as the cultural and creative industries, has lagged behind, making it difficult to form an effective economic feedback mechanism (Stauffer, 2021). Although Gansu Province has made certain achievements in cultural heritage protection, there are still

deficiencies in the growth of cultural and creative industries, making it challenging to support the safeguarding and continuation of cultural heritage through industrial revenue.

4.2 Social Factors

4.2.1 Insufficient Public Awareness

The public lacks awareness of the importance of protecting and inheriting cultural heritage, and their participation is low. Although Gansu Province has strengthened the publicity and education of cultural heritage through various means, the public's participation is still low, and they lack initiative and enthusiasm in protecting cultural heritage.

4.2.2 Serious Brain Drain

Due to the limitations of regional economic development and employment opportunities, there is a serious loss of professional talent. The intersection of digital technology and cultural heritage protection requires professional talents with interdisciplinary knowledge, but there is a large gap in this regard in the Hexi Corridor region. At present, cross-disciplinary compound talents who can truly combine technology and art are extremely rare. Digital art requires compound talents who understand both technology and art (Liu & Ge, 2024). In addition, how to achieve interdisciplinary talent training, create talents who are proficient in digital technology and have artistic thinking, promote the rational layout of technical talents, encourage technical talents to innovate boldly, and realize the linkage of production, learning, research , and practical utilization in an unconventional way depends on the overall coordination of enterprises, universities, art groups, and government departments.

4.3 Policy Factors

4.3.1 Inadequate Policy Implementation

The implementation of the national policies in the Hexi Corridor region is difficult and the policy implementation effect is not ideal. Although Gansu Province has formulated a series of implementation opinions on the reform of cultural relics protection and utilization, it still faces many challenges in the specific implementation process.

4.3.2 Insufficient Policy Targeting

The lack of policy support specifically for the utilization of digital intelligence technology makes it difficult to meet the actual needs of

chemical fertilizers, and the preservation and transmission of cultural heritage. Li Liusan, member of the National Committee of the Chinese People's Political Consultative Conference and president of the Chinese Academy of Cultural Heritage, suggested that we should continue to strengthen basic research around the outstanding problems and challenges facing the cultural heritage field, and address the "bottleneck" problems in the key core technology fields of cultural relics security as soon as possible to make up for the shortcomings and weaknesses. In addition, the digitization of cultural relics is an important part of the construction of Digital China. It is recommended that a unified cultural relics digitization standard be formulated and issued as soon as possible at the national level, and the entire process of collection, sorting, storage, processing, and use should be included in the standard specifications (Wang, 2015). By digital technology in the safeguarding and perpetuation of cultural heritage of the Hexi Corridor are rooted in the combined effects of insufficient capital investment, lagging industrial development, insufficient public awareness, serious brain drain, inadequate policy implementation, and insufficient policy targeting. The presence of these issues has impeded the profound advancement of the safeguarding and perpetuation of the cultural heritage of the Hexi Corridor, and effective solutions and countermeasures need to be adopted to deal with them.

5. PRESERVATION AND PERPETUATION OF THE HISTORICAL AND CULTURAL HERITAGE OF THE HEXI CORRIDOR IN THE DIGITAL AGE

5.1 Strengthen Technology Research and Development and Innovation

In the digital era, the protection and inheritance of the historical and cultural heritage of the Hexi Corridor faces unprecedented opportunities and challenges. In order to effectively respond to these challenges and achieve sustainable development of cultural heritage, it is necessary to explore a path for the protection and inheritance of the Hexi Corridor from multiple aspects, including technology research and development and innovation, talent training, laws and regulations, and policy support.

5.1.1 Promote the Digitization of Cultural Relics

The digitization of cultural relics is an important means of protecting cultural heritage in the digital age . Through high-precision three-dimensional scanning, digital modeling and other technologies, cultural

relics can be digitally archived and permanently preserved (Blake, 2000).

The Dunhuang Academy has completed the digital image acquisition of 289 caves in the Mogao Grottoes, covering an area of 28,100 square meters. Using technologies such as virtual reality (VR) and augmented reality (AR), the public can be provided with an immersive cultural heritage experience, enhancing their understanding and interest in cultural heritage.

5.1.2 Utilizing Big Data and Artificial Intelligence Technologies

The utilization prospects of big data and artificial intelligence technologies in cultural heritage protection are broad. By analyzing the monitoring data of cultural heritage, potential damage can be predicted and protective measures can be taken in advance (Yu, 2008).

The use of AI technology to efficiently monitor and dynamically analyze the atmospheric environment, ancient building damage, exhibition hall temperature and humidity, and visitor flow can provide a scientific basis for the safeguarding of cultural heritage. Meanwhile, artificial intelligence technology can also be used for the intelligent restoration and reconstruction of cultural heritage, improving the efficiency and accuracy of restoration work.

5.1.3 Conduct Interdisciplinary Research and Cooperation

The safeguarding and continuation of the cultural inheritance is a complex systematic project that requires the collaborative efforts of multiple disciplines. Strengthening cooperation with universities and research institutions and conducting interdisciplinary research can provide more comprehensive and in-depth technical support for the safeguarding of cultural heritage (Yin, 2023).

The National Museum of China and the Communication University of China jointly produced an original cultural relic revitalization stage play, which achieved an innovative display of cultural heritage through interdisciplinary cooperation.

5.2 Cultivate and Introduce Professional Talents

5.2.1 Strengthen Professional Education in Cultural Heritage Protection

Cultivating professionals with interdisciplinary knowledge is the key to solving the problem of talent shortage. Colleges and universities should set up majors related to cultural heritage protection, strengthen professional education, and cultivate compound talents who are proficient in both technology and art (Xu, 2022). Hexi University has established a cultural

heritage digital education platform to carry out cultural heritage protection education for students and the public.

5.2.2 Providing Vocational Training and Practice Opportunities

In addition to professional education, vocational training and practical opportunities should be provided for in-service personnel to improve their professional skills. Technical exchanges and talent cultivation in the field of cultural heritage protection should be strengthened through training courses and seminars. In addition, enterprises are encouraged to cooperate with universities and scientific research institutions to provide students with internship and practical opportunities to promote the effective connection between talent cultivation and actual needs.

5.2.3 Optimizing the Talent Environment to Attract and Retain Talents

Improving the working environment and increasing remuneration are important measures to attract and retain professional talents. Local governments should introduce relevant policies to improve the remuneration level of cultural heritage protection workers, improve working conditions, and provide a good development environment for talents. At the same time, by establishing a talent incentive mechanism, individuals and teams that have made outstanding contributions to cultural heritage protection work can be commended to stimulate the enthusiasm and creativity of talents (Zhu, 2024).

5.3 Improve the Legal System and Policy Support System

5.3.1 Strengthening the Construction of Laws and Regulations

Formulate laws and regulations specifically for the use of digital technology in the safeguarding and continuation of the cultural inheritance, standardize the utilization of technology, and safeguard the legitimate rights and interests of cultural heritage. It is recommended that a unified cultural relic digitization standard be formulated and issued as soon as possible at the national level, and the entire process of collection, sorting, storage, processing, and use be included in the standard specifications.

5.3.2 Introducing Special Policy Support

Introduce specific policies to support the utilization of digital technologies in the safeguarding and continuation of the cultural inheritance, including financial support and tax incentives. The government can encourage enterprises and social organizations to engage in cultural heritage safeguarding projects by setting up an additional trust

fund and providing tax exemptions. Enhance oversight and assessment of policy implementation to ensure the effective execution of policies.

5.3.3 Promote Open Sharing of Cultural Heritage Resources

Strengthen the open sharing, development and utilization of cultural relics resources, data and information, and realize the resource sharing of publicly available cultural relics data. By establishing a cultural heritage database, facilitating the sharing and circulation of information on cultural heritage and providing data support for the preservation and continuation of cultural heritage. At the same time, encourage social forces to engage in the safeguarding and perpetuation of cultural heritage, and create a positive environment for the participation of the entire society.

5.4 Expand Channels for the Dissemination and Utilization of Cultural Heritage

5.4.1 Innovate the Way of Spreading Cultural Heritage

Use digital intelligence technology to innovate the way cultural heritage is disseminated and improve its visibility and influence. Realize the digital dissemination of cultural heritage through virtual museums, online exhibition platforms, digital media and other means. Combine emerging formats such as online variety shows, online live broadcasts, and online performances to derive new cultural products and services and enrich consumers' aesthetic experience.

5.4.2 Facilitating the Revitalization of and Access to Cultural Heritage

The revitalization of cultural heritage is an important way to achieve enduring advancement of cultural heritage. By developing cultural and creative products, holding cultural activities, and creating cultural experience projects, cultural heritage can be integrated into modern life and the public's sense of belonging and participation in cultural heritage can be enhanced. The historical and cultural cities in the Hexi Corridor have achieved the revitalization of cultural heritage by developing cultural and creative products and holding situational stage plays.

5.4.3 Strengthen Cultural Heritage Education and Public Participation

Enhancing the public's understanding and awareness of cultural heritage is crucial for its safeguarding and perpetuation. Through cultural heritage education activities, we can raising the awareness of the public and appreciation of cultural heritage. Simultaneous, we can establish a public engagement platform to motivate individuals to take part in cultural

heritage protection and inheritance activities, fostering a positive environment for societal involvement.. The digital era offers novel prospects and challenges for safeguarding and perpetuating the historical and cultural heritage of the Hexi Corridor. By strengthening technological research and innovation, cultivating and introducing professional talents, improving the legal and policy support system, and expanding the channels for the dissemination and utilization of cultural heritage, we can effectively address the current challenges and promote the sustainable development of the historical and cultural heritage of the Hexi Corridor.

6. DISCUSSION AND OUTLOOK

proposes corresponding solutions through an in-depth analysis of the utilization status, challenges and root causes of digital intelligence technology in the safeguarding and continuation of the cultural inheritance in the Hexi Corridor. Digital intelligence technology has brought new opportunities for the safeguarding and continuation of the cultural inheritance in the Hexi Corridor, but it also faces challenges such as high technical costs, shortage of professional talents, and insufficient legal and policy support. By strengthening technological research and innovation, cultivating and introducing professional talents, improving the legal and policy support system, and expanding the channels for the dissemination and utilization of cultural heritage, these challenges can be effectively addressed and the enduring progress of cultural heritage in the Hexi Corridor can be promoted. In the future, we should further enhance the research on the application of digital intelligence technology in the safeguarding and perpetuation of cultural heritage, and promote technological and model innovation. It is recommended that subsequent research focus on the long-term effects of digital intelligence technology in the safeguarding and continuation of the cultural inheritance, as well as how to better combine local characteristics and cultural needs to achieve the revitalization and sustainable advancement of cultural heritage. Moreover, it is essential to enhance international cooperation and exchanges, draw on international best practices, and elevate the overall level of cultural heritage protection and inheritance in the Hexi Corridor.

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