

Digital Technology to Promote the Construction and Utilization of the Grand Canal National Culture Park—A Case Study of Hangzhou Section

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Abstract: As a key task in the 14th Five-Year Plan period, the construction of the Grand Canal National Culture Park, China has successively promulgated various development programs and special plans from the national to the local level, forming a special planning system for specific regions. Hangzhou City, Zhejiang Province, also attaches great importance to the construction of the Grand Canal (Hangzhou Section) National Culture Park, and coordinates the protection and inheritance of the culture of the Grand Canal in a high-quality manner. Based on the existing resources and construction situation of the Grand Canal (Hangzhou section), this paper conducts field research within the scope of the construction of the Grand Canal National Culture Park in Hangzhou section aiming to find out the problems of the current digital construction, summarize and refine the digital protection-construction-utilization path by combining with the advanced digital technology. And it ultimately puts forward proposals of digital integration and development of the Grand Canal National Culture Park for the canal cities of the whole country and even the world.

1. Introduction

National Culture Park is a new concept innovatively put forward by China in 2017. This project which can integrate existing important resources and own a variety of functions such as protection, inheritance and utilization, cultural education, public service, etc. It is a public cultural carrier with a specific open space. In December 2019, the issuance of the "Great Wall, Grand Canal and Long March National Culture Park Construction Program" was issued, marking the normalization of the Grand Canal National Culture Park construction project. The construction of the project is conducive to the protection of historical relics and cultural treasures handed down from our ancestors, while helping to optimize the supply of cultural tourism in China to meet the people's higher demand for leisure and entertainment. With the development of science and technology, digital technologies such as big data, artificial intelligence, 5G continue to emerge, forming a huge impact on the traditional culture and tourism industry. The improvement of production efficiency and the transformation of the economic development model brought about by high-tech make digitization and intelligence an important direction for the future development of the industry. For the research on the digital construction of the Beijing-Hangzhou Grand Canal and Grand Canal National Culture Park, many experts and scholars have provided many valuable suggestions at the macro level, but the members of this project team have found that the existing researches have not clearly compiled a summary of the digital development mode of the Beijing-Hangzhou Grand Canal National Culture Park as a whole. Therefore, this paper takes the Grand Canal National Culture Park (Hangzhou Section) as the research object, summarizes its current digital technology achievements, creatively analyzes and summarizes the construction path model of the Grand Canal National Culture Park (Hangzhou Section), and

explores the problems in the construction of the project through field interviews, aiming at put forward scientific and reasonable digital reform and development suggestions for the construction of the Grand Canal National Culture Park and other canal cities in the world.

2. Background of the Digitized Foundation of the Grand Canal National Culture Park (Hangzhou Section)

In July 2019, the central government adopted the Construction Plan for the Great Wall, Grand Canal, and Long March National Culture Park, which emphasized the need to make full use of existing facilities and digital resources, establish online facilities such as official websites and digitization platforms, use modern technology to promote the digital reproduction of cultural relics and cultural heritage resources and create cyberspace for the protection of the Grand Canal's digital technology and the development and sharing of resources. In recent years, Hangzhou, as the starting point of the Beijing-Hangzhou Grand Canal, has been committed to promoting the digital protection, inheritance and promotion of the Grand Canal World Heritage. From the idea of Building a digital Hangzhou put forward by Hangzhou in 2022 to Opinions on Promoting the Application of Digitization of Non-legacy Heritage issued by Hangzhou in 2023, it is proved that "digitization" has played an important role in the development of the Grand Canal. In particular, the "Digital Canal" management system established by Hangzhou in 2022 in the context of digital heritage protection, which combines the actual situation of Hangzhou with local conditions provides digital technical support for the living protection and inheritance of the World Heritage of the Grand Canal in an all-round, systematic and effective way as far as possible.

2.1. Existing Resources of the Grand Canal National Culture Park (Hangzhou Section)

The existing resources of the Grand Canal consist of four parts which are material cultural resources, intangible cultural resources, existing natural and humanistic landscape resources and existing water environment resources. So, the utilization of the abundant resources of the Grand Canal (Hangzhou section) has become an important issue nowadays.

The World Cultural Heritage of the Grand Canal (Hangzhou section) is a material cultural resource composed of two heritage areas of the Jiangnan Canal and the Zhedong Canal, seven World Cultural Heritage sites within the Grand Canal, and three parts of the important remains along the route, including municipal-level cultural heritage. In the process of the protection, inheritance and utilization of the Grand Canal culture and the construction of the National Culture Park, Hangzhou actively builds its digital experience platform. It utilizes modern technology to realize the digital reproduction of cultural relics and the informatization management of the cultural heritage, and construct a complete database of cultural heritage to collect the digital files of the various point segments of the Canal, so as to strengthen the protection and inheritance of the tangible cultural heritage of Hangzhou section of the Grand Canal.

The Intangible cultural resources of The Grand Canal (Hangzhou section) include traditional folklore, traditional festivals, traditional music and traditional crafts and culture, which are composed of national and municipal intangible cultural heritages and other related intangible heritages. Hangzhou organizing activities regularly for the protection of cultural heritage related to the Grand Canal launches vivid and rich contents such as small programs, online guides, interactive games and classes related to the Grand Canal Cloud Experience, which effectively realizes the digital inheritance and protection of intangible heritage.

The existing natural and humanistic landscape resources, due to the complexity of their composition including some once important landmarks and some river channels, ecological wetlands, hilly mountains, polder fields and characteristic vegetation coexisting with the ecosystem of the Grand Canal, etc., is now utilized rationally mainly through unified planning, unified management, hierarchical responsibility, and overall coordination. Specifically taking the river protection and development as an example, the "Beijing-Hangzhou Canal Zhejiang Section Intelligent Construction, Management and Maintenance Science and Technology Demonstration Project", which was implemented on October 26, 2023, has solved the second channel of the Canal by focusing on the

'whole-process intelligent construction, whole-life digital management and maintenance'. The project solves the problem of the second channel of the canal by focusing on 'whole process intelligent construction, whole life digital management and maintenance', and effectively applies digital technology to the restoration and utilization of the river.

The water environment of the Hangzhou section of the canal which consists of the Qiantang River Basin and Taihu Lake Basin, covers a large area with varying water quality conditions. And in order to achieve unified supervision and remediation, Hangzhou has taken all 100 tributaries along the canal into the monitoring scope during the period of 2014-2019, explored and constructed a "1+1+N" intelligent water management system (i.e. 1 big data platform, 1 core scenario and N district and county applications), striving to achieve full coverage of water quality monitoring basins. Through an important multi-functional digital platform - the "Beijing-Hangzhou Canal Water Environment Information Management System", the ecological environment is transformed digitally, realizing the information monitoring summary and modernized management of the canal and guaranteeing the long-term stability of the canal water quality.

2.2. Policy Background of Digitization Construction of the Grand Canal National Culture Park (Hangzhou Section)

In recent years, policy support has pointed out the direction for specific project works on the application of digitization in the whole chain of cultural heritage protection, traceability and adaptive use, and provided a solution path for the topic of resource protection, development and value transformation. Figure1 below is a policy support map that adds the specifics of relevant policy support.

Administrative subdivision (e.g. of provinces incountries)	Timing	Policy	Concrete content
China	2022-06-15	The General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the Opinions on Advancing the Implementation of the National Strategy for the Digitization of Culture	By the end of the 14th Five-Year Plan period, a cultural digitalization infrastructure and service platform will have been basically built, and a three-dimensional cultural service supply system integrating online and offline will have been formed. By 2035, a national cultural big data system will have been completed, realizing the sharing of the fruits of the digitization of Chinese culture by all people.
	2022-08-26	The General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the Cultural Development Plan for the Fourteenth Five-Year Plan.	Integrate a number of important cultural resources represented by the Grand Canal, insist on the protection and inheritance of cultural relics and non-heritage in the whole process, and systematically promote key infrastructure projects, such as digital reproduction. Focus on excavation and protection of the main functional areas, implement park management and operation, and create an important symbol of Chinese culture.
	2022-10-16	Report on the "Twentieth Party Congress"	Implementation of the national strategy for the digitalization of culture.
Zhejiang Province	2022-06-27	Report of the Fifteenth Congress of Zhejiang Province	Promote the strategy of cultural digitization, create a national digital cultural innovation base, strengthen the integration of culture and tourism and international dissemination of the provincial brand.
Hangzhou city	2022-02-01	Program on the Protection, Inheritance and Utilization of the Grand Canal Culture in Hangzhou and the Construction of the National Cultural Park	Hangzhou will focus on building ten landmark projects including the Beijing-Hangzhou Grand Canal Museum, the Grand Canal Hangzhou Steel Industrial Site Comprehensive Protection Project, and the Canal Digital Twin Platform.
	2023-09-20	Circular of the General Office of Hangzhou Municipal People's Government on the Issuance of the Action Plan for Accelerating the Construction of the International Cultural and Creative Center of Hangzhou (2023-2025)	In-depth implementation of cultural digitization strategy, improve and perfect the integration of cultural science and technology innovation system, build and make good use of "cultural and creative e-point pass" and other cultural enterprises digital intelligence application service platform. In-depth promotion of Hangzhou excellent traditional cultural resources digitalization, network dissemination. Support the content creation and production of digital communication and cultural product research and development, explore the use of digital means to develop Liangzhu culture, West Lake culture, the Grand Canal culture, Song culture and other characteristics of cultural IP products, to create a number of phenomenal digital cultural brands with Chinese style, in line with the international market, the formation of digital cultural brand matrix, accelerate the cultural "go global. The pace of "going out" of culture will be accelerated.
Lirping district	1905-07-13	Three-Year Action Plan for the Protection, Inheritance and Utilization of the Grand Canal Culture and the Construction of the National Cultural Park in Lirping District of Hangzhou City	It focuses on building a youth entrepreneurship base in Hangzhou metropolis and a digital culture innovation port, and strives to build a modern digital intelligence platform in Lirping and an internationalized talent gathering place in Hangzhou.
Gongshu district	2023-11-09	Implementation Opinions on Encouraging Digital Innovation and Development of Cultural Industries	Incentives for cultural and creative enterprises to digitally empower the powerful canal IP. The proposed high level of public cultural quality enhancement project board proposed to continue to promote the "Grand Canal Culture" logo project, to create a brand of public cultural activities in the Grand Canal ip high quality to promote public cultural space enhancement project to elaborate the planning of the Grand Canal National Cultural Park Gongshu project group.

Figure 1 Digital Construction Policy

3. Key Technologies and Applications of the Grand Canal National Culture Park (Hangzhou Section)

3.1. New Media Technologies and Specific Applications

New media technology mainly refers to a series of media forms and tools that are based on modern information technology, communication technology, etc. and combined with computer technology, network technology, multimedia technology in order to realize the production, dissemination and interaction of information [1]. New media technology, with its characteristics of multimedia, real-time, interactive and data characteristics, as well as the advantages of diverse forms of expression and real-time information dissemination, organically integrates and disseminates graphic, audio and video and other forms of content through the Internet, mobile networks and other means to achieve a wide range of dissemination, interactive sharing.

In order to effectively pass on and protect the historical and cultural heritage of the Hangzhou section of the Beijing-Hangzhou Grand Canal, the Hangzhou Municipal Government has actively promoted modern mass media, which transforms a single cultural mode into an all-encompassing mode of communication in the era of integrated media by means of digitized technical means, such as the shooting of short videos, audio podcasts, and graphic recordings. Hangzhou has also made use of online media to establish public numbers such as "the Beijing-Hangzhou Grand Canal Scenic Spot" and "Hangzhou Grand Canal Historical and Cultural Neighborhoods" to disseminate canal culture in a digitalized way and to facilitate publicity and communication. The Hangzhou Municipal Government also actively guides and encourages universities and scientific research institutions to promote the protection and inheritance of the Grand Canal culture by utilizing modern technological means, such as advertisement contests, photography contests and short video contests. For example, in 2022, a short video competition "I am in Jiangnan, Poetry about the Grand Canal" was held to encourage university students to actively protect and pass on the culture of the Grand Canal in the context of new media communication, and the works were disseminated and displayed through the Internet and short video platforms. The Hangzhou Municipal Government also actively promoted the participation in the filming of the documentary "Canal Talk", spreading the influence of the Grand Canal culture to the whole country and even the whole world. These activities and publicity efforts have also been integrated into the "Things about the Grand Canal" audio mini-course through online news focuses, the Yunyou Canal mini program, the guide map for guarding the heritage sites of the Grand Canal, and the appreciation of couplets, etc., so as to enable more people to understand and recognize the culture of the Hangzhou section of the Grand Canal in the form of audio.

3.2. AR, VR Technology and Specific Applications

Virtual Reality (VR) Technology is based on modern high technology with computer technology as the core. It is a comprehensive technology that generates highly realistic three-dimensional environment in many aspects, such as vision, hearing, and touch by using computer to build simulation environment. At the same time, it is also necessary to use virtual reality helmets, three-dimensional mouse and other hardware devices to allow participants to experience things in virtual space in real time, interact with a variety of objects in the virtual world, manipulate people and things in the virtual world and get instant feedback, so that participants can get immersive feelings and experiences experience the sense of immersion and achieve the effect of immersive experience [2].

Augmented Reality (AR) Technology is the technology of superimposing virtual information into the real environment which has a wide range of applications. The future development trend of the technology includes the improvement of hardware equipment, the enhancement of user experience, and the strengthening of privacy and security protection, etc. The principle of AR Technology is to organically combine real scenes with virtual information through technological means of computer vision, sensors, localization, and image recognition to create a brand-new scene experience. By wearing special glasses or using mobile devices, users can superimpose and integrate virtual objects or information with the real physical environment to achieve real-time online interaction [3].

The Beijing-Hangzhou Grand Canal Museum has innovated exhibition and display methods to present a lifelike cultural scene of the Grand Canal to the public. The museum provides a real-time

demonstration of heritage sites along the Grand Canal such as Hangzhou's Qiaoxi Historic District, Fuyi Cang, and Gongchen Bridge, allowing visitors to see the heritage sites on site at the museum, providing an unprecedented visiting experience. The pavilion not only strives for excellence in exhibits, but also fully utilizes AR and VR technologies to vividly display the river engineering and technical principles of the Grand Canal, so that the audience can fully experience the profound history and cultural heritage of the Grand Canal. In order to meet the exhibition needs of audiences of different ages, the museum has also specially arranged multimedia animation explanation, interactive game experience and other exhibits, enabling the audience to understand and feel the culture of the Grand Canal more vividly and intuitively. The museum actively develops the digital brain, and integrates three digital exhibits, namely " the Grand Canal Brain ", "the Grand Canal Star Spectrum ", and "the Grand Canal Wall of Everything ", to present the history, characters, cultural relics, and attractions related to the canal in a three-dimensional and complete manner, which helps audience better enjoy the culture of the Grand Canal at one stop in the Beijing-Hangzhou Grand Canal Museum.

3.3. Digital Image Correlation Technology and Specific Applications

Digital Image Correlation Technology is a non-contact optical measurement technique, the basic principle of which is to divide the delineated area in the image before deformation into pixel units and use digital photography technology obtain a digitized scatter image of the DUT surface. Next, this scatter image is processed using digital image processing techniques to match the geometric points on the DUT surface and track the positional changes of the geometric points in order to obtain the deformation information of the DUT surface [4].

In order to protect and pass on the world cultural heritage of Gongchen Bridge in Hangzhou, the Comprehensive Protection Center of the Beijing-Hangzhou Canal (Hangzhou Section) has established cooperation with Zhejiang University to jointly carry out the project of archaeological research and restorative display of Gongchen Bridge architecture. The project aims at conducting an all-round research and display of Gongchen Bridge through 3D digitization means, providing scientific and accurate data and valuable reference for educational development, public display and archaeological research. The project includes a variety of technical means, such as 3D laser scanning, multi-image 3D reconstruction, and drone tilt photography, to collect data in an all-round and dead-angle-free way, so as to complete the 3D digitization of the Gongchen Bridge. The center can use these accurate 3D model and orthophoto map data to realize the comprehensive systematic management of Gongchen Bridge and the protection of its cultural relics value, and carry out public education through these data to let more people understand the history and culture of Gongchen Bridge. It provides real and reliable references for the exhibition and display of the 3D model and orthophoto map data, truly reproducing the historical elegance of Gongchen Bridge.

In addition, the project has developed a set of high-precision three-dimensional models and on-site photos, orthophotos, 360-degree panoramic linkage of ancient building restoration display platform. The platform provides visitors with a more realistic and detailed restoration display of ancient buildings by combing the 3D model with on-site photos, orthophotos and 360-degree panoramas. The implementation of this digital preservation project offers new possibilities to the protection and inheritance of cultural heritage, and the young provide new ideas and methods for the digital preservation project through their own professional knowledge and innovation ability.

4. Field Research

4.1. Practical Purpose

After following the online research and consulting the relevant literature, the author has formed a more systematic knowledge of the overall situation of digitization in Hangzhou, in order to more specifically understand the problems in the construction of the Grand Canal National Culture Park (Hangzhou section) and then follow up on the digitization of the scenic area to put forward targeted recommendations. The author offline investigates the points related to the construction and conducted interviews with the local tourists and the relevant builders. The research route mainly takes the

"Hangzhou Grand Canal National Culture Park Plan" as the program, the important window of the Grand Canal cultural research as a supplement, and the ten core display gardens mentioned in the above plan as the basis for the division of the thematic display spatial pattern, which were visited in the field. The ten core exhibition gardens are the physical exhibition spaces of the Grand Canal National Culture Park (Hangzhou section), which embodies the core value characteristics of the Beijing-Hangzhou Grand Canal (Hangzhou section).

4.2. Course of Action

The offline interviews were conducted in six days. According to the ten core display parks and important windows for the study of the Grand Canal culture, 20 heritage protection sites were visited. The author actively interviewed 66 people and 32 valid interview records, with the interviewees including residents, foreign tourists, and some staff members after collecting and sorting out. The interviews covered a wide range of ages and occupations, from children to the old, and from farmers to photographers. The interviews, the key questioning direction of which is digital technology were personalized according to the interview outline and the background characteristics of the people, and personalized questions were asked according to the specific interview location. Table 1 shows the outline of this interview, which is designed from five major directions: entry scenarios, content experience, symbolic identification and emotional docking, as well as identification and imagination. The purpose is to understand the perception of the local residents and tourists on the Grand Canal National Culture Park (Hangzhou section), satisfaction with the current construction situation and future suggestions.

Table 1 Synopsis of an Interview

Into the scene	Basic information	1. What channels did you learn about the scenic spot? 2. What kind of online channel do you like most to know about the scenic spot? 3. Do you think the online publicity work of this scenic spot is adequate?
Content Experience	Overall Perception	1. What is your overall satisfaction with this tour? Please answer the following questions with your tour experience and the six functions of the scenic spot.
	Conservation and Inheritance	1. What is your satisfaction with the digitalization of the scenic spot in all aspects? 2. What aspects of digital technology do you think have provided you with convenient or novel experiences during your visit? 3. What do you think are the shortcomings of the scenic spot, especially in terms of digitalization, and what suggestions do you have?
	Utilization	
	Culture and Education	
	Public Service	4. What is your demand for the future digital construction of the scenic spot?
	Tourism	
	Recreation	
Scientific research		
Symbol Recognition and Emotional Docking	Subjective Evaluation	1. What is your evaluation of the culture of the Grand Canal after the tour? 2. What new things have you learned after the tour?
Recognition and Imagination	Attitudinal Perception	1. Would you like to visit this place again or recommend others to visit this place?

4.3. Interview Findings

4.3.1. Cultural Attributes for Future Digitization

The results of the interviews show that Hangzhou citizens and visitors are most concerned about the cultural attributes of the construction of the Grand Canal National Culture Park, followed by

public service attributes. In terms of actual experience, they pay more attention to the convenience and benefits of the project. At the same time, there are some problems in ecological protection, management system, etc. Overall, the feedback satisfaction of the construction is high, but there are still some aspects that need to be improved.

4.3.2. Some museums lack novelty in digital presentation

The lack of innovation in the internal displays and activities of museums fails to attract more visitors and enhance the interactive experience of visitors. For example, the current interactive experience of museums is mainly through the demonstration display of exhibits and computer interactive facilities, etc. However, these methods lack interactivity and visitors cannot participate in them. To a certain extent, it weakens the relationship between museums and their audiences, and also weakens their attractiveness to tourists.

4.3.3. The development of tourism-type attractions is uneven, and the flow of people in some ancient towns is low

Gongchen Bridge and the surrounding three major historical and cultural districts have now become key popular tourist hit points, but some ancient towns such as the Tangqi Ancient Town, westbound across the pond line pier and other ancient town monuments are still not enough publicity. In contrast, the flow and visibility of people in these towns are significantly lower.

4.3.4. The approval of cultural relics is inefficient and digitized efficient feedback mechanism is lacked

For example, residents of Tangqi Ancient Town respond that the government renovation has failed to better preserve the monumental heritage, and residents of Xixing Wharf react that the government renovation has failed to achieve the desired results. The approval process is cumbersome, and the declaration time is long. Some of the projects are not satisfied by the public in terms of the quality of the construction and the degree of completion.

4.3.5. Some of the infrastructure is not well developed and the digital guide system still needs to be upgraded

For example, there is a lack of public restrooms and stores for food in some parks. The public instructions are not clear, so that it is not possible to find the information desk in time, and it is even more difficult to find it when there is a large flow of people. This not only affects the visitors' experience, but also affects the image and development of the city.

5. Theoretical Path Analysis of Digital Construction of the Grand Canal National Culture Park

Based on the relevant requirements of the Program for the Construction of the Great Wall and the Great Canal and the Great March National Culture Park and the Plan for the Construction and Protection of the Grand Canal National Culture Park, this paper carries out the digital exploration of the construction, utilization and protection in accordance with the four types of functional zones, namely, control and protection zone, thematic display zone, culture and tourism integration zone, and traditional utilization zone. Figure 2 above shows the theoretical theory roadmap. In order to clearly define the focus of differentiation in construction and protection and to explore the theoretical path of digitizing the construction of the Hangzhou section of the Grand Canal National Culture Park, we should focus more on exploring the intrinsic links between the four functional reserves and the theoretical pathways.

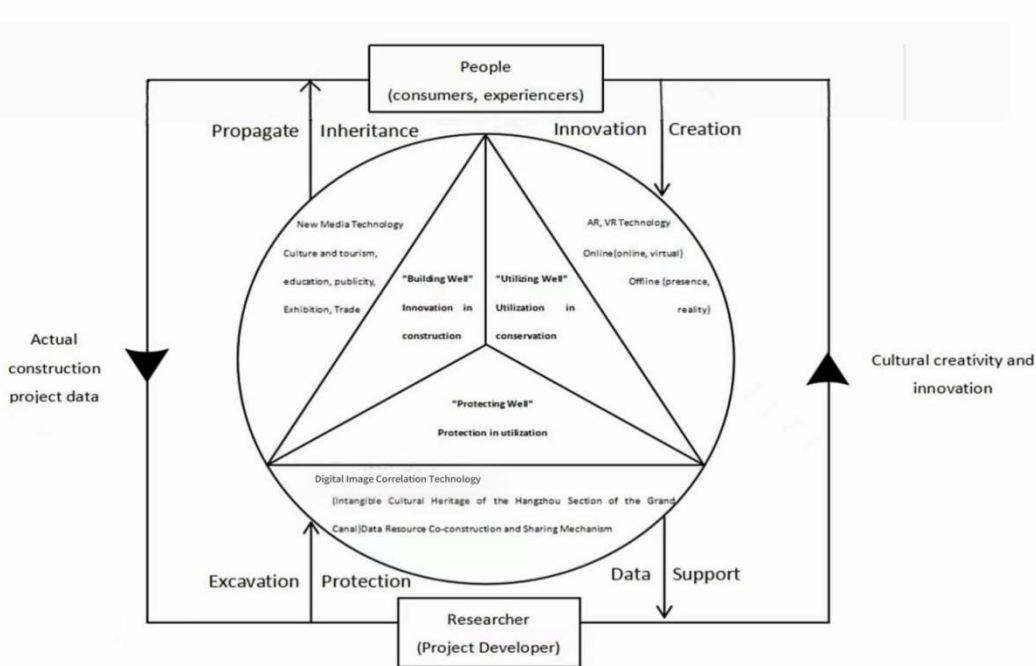


Figure 2 Digital Construction Theoretical Roadmap

5.1. Building Well

Mainly focusing on the "Theme Exhibition Area" and "Culture and Tourism Integration Area", it emphasizes innovation in construction, accelerates the completion of the Grand Canal National Culture Park through new media technology, and digitally builds the Hangzhou section of the Grand Canal. The material space of the Hangzhou section of the Grand Canal includes both the initial environment and architectural structures, as well as the construction and implementation of all material environments, such as the secondary remodeling of buildings. In the construction process, new media technology not only provides technical empowerment for the landscape digitization in the Grand Canal National Culture Park (Hangzhou Section), but also helps the intangible cultural heritage to break the time and space limitations and realize efficient dissemination, which greatly enhances the popularity and influence of the Grand Canal culture. At the same time, it helps the Grand Canal National Culture Park to jump out of the shackles of the resources-based approach to the macroscopic digitization from the business-based approach to the construction of the Grand Canal, which will in turn boost the synergistic development of tourism in all provinces and cities along the canal. On the one hand, it realizes the further integration of culture and tourism and plays a positive role in the local economy; on the other hand, it helps to inherit the culture of the Grand Canal, increase its popularity and realize the effective inheritance of cultural heritage.

5.2. Utilizing Well

Mainly focusing on the "traditional utilization zone", the "online + offline" experience of intangible cultural heritage is realized through Virtual Reality Technology and Augmented Reality Technology, so as to promote its modernized digital development and living inheritance, and to realize protection in utilization. Adhering to the idea of not only keeps the content of the Grand Canal intangible cultural heritage unchanged, but also encourages the diversification and modernization of its forms of utilization. And it should also attract the public to understand the culture of the Grand Canal, participate in the actual protection of the Grand Canal, and carry out reasonable utilization and development. The digital development and protection management system of the cultural heritage is utilized to fully excavate the potential of digital utilization of the Grand Canal intangible cultural heritage, analyze the cultural connotations of the Grand Canal in the new era, study the composition of its value, and broaden new development ideas for cultural exchanges along the canal. New ideas for cultural exchanges along the canal are needed to be developed and in-depth excavation and

organization of cultural heritage resources of the Hangzhou section of the Grand Canal are needed to be carried out. Links are established between important nodes in the linear space of the cultural heritage of the Grand Canal, thus retaining the overall data of the cultural heritage of the Grand Canal. For sustainable development and utilization, to speed up the construction of a modernized platform that can store the data for a long period of time, to make in-depth correlation and display between the resources can work a lot. In order to realize sustainable development and utilization, the construction of a modern platform for long-term data storage will be accelerated, and the resources can be deeply related and displayed, thus meeting the needs for storage, control and dissemination of the cultural heritage resources of the Grand Canal.

5.3. Protected Well

Mainly focusing on the "Control and Protection Zone", the Intelligent Digital Protection of Intangible Cultural Heritage of the Hangzhou Section of the Grand Canal is carried out with the objective of digital reproduction by means of Digital Image Correlation Technology, so as to realize the inheritance in the protection. It is also necessary to excavate the characteristics, historical and cultural connotations and contemporary values of the intangible cultural heritage to carry out innovative protection of culture. The timely collection, organization and storage of data, documents and images related to the Grand Canal are essential. The data monitoring and analysis system is expected to be improved and refined. Building a data protection system that extends from research, application to the return of integrated results to the data can continuously improve the planning, design and operation of the construction of the National Culture Park of the Grand Canal. At the same time, the work support of multiple departments such as culture and tourism and the development support of related industries give full play to the maximum value of data assets through data sharing. Focusing on optimizing the ability of municipal governments of various states and cities in the province to grasp related data and information resources as early as possible, powerfully improves the related work efficiency, and realizes the omni-directional and synchronous application of big data for the construction of the Grand Canal National Culture Park in the whole of Zhejiang Province.

5.4. Summary of Pathways

Analysis of China's current predicament of building National Culture Parks, as well as the difficulties in the construction of the Grand Canal National Culture Park can be found in its modernization and construction of specific paths. Due to the relative lack of research results, how to integrate the digital technology along the Grand Canal and the existing resources with the national cultural database in the background of the national cultural digitization strategy is a difficult problem to be solved. In the meanwhile, the digitization construction of the National Culture Park is mostly confined to the digitization of a single dimension, such as museums, which is also a problem that needs to be paid attention to, and how to consider the formation of multi-dimensional digitization in an integrated manner is also a major difficulty that needs to be studied. Therefore, summarizing the current construction experience of the Grand Canal National Culture Park and combining with the construction results of the Hangzhou section of the Grand Canal, it can be deduced that innovation in construction, protection in utilization, and inheritance in protection will become the relationship between the digitization construction of the Hangzhou section of the Grand Canal, which will in turn lead to the refinement of a solid and reliable theoretical path for the digitization construction of the Hangzhou section of the Grand Canal, i.e., "Construction -Utilization - Protection" common development.

6. Suggestions for the Promotion of Digital Integration Development of the Grand Canal National Culture Park

6.1. Constructing A Mechanism for the Common Construction and Sharing of Data Resources

At present, the level of cultural construction of cities along the Grand Canal in China is different, and there is also a lack of an overall linkage of the Grand Canal cultural sharing data system. All

cities along the Grand Canal should jointly create a digital Grand Canal document resource protection system, implement macro regional adjustment, do a good job in task allocation and cooperation within the region, and choose the development path of comprehensive construction. The literature administration office of each city should take the initiative to organize the printed Grand Canal literature resources in its own region, digitize, efficiently summarize and preserve the related paper literature. And each library should break down the information barriers, jointly build online information databases, create shared electronic libraries, and actively integrate into the general environment of the Beijing-Hangzhou Grand Canal literature resources construction. Relevant industries are supposed to cooperate to create the scale advantage of the Beijing-Hangzhou Grand Canal literature resources [5], and avoid duplication and waste to the greatest extent. And ultimately, the common construction and sharing of the Beijing-Hangzhou Grand Canal literature resources will be achieved, reducing the construction gap between cities along the route, and promoting the balanced development of various attractions.

6.2. Improvement of Environmental Monitoring Data Management System

Currently, the environmental management of the Beijing-Hangzhou Grand Canal lacks a systematic and hierarchical testing and management platform, and data cannot be shared among provinces and cities. So there is still room for improvement in development and construction. As a result, at the technical level, it is recommended to accelerate the construction of a perfect environmental testing management system, break the data barriers, and realize the mutual circulation of environmental information on the water quality of the Grand Canal. At the application level, it is suggested to establish a mechanism for cooperation between the government and regulatory agencies, scientific research institutions, social organizations, etc., and participate in the collection, analysis and decision-making of environmental data, forming a multi-party collaborative and highly integrated environmental protection system. Finally, it is also extremely important to expedite the cultivation of relevant personnel's comprehensive quality of digital inspection. As Wu Yixuan points out, China's construction of the system in terms of technology and equipment is gradually narrowing the gap with other countries, but some management elements such as personnel and processes are not developed enough [6]. Therefore, while improving the hard level of the perfect system, we should not ignore the improvement of the soft power of the personnel, which makes the maximum benefits of the system better utilized.

6.3. Optimizing the Grand Canal Virtual Reality System

The research found that the people are most concerned about the cultural attributes of the construction of the Grand Canal National Culture Park (Hangzhou section), and the virtual reality system is one of the important technologies for the future tourism industry to build this attribute. This technology can store culture in a safer way, display and disseminate it in a simpler way, and bring more profound experience to the people with more innovative technology. The Grand Canal National Culture Park (Hangzhou section) has begun to see results in the virtual reality technology widely used in museums, WeChat public numbers and other scenes, initially realizing the digitization of landscape cultural relics as well as the demonstration of non-heritage cultural skills.

However, there are still some problems such as the lack of real display screens, the lack of flexible operating systems, the lack of wide scope of application and relatively single modes of application. Therefore, in terms of technology, localities should speed up technological innovation, increase capital investment, cultivate relevant technical talents, optimize image quality and clarity, use higher frame rate technology to enhance visual effects and improve the interactive experience by improving the physical engine and sound design. At the same time, attention should be paid to creating a sense of realism and optimizing the details of the scene, reducing the sense of disconnection between the online and offline experience. In terms of innovative use, a number of technical exchange competitions should be created to continuously improve the level of technical awareness around the world, and appropriate subsidies and policy support should be given to stimulate the enthusiasm for the use of the technology. Advocating VR+, broadening the development of the technology's use in multiple fields, and making full use of the experience advantages brought by the technology greatly

create a new situation of intelligent cultural tourism.

6.4. Expanding New Forms of Digital Heritage Dissemination and Presentation

Nowadays, the spreading and presenting the Grand Canal heritage in domestic canal cities are traditional and single, neglecting the aesthetic experience of the masses for canal culture. For example, in the process of practice, the author finds that the ways of presentation in some museums in the scenic area that are very different from the traditional means of displaying museums lack innovation, leading to sense of boredom and aesthetic fatigue of some tourists. Each canal city should improve the problem of lack of new-style digital presentation and update the presentation mode through the cultural heritage of the Hangzhou Grand Canal section of the data collection, classification, sorting, output, feedback and reconstruction to strengthen the connection with the viewers and show the cultural charm of the cultural heritage of the Grand Canal at home and abroad. Learning advanced landscape design techniques can better combine the concrete intuitive feelings of the Grand Canal cultural heritage in the visual sense with its deep abstract connotations, realizing the sustainable development goal of the Grand Canal culture protection and inheritance by updating the aesthetic experience of the masses [7] and establishing the depth of the viewer's experience through the process of sensory perception atmosphere experience, and connotation understanding.

6.5. Promote the Development of Digital Smart Tourism

In the actual research process, some scenic spots public service construction need to be improved. For example, some infrastructure guide signs cannot guide tourists well, etc. One of the most important ways to solve this problem is to improve the construction of the digital guide system, and to accelerate the creation of digital smart tourism in general. Canal cities should adopt innovative technologies such as cloud technology and the Internet of Things to realize the intelligent upgrading of the tourism industry's network and create "intelligent scenic spots" including service optimization, management upgrading, effective marketing and high-quality experience. Scenic spots and canal culture bases need to be fully integrated into 5G networks, big data centers and other facilities to show cultural and tourism resources through digital means so that tourists can visit and browse online, promoting the digitization of cultural and tourism resources. Digital technology such as images, VR/AR, 3D holographic projection [8] should be used to integrate various types of cultural and tourism resources. Then new types of digital experience products, immersive interactive experiences, virtual reality displays and intelligent guides should be created and developed to achieve a high degree of integration of resources, and promote the display of multiple cultural values of cultural tourism resources, the progress and upgrading of "intelligent cultural tourism".

6.6. Improvement of the Mechanism of Government and People's Consultation and Co-Construction

During the construction process of the Grand Canal National Culture Park, a variety of mechanisms have been set up to listen to public opinion. People are present at various important conferences, and suggestions from the public are also collected when policies are formulated, achieving good results. However, the feedback of public opinion still lacks a more routine, systematic, concise and effective way, which has a certain room for optimization. For example, in practice, some residents react to the feedback mechanism of canal supervision with low efficiency and complicated process. In terms of feedback methods, localities should first summarize existing feedback mechanisms and then innovate them with digital technology. A new digital feedback mechanism with simpler operation and more standardized operation process should be formed. As for feedback channels, the government should consider different groups and choose appropriate channels. At the same time, the coverage of feedback should be expanded to diversify the sources of opinions, which will be helpful for making more scientific decisions. In order to improve the effectiveness of feedback, the government can add some incentive mechanisms. For example, a point accumulation and redemption mechanism can be used to encourage people to share their opinions. In addition, the results of the construction after listening to public opinion should be published regularly. In this way, the public can see the substantive impact of the feedback, which helps to strengthen the trust between

the government and the people. While improving the feedback mechanism, the publicity of the mechanism should also be strengthened to make it enter people's lives and be more easily seen by the public, so as to enhance people's awareness of the supervision and feedback mechanism. The supervision and feedback platform should also publish more complete information related to the construction of the Grand Canal National Culture Park to ensure that the people have a more comprehensive knowledge of the construction status and reduce the impacts of the information gap in the feedback process, facilitating the people to put forward more effective suggestions and proposals. The information should also be published on the supervision and feedback platform to ensure that the public has a more comprehensive knowledge of the construction status and reduce the impact of poor information in the feedback process, which is conducive to the public to put forward more effective opinions.

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