

Original Paper

AI Empowerment and Twin-City Symbiosis: Development Paths for the Digital Preservation, Revitalization and Living Heritage Transmission of Intangible Cultural Heritage of Shared Origins in Shenzhen and Hong Kong

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Abstract

This study examines how Artificial Intelligence (AI) can support the digital preservation, revitalization, and living transmission of Intangible Cultural Heritage (ICH) shared by Shenzhen and Hong Kong. Geographically close and culturally connected, the two cities share traditions such as the Qilin Dance, herbal tea culture, and Hakka folk songs, but cooperation faces both opportunities and constraints under the “one country, two systems and three legal jurisdictions” framework. The study reviews policies, laws, and regulations at the national, Guangdong-Hong Kong-Macao Greater Bay Area, Shenzhen, and Hong Kong levels to assess their implications for cross-border ICH digitalization. It integrates digital humanities, cultural ecology, and living heritage transmission into an analytical framework. Through case studies of the Qilin Dance and Hakka folk songs, it examines existing digital practices, differences between the two cities, and opportunities for cooperation. Based on these findings, it proposes development pathways involving governments, public institutions, enterprises, social organizations, and data platforms. The study seeks to provide theoretical and practical guidance for cultural integration between Shenzhen and Hong Kong and for developing a “Greater Bay Area model” of ICH transmission in the digital age.

Keywords

Shenzhen-Hong Kong ICH of shared origin, digital humanities, cultural ecology, living heritage transmission

1. Introduction

Shenzhen is a new, large-scale city that has been developing rapidly and is leading the way in digital technology. Hong Kong is an open-city that meets the needs of people from all over the world and has built a good cultural industry system. The two cities are close to each other and also culturally rich. They have the same cultural origins and a large amount of intangible cultural heritage, such as Cantonese and Hakka traditions. The examples include the Hakka Qilin Dance in Pingshan and Longgang, Shenzhen; the Hang Hau in Sai Kung, Hong Kong; the herbal tea culture of the Lingnan region; and the Hakka folk songs passed down through generations in Hakka communities in both places.

With the pace of urbanisation and changes in people's lives, traditional ways of spreading knowledge orally and through experience are becoming less viable, and young people are showing reduced interest in traditional culture. Therefore, many forms of artificial intelligence technology have been employed to achieve low-cost, high-efficiency digital documentation of ICH, and also to realise intelligent interaction, immersive experience and creative generation through deep learning, Natural Language Processing (NLP), Virtual and Augmented Reality (VR/AR) and Generative Artificial Intelligence (AIGC). At the same time, they can help build a living cultural resource for the community that inspires people and brings economic and social benefits.

Therefore, the main research question is: Given the current circumstances of policy support and legal regulation, how can we integrate the technological strength of Shenzhen with the cultural resources of Hong Kong to jointly advance the development of AI-enabled digital preservation, revitalization and inheritance of their shared Intangible Cultural Heritage (ICH)? The problem this paper addresses is introduced in the background of the policy, a theoretical framework is established, representative cases are analyzed in detail, and finally, a forward-looking and implementable development plan is put forward. The structure of this report is as follows: Section 2 presents the relevant policy and regulatory background; Section 3 introduces the theoretical foundation of this study; Section 4 provides case studies of the Qilin Dance and Hakka folk songs; and finally, Section 5 summarizes the contents and discusses the development outlook.

2. Policy and Regulatory Background

Both the promotion and dissemination of ICH shared by Shenzhen and Hong Kong are subject to the multi-level system of policies and regulations at the national and local levels. Therefore, one needs to know about the policy environment in order to consider whether to develop it further.

2.1 National Top-level Design: Establishing the Strategic Direction of "Cultural Digitalisation"

In recent years, China has paid more and more attention to protecting intangible cultural heritage and to digital transformation in the cultural sector, issuing a series of programme documents that have provided strong policy support for the digitalisation of ICH across the country.

First, in 2021, the “Opinions on Further Strengthening the Protection of Intangible Cultural Heritage” specified that efforts should be made to “strengthen the digitalisation of intangible cultural heritage archives”, indicating that digital technology should be employed to organise and protect this heritage (Xinhua News Agency, 2021). It will offer direct policy support and practical assistance for the digitalisation of collections and the preservation of all ICH projects, including those with joint origins in Shenzhen and Hong Kong.

Second, in 2022, the Opinions on Promoting the Implementation of the National Cultural Digitalisation Strategy were issued and elevated cultural digitalisation to the level of a national strategy. In addition to the two main projects of building the national cultural network and establishing a national cultural big data system, this document also offers a more comprehensive institutional and legal basis for the digitalisation of cultural heritage, covering ICH (Xinhua News Agency, 2022).

2.2 Guangdong-Hong Kong-Macao Greater Bay Area Planning: Building a Regional Ecosystem for Collaborative Innovation

In accordance with the national strategy, planning for the Guangdong-Hong Kong-Macao Greater Bay Area has created a good general environment for the integration of culture and technology in the region, especially for cross-border cooperation.

In the 2019 Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area, it was proposed to jointly build a “cultural Greater Bay Area” and enhance cooperation among Guangdong, Hong Kong and Macao in the preservation, research and exhibition of cultural heritage (Xinhua News Agency, 2019). This is the highest-level policy support for cooperation between Shenzhen and Hong Kong on the subject of ICH.

Based on the above, Guangdong Province has introduced a number of policies to further strengthen the path of implementation. For example, in the 2024 Data Asset Policy Compendium, under the measure “Enhance the level of digital cultural development”, it is stated that “Cultural Guangdong” platform will be strengthened and the development of cultural and tourism big data promoted. Although the above measures do not explicitly mention ICH, the aim is to build a “system of cultural data products and services” that can provide a platform for the transformation and application of digital ICH results (Global Data Asset Council, 2024). In addition, there is a policy direction to promote the joint development of smart city clusters in Guangdong, Hong Kong and Macao, strengthen integration and connectivity in cultural tourism among the three regions, and thus have created many application scenarios for cross-border presentation and dissemination of digital intangible cultural heritage.

In recent years, all kinds of methods have been employed by the Greater Bay Area to promote cross-border data flow in support of economic development. The plans to build a “data special zone” in the Greater Bay Area and introduce a “whitelist” system will directly solve the main bottlenecks in data flow under the framework of “one country, two systems and three legal jurisdictions”; if these pilot

projects can be successfully extended to the cultural sector, the institutional costs of sharing and transferring ICH data between Shenzhen and Hong Kong will be significantly reduced. For example, in December 2023, the National Cultural Heritage Administration and the Government of the Hong Kong Special Administrative Region signed an agreement to strengthen exchange and cooperation in the field of cultural heritage (National Cultural Heritage Administration, 2022); although it mainly covers tangible cultural heritage, it has also provided a good reference and model for digital cooperation in Intangible Cultural Heritage by emphasizing the use of advanced technology and information sharing.

2.3 Shenzhen-Hong Kong Cooperation Arrangements: From Framework Agreements to Practical Implementation

As of now, Shenzhen and Hong Kong have not signed a special cooperation agreement on the “digital preservation of intangible cultural heritage”, but both cities have built a multi-level and all-encompassing framework for cooperation that can provide a foundation for more focused collaboration in the future.

Earlier agreements, such as the Memorandum on Strengthening Shenzhen-Hong Kong Cooperation in 2004 and the Cultural Cooperation Agreement in 2008, had already set up regular high-level talks and interdepartmental coordination channels. In recent years, cooperation has become more concrete, as shown by the cooperation agreement signed between the Hong Kong Arts Development Council and the Shenzhen Bureau of Culture, Sports and Tourism in 2013, and by grassroots and semi-official exchange platforms, such as the Shenzhen-Hong Kong lion dance activities under the “ICH in the Community” initiative. The above activities have continuously built mutual trust and understanding among the cultural communities of the two cities (Hong Kong Arts Development Council, 2013).

Another good point is that the Shenzhen Intellectual Property Protection Center has set up a “Shenzhen-Hong Kong Collaborative Service Point for ICH Protection”. Service Point has provided many services for the ICH project so far, such as fast-track rights confirmation, infringement risk alerts, rights protection assistance, etc.; an example is the Sha Tau Kok Fish Lantern Dance in Hong Kong. It shows that Shenzhen-Hong Kong cooperation has advanced from general cultural exchange to the specific and legally important area of intellectual property protection for ICH.

2.4 Main Legal and Regulatory Problems: Cross-border Data, Intellectual Property and Cultural Security

Although there have been some policy developments recently, there are still three main legal and regulatory problems in the operation of Shenzhen-Hong Kong cooperation on ICH digitalisation. These are also places where the next round of policy innovation will take place.

Tension in the “Three Laws” Framework for Regulating Cross-border Data Flows and Greater Bay Area Specific Experiments

Digitalisation of ICH has produced a large amount of data, such as high-definition pictures of heritage bearers, oral-history recordings, three-dimensional models etc., some of which contain personal

information. The transfer of such data from Shenzhen to Hong Kong must comply with the Cybersecurity Law, Data Security Law and Personal Information Protection Law of the Mainland, as well as the Personal Data (Privacy) Ordinance in Hong Kong. The requirements for cross-border transfer of data in China are relatively high, and the corresponding procedures are quite complex (Research Group of the Institute for the Guangdong-Hong Kong-Macao Greater Bay Area et al., 2021). At present, cross-border data approval in the cultural and tourism sectors of the Greater Bay Area is relatively slow. A dispersed system of rules that relies too much on rules is not conducive to good cooperation. Therefore, the Greater Bay Area has been taking a “pilot-first” approach and trying various ways, such as “data customs” in Hengqin and Nansha, and has also set up standard contracts and whitelist systems across the whole area. If the certified ICH research institutions and cooperation projects can be added to such whitelists in due course, the efficiency of collaboration will be improved.

Conflicts over Intellectual Property Ownership in the Three Jurisdictions and the Construction of Coordinated Protection Mechanisms

Mainland China, Hong Kong and Macao have different standards for recognising intellectual property rights, different scopes of protection and different levels of compensation for infringement (Jiang, 2015). There will be different applications of the law and difficulties in the exercise of rights. The first is to strengthen the joint defence system. Building on the existing Guangdong-Hong Kong and Guangdong-Macao intellectual property cooperation framework, the construction of a unified Greater Bay Area intellectual property information exchange platform and sharing mechanism is in line with the direction set out in the Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area. Area can also set up a cross-regional centre for arbitration and mediation of intellectual property disputes in intangible cultural heritage and promote cooperation and mutual recognition of relevant rules.

Balancing Cultural Security and Data Governance

Increase the openness and sharing of data, but be mindful of cultural security and other risks as well. ICH data have rich history and culture, and how such materials are digitally presented and understood is also closely related to the protection of cultural sovereignty. Therefore, in order to protect cultural security, a classified and hierarchical data protection system will be built to provide stronger guarantees for important ICH data that contains state secrets or has great public interest. At the same time, an organised Guangdong-Hong Kong-Macao mechanism for joint risk prevention, control and early warning should be established to conduct compliance audits of digital content and ensure that its spread is in line with historical facts and mainstream values. Thus, there will be neither too much openness nor too much security.

In short, the digital development of the ICH of shared origin in Shenzhen and Hong Kong is currently in a strategic “window of opportunity”, and although policy support has been continuously expanded, the creation of specific regulatory rules has not been fully achieved yet. The country will set the overall

direction, and the Greater Bay Area Plan is a cooperative system. To achieve the goals outlined in this strategy, several institutional reforms are needed at the fundamental level of law and order in recent years.

3. Theoretical Review: Building a Multidimensional Integrated Analytical Framework

To systematically study the digital development path of the ICH in light of AI and to establish a shared origin of Shenzhen and Hong Kong, this paper integrates theoretical ideas from several related fields to construct a four-dimensional analytical framework of “documentation-transmission-communication-innovation”.

3.1 Theory of Digital Humanities: Establishing the Foundation for Digital “Documentation”

Digital Humanities are a combination of the humanities and computer science. It is the foundation and spirit of the technology for the digital preservation of ICH. The goal of employing computation is not just to change the cultural heritage into a digital form, but also to organise this material systematically via computational methods, extract knowledge from it, and thus generate new knowledge and understanding (Deng et al., n.d.).

The application of digital humanities in the area of ICH preservation can be divided into the following parts.

Multimodal Data Integration: ICH is a very complex cultural system that includes skills, rituals, oral traditions, physical spaces, etc. Many technologies have been employed in digital humanities to integrate dispersed and various data in a single system and construct a “digital twin” or “living specimen”, such as Three-Dimensional Modelling (3D modelling), Geographic Information Systems (GIS), high-definition audio and video recording, semantic annotation etc. The “Digital Qilin Dance” project in Pingshan, Shenzhen, is a representative case; high-precision motion-capture technology has been used to record the movements of the heritage bearers in detail.

Construction of knowledge graphs: Based on semantic analysis and entity-relation extraction of ICH-related documents, oral histories, images etc., a knowledge graph for ICH can be built. Such a system is more than just a typical database; it is a visual and explorable knowledge network that can reveal the deeper connections among all the parts of an individual’s ICH practice and between different ICH traditions.

Computational Analysis: Given the organised data, various kinds of computational studies can be carried out, such as pattern recognition and evolutionary pathway analysis. For example, one can analyse the melodies and lyrics of Hakka folk songs from different times to see how they have changed in style, or compare the motion data of Qilin Dance in Shenzhen and Hong Kong to detect any minor differences in style more accurately.

Therefore, Digital Humanities will provide the theoretical basis for the first direction of this study, which is “digital documentation and archiving”; that is to say, the construction of high-quality, well-organised and computationally accessible digital resource repositories should be based on preservation.

3.2 Living Heritage Transmission and Memory Theory: Guiding Revitalised Transmission

The Spirit of ICH is “alive”, and it is carried forward by the actions, memories and inheritance of generations. The French sociologist Maurice Halbwachs proposed a concept of “collective memory” and believed that this memory is organised by society. In light of the above, the inheritance of ICH can be viewed as a continuous link in the chain of collective memory.

Therefore, digitalisation of ICH should not be reduced to a “digital mummy” in a database; rather, it should be used to promote the living inheritance transmission of ICH. Based on the above reasoning, the concept of “living heritage transmission” is defined as follows:

Practice-oriented transmission: Practice itself is the foundation of heritage inheritance. Digital tools can help learn more easily and are not replacing heritage bearers as the masters and teachers of this culture. AR technology can be employed to show students the correct cutting angle for paper-cutting in real time, and VR technology can be used to have them practise the basic steps of the Qilin Dance repeatedly in a virtual environment.

Community participation: Several communities have set up ICHs. The digitalisation project should be driven by the community, and its members should participate in the construction process of digitalisation to become the first recipients of the benefits. According to the above, “participatory ethno-animation” is one such type (Wang, 2019).

The “data-practice” double-helix model: Some scholars have proposed that the ideal form of digital heritage transmission should be a double helix, and “data” and “practice” should develop together (Huang et al., 2026). Collect data on the heritage activities, convert it into digital resources, and then spread and promote new heritage activities through education, learning and experience. Then, the new practices will produce more data and form a good, continuous loop.

Living heritage transmission theory thus offers a direction for the second dimension of this study, “living heritage transmission and education”; finally, it needs to be digitalised to serve human activities and support the continuous life of heritage communities.

3.3 Communication Theory and Cultural Space Theory: Extending the Scope of Social Communication

The life of ICH also needs to be spread and accepted by all sectors of society, not just in local communities. Communication theory can help us study the spread of digitally mediated intangible cultural heritage. According to the Encoding/Decoding theory proposed by Stuart Hall, when ICH is digitised or “encoded”, its original cultural context and profound meanings may be lost or changed; audiences will “decode” the digital cultural products according to their own cultural backgrounds and

thus produce different or incorrect interpretations (Ding, 2026). Therefore, the design of digital cultural products should be in line with the cultural ideas and accessible to all.

Closely related to this is the theory of “cultural space”. It believes that intangible cultural heritage cannot be separated from the physical spaces and social environments where it takes place (Gao, 2026). New technology can be used to create a “digital cultural space”, and spaces such as the stages of late Qing Dynasty theatre or Republican-era teahouses that have been lost or altered can be reconstructed; thus, viewers may be able to experience the original cultural atmosphere of Intangible Cultural Heritage (ICH) immersion and gain deeper cultural understanding of this heritage. Application of XR Technology in the Reconstruction of the Performance Environment for Cantonese Opera at Guangzhou’s Yongqingfang is an excellent case of building a digital cultural space.

According to Boisot’s Information Space (I-Space) theory, the spread of ICH knowledge can be viewed as movement in the four directions of codification, abstraction, diffusion and absorption (Boisot, 2000). AI-driven digital products, such as interactive games and virtual museums, are good ways to spread the knowledge of Intangible Cultural Heritage (ICH) from specific communities, but there is still a risk that this knowledge will remain in its original, uncoded and concrete form.

Together, these theories form the third dimension of this study: “social communication and experience”, and it is proposed that all kinds of digital media and immersive technologies should be used to break down cultural barriers and enhance public awareness and interest in intangible cultural heritage.

3.4 Cultural Ecology and Innovation Theory: Building an Ecosystem for “Sustainable” Development

For ICH to be truly “alive”, transmission and communication alone are not enough. It should also find ways to adapt to the current socio-economic system and build a healthy “cultural ecology” (Luo, 2026). Cultural Ecology theory holds that ICH is an ecosystem constantly changing due to changes in society, economy and nature. With the progress of digitalisation, a cultural ecosystem for intangible cultural heritage is beginning to take shape.

Multi-stakeholder cooperation: The ecosystem includes many entities, such as the people with cultural heritage, governments, research institutions, technology companies and the public. A good ecosystem needs to establish good cooperation among all parties to share resources, risks and rewards fairly. The Pingshan District Government, Shenzhen University, Qilin Dance heritage groups and Zhongfu Chanchuang Technology are closely cooperating on the Pingshan Qilin Dance project, and this is a representative case of such a collaborative ecosystem.

Extension of the Industrial Value Chain: New Ways to Realise the Value of ICH through Digitalisation. Extracting the core cultural symbols and aesthetic features of the heritage tradition, applying technologies such as AIGC for secondary creation, and thus a large number of cultural and creative products can be developed, including digital collectibles, game skins, film and television IP, etc. Such products can generate economic benefits to fund preservation and allow ICH to enter the daily lives of

younger generations in a more fashionable and contemporary way. Microsoft Xiaoice has been working with Suzhou embroidery and AIGC-assisted innovation in Huizhou brick carving; therefore, it is possible to create new works based on ICH using AI as well.

A Three-Dimensional Dynamic Framework for “Cultural Space - Community Participation - Industrial Innovation”: Some scholars have put forward an all-weather analysis structure to show that the three parts are mutually beneficial (Liu & Liang, 2025). Protecting the original cultural spaces of intangible cultural heritage provides a basis for motivating community participation; active participation by the community can be a source of inspiration for industrial innovation, and finally, successful industrial innovation can offer financial support for the maintenance of cultural spaces and the development of heritage communities.

Therefore, cultural ecology theory can offer a plan for the “ecological development and innovation” of Intangible Cultural Heritage (ICH), and the ultimate goal is to build a self-sufficient cultural ecosystem that can thrive for a long time. In short, this paper puts forward a four-dimensional model to systematically study and evaluate the development path of digital technology for intangible cultural heritage, incorporating digital humanities (documentation), living heritage transmission (transmission), communication studies (communication) and cultural ecology (innovation), all of which have their origins in Shenzhen and Hong Kong.

4. Case Studies: The Landscape of Digital Practices for ICH of Shared Origins in Shenzhen and Hong Kong

Based on the theoretical framework introduced in the previous section, this paper will take specific cases of ICH shared by Shenzhen and Hong Kong, such as the Qilin Dance and Hakka folk songs, to analyze their current situation, main achievements, deficiencies, and cooperation potential in the field of digital culture.

4.1 The Qilin Dance: A Model of Technology-Enabled Preservation in Shenzhen and Shenzhen-Hong Kong Collaboration

The Qilin Dance is an important folk culture in both Shenzhen and Hong Kong with a long history. Bantian Yongshengtang and the Gankeng Qilin Dance team in Shenzhen, as well as the Hakka Qilin Dance tradition of Hang Hau in Sai Kung, Hong Kong, have the same cultural roots and regularly organise offline exchanges and joint performances. Among all the forms of ICH, the Qilin Dance has achieved good results in digital archiving, interactive communication and legal protection.

Digital Documentation and Archiving: Shenzhen’s “Living Specimen” Project

The “Digital Qilin Dance” project is a joint undertaking by Pingshan District in Shenzhen and the College of Physical Education at Shenzhen University; it is China’s first organised digitalisation project

focusing on the Qilin Dance and offers a good reference for the theory of digital humanities (Zeng, 2025). Its first few technologies are:

1) High-precision motion capture: A special sensor-based suit was fitted to the heritage bearers of the project team, and holographic motion-capture technology was employed to record all ranges of motion in the Qilin Dance, such as footwork, body movement, gestures, and even the fine movements of the Qilin's head, to the millimetre.

2) Construction of 3D Models and Database: Based on the large amount of collected data, high-definition three-dimensional digital models have been created, and AI algorithms have been employed to clean and normalise the data. At the same time, the project team has carried out extensive fieldwork and collected more than 50,000 Chinese characters of interview notes and over 3,000 photographs to create a complete "digital gene database for intangible cultural heritage" that includes oral history, text and pictures, motion data etc.

It will help us document the endangered traditional skills in times of crisis, and more importantly, create a reusable, analyzable and computationally accessible "living specimen" to provide a solid data foundation for future transmission, communication and innovation.

Hong Kong has not yet set up a Qilin Dance digital archive project of this scale and with this level of technology. Therefore, investment in the digital ICH infrastructure has not been distributed evenly among Shenzhen and Hong Kong; given the rich technological resources and strong government support, Shenzhen has led the way in both the scale and precision of data collection.

Living Heritage Transmission and Education: AI Teaching Assistants and Curriculum Development

Based on the "living specimen" database, Shenzhen's practice is a good case of the "data-practice" double-helix model.

Curriculum Integration: With the help of the above digital resources, Pingshan District has developed Qilin Dance courses for primary and secondary school students and successfully integrated intangible cultural heritage into the school curriculum. Digital materials can make teaching more intuitive and appealing, thus attracting the interest of young people.

Social Communication and Experience: From Data to Immersive Storytelling

Although the search results show that there is still a long way to go in developing online communities and fully utilizing the communication power of digital technology for the Shenzhen Qilin Dance, the current digital achievements have provided a foundation for future immersive communication. The 3D model and motion data have been created, so now we can make:

VR Immersive Experience: People can virtually "wear" the Qilin costume in first person and learn about and experience the Qilin Dance in reconstructed environments, such as a Hakka walled village or a festival square, to feel the unique cultural atmosphere more deeply.

AR Interactive Exhibitions: At museums or cultural centers, a smartphone or tablet can be used to scan a physical Qilin head and see a virtual Qilin start dancing on the screen, learn about the cultural story of the Qilin etc.

Ecological Development and Innovation: IP Commercialisation and Cross-border Legal Cooperation.

Another good point of the Qilin Dance case is that it has a relatively open path for industrial development and has also introduced new Shenzhen-Hong Kong cooperation models.

Commercial Cooperation: Shenzhen University has begun to build a dual-barrier protection system for the “cultural intellectual property and technological patents” of the Qilin Dance and is expanding the scope from cultural inheritance to broad industrial integration.

In short, the case of the Qilin Dance shows that high-precision digital documentation can be used to develop AI-assisted transmission of living heritage, intellectual property commercialisation and cross-border legal protection. It shows that Shenzhen is at the forefront of applying technology and that Shenzhen-Hong Kong cooperation has already started to show results in the area of legal services. In the future, the technological achievements of Shenzhen should be integrated more closely with the strengths of Hong Kong in cultural storytelling and international communication platforms to jointly build a digital cultural brand for the Qilin Dance that can spread globally.

4.2 Hakka Folk Songs: Exploration of Multimedia Publishing and Social Media Communication

Hakka folk songs are a shared oral culture of the Hakka people in Shenzhen and Hong Kong, and their transmission has traditionally been mainly through oral teaching and experience. The development path of digital media differs from that of the Qilin Dance, and it has placed more importance on multimedia integration and new-media communication.

Digitalisation of Archives and Documents: From Audio Tapes to Multimedia Norms

Different from the motion-capture method used for the Qilin Dance, the main medium of Hakka folk songs is “sound”; thus, the first digitalisation efforts focused on audio recording and archiving. A digital platform for Hakka folk songs has been set up in Longmen County, Huizhou, and audio recordings and organised records of their distribution have been created.

An older way has been to use the international ISLI/MPR standard. In 2020, Jinan University published the book “Entering the World of Hakka Folk Songs” and added MPR codes to the printed musical scores; thus, readers can use a compatible reading pen to listen to the corresponding audio recordings and watch performance videos (Wang, 2020). The kind of “multimedia presentation technology” mentioned can integrate fixed musical notation with moving pictures and sound; it is relatively low-cost and very good for digitalisation. It is not as organised as a knowledge graph, but it can help people use and learn about the heritage materials more easily.

Currently, there is no single public database that has combined digital soundscapes and Hakka folk song materials from both Shenzhen and Hong Kong. Resources are distributed among all departments and people, and there is no centralised, organised archive system.

Living Heritage Transmission and Education: Grassroots Practice in the New Media Era

The transmission of living heritage for Hakka folk songs in the digital era has been largely bottom-up. According to the above search results, a large number of Hakka folk song livestreams and short videos have been posted on social media platforms such as Douyin and Kuaishou, and many folk song enthusiasts organise both online and offline singing events independently. The above are an original and dynamic way of transmitting ICH in the digital era.

Therefore, the digital path for Hakka folk songs can be described as “light on technology and strong on communication”. It has the advantage of spontaneous community participation and wide application of new media, but it also lacks systematic data integration and the application of advanced technologies. In the future, Shenzhen and Hong Kong will cooperate to build a high-quality digital soundscape archive of Hakka folk songs and develop AI-assisted tools for composition and learning that integrate the spirit of community-based transmission with professional technology.

5. Conclusion and Outlook: Towards a Digital Cultural Twin City

Based on the systematic review and analysis of the policy environment, theoretical framework and representative cases, this paper presents the complex situation, main problems and significant opportunities of AI-enabled digital preservation, revitalization and living heritage transmission of ICH of shared origins in Shenzhen and Hong Kong.

5.1 Summary of Research Results

Policy Environment of “Strong Macro-level Support but Weak Operational Mechanisms”: There are good strategic directives and general policy systems at the national and Greater Bay Area levels for cultural digitalisation. However, at the operational level of cross-border cooperation between Shenzhen and Hong Kong, no particular and effective institutional arrangements have been established yet for the flow of data and recognition of intellectual property rights. Therefore, the current situation can be described as “top-down design has started, but progress at the micro-level is slow”.

An increasingly coherent theoretical system has been built; digital humanities, living heritage transmission, cultural ecology and other theories have all provided full support for the entire chain of “documentation-transmission-communication-innovation”, and the view that digitalisation is only about creating static specimens of living heritage has been avoided.

Asymmetrical but complementary practical development: Digital Practices in Shenzhen and Hong Kong are quite different. Through projects such as the Qilin Dance, Shenzhen has shown that it is a “city of technological innovation” with good technology and a large amount of government investment. At the

same time, projects for herbal tea culture have shown some deficiencies in the awareness and responsiveness to changes in the market. Hong Kong is a city with outstanding culture that has achieved good results in protecting cultural brands and building physical transmission networks for areas such as herbal tea culture, and has also been applying frontier digital technology and AI more cautiously in terms of both depth and scope.

The main problems are “connectivity” and “integration”: The basic issue is how to connect various resources across Shenzhen and Hong Kong, such as technology, funds, data, people, etc., and to achieve deeper integration of technological thinking with cultural thinking. Align the rules for law at the institutional level, standardise the data at the platform level, and change the idea from “digitisation for preservation” to “preservation through revitalisation”.

5.2 Proposed Development Directions

Based on the above results, this report puts forward an organised development plan for the four pillars to promote cooperation between Shenzhen and Hong Kong in the digitalisation of their joint ICH.

Pillar 1: Top-down Design and Institutional Innovation

Establish a “Shenzhen-Hong Kong Task Force for ICH Digitalisation”: Within the current framework of Guangdong-Hong Kong-Macao cultural cooperation, a permanent task force will be established that includes the cultural, technological, commercial and legal departments of the governments in both cities, as well as relevant industry experts. A task force will organise joint projects, allocate funds and issue technical and institutional norms.

Pilot a “Cross-border Mechanism for ICH Data and Intellectual Property”: Based on the experience in Hengqin and Nansha, a special pilot mechanism will be set up to guarantee the security and orderliness of the cross-border flow of cultural heritage data. A “trusted list” will be set up for certified ICH cooperation projects and research institutions to reduce the need to send data abroad. At the same time, Shenzhen and Hong Kong should establish a system of joint recognition for the registration, valuation and trading of digital intellectual property based on ICH.

Pillar 2: Digital Infrastructure and Data Sharing

Jointly establish a “Greater Bay Area Digital Gene Repository for ICH of Shared Origins”, and utilize the strengths of Shenzhen, Hong Kong and Macao to build a first-class project for a cloud-based digital ICH repository that meets all the needs of open sharing. Repository should have the following features: Unified Data Standards: A single set of international metadata standards will be used to ensure the compatibility of data; Integration of High-Quality Data: Motion-capture data of the Qilin Dance and digital audio recordings of Hakka folk songs need to be combined; AI-driven Management: An AI engine capable of automatic content annotation and intelligent search and recommendation of related items should be developed; Open API Access: An API will be provided to support secondary development and innovative applications by researchers, developers, educational institutions, etc.

Pillar 3: Technological Empowerment and the Dual-Track Development Strategy

Present the “AI + Living Heritage Transmission” Two-Track Strategy

AI for Preservation and Authenticity: High-precision documentation, data restoration, knowledge mining by AI, etc., should continue to be carried out to build a strong digital foundation for the preservation of Intangible Cultural Heritage (ICH). AI can learn the small differences in the movement of all Qilin Dance schools and create a personalised “skill map”.

AI for Innovation: We should actively promote the application of AIGC in the field of ICH. “AI + ICH” creative competitions can be held to encourage young artists and designers to use AI tools, draw inspiration from traditional Chinese culture, and create new forms of music, visual art, fashion design, game characters and other cultural products.

Pillar 4: Ecosystem Construction and Industrial Integration

Construct a “Matrix of Immersive Experiences and Social Communication”

Jointly develop digital experience spaces: Shenzhen and Hong Kong can cooperate to build immersive digital art venues for Intangible Cultural Heritage (ICH) in the technology park area of Shenzhen and the West Kowloon Cultural District in Hong Kong, and organise joint rotations of VR/AR projects.

Incubate cross-sector cultural IP: A “Shenzhen-Hong Kong ICH IP Incubator” will be established to connect technology companies in the two cities, such as Tencent and NetEase, with cultural enterprises. Digitisation of cultural elements from the Qilin Dance, Hakka folk songs and other traditions can then be organised and used in various popular cultural products, such as games, animation and films, to add cultural and commercial value.

Develop digital cultural consumption: Based on the blockchain-based ICH digital collectibles, new types of cultural consumption can be created by combining them with offline activities, such as admission tickets and masterclasses.

5.3 Research Limitations and Future Work

The above proposed ways will undoubtedly have more serious practical problems in terms of implementation, such as a lack of funds and technology, a shortage of specialised personnel etc. Therefore, the following research will be more focused on empirical studies of user acceptance of digital heritage products, evaluation models for the economic and social impact of ICH digitalisation projects, and models of international cooperation in digital cultural heritage with countries participating in the Belt and Road Initiative.

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