



The digital conservation and intellectual property management system construction of intangible heritage of conventional Chinese physical activities in the public domain

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SUMMARY: *The study focuses on the internal structure of digital conservation and intellectual property management system, aiming to construct a digital conservation and intellectual property management system for intangible heritage of conventional Chinese physical activities in the public domain. Firstly, by exploring digital techniques and introducing the TAM-TOE model, the implementation path of digital conservation and intellectual property management system for intangible heritage of conventional Chinese physical activities in the public domain is analyzed from three dimensions: organization, technology, and environment; Secondly, the study proposes specific strategies as illustrated by database classification design, innovative development, resource integration, and sharing paths. At the same time, it points out that the digital conservation and intellectual property management of intangible heritage of conventional Chinese physical activities currently face challenges as illustrated by low adaptation of digital conservation technology, incomplete systems, slow updating of concepts, and lack of mutual promotion mechanisms between culture and digital techniques. This research provides a reference for the layout of digital techniques in the course of protecting intangible heritage of conventional Chinese physical activities, emphasizing the importance of building a unified framework to facilitate its innovative inheritance and development.*

KEYWORDS: *Conventional Chinese physical activities; Intangible heritage; Public domain; Digital conservation; Intellectual Property Management System; TAM-TOE model*

1 Introduction

Digital techniques play an indispensable part in improving the safeguarding and intellectual property management inheritance system of intangible heritage of conventional Chinese physical activities, enhancing the level of safeguarding and intellectual property management inheritance of intangible heritage of conventional Chinese physical activities, and increasing the dissemination and popularization of intangible heritage of conventional Chinese physical activities [1]. Digital techniques have become an important driving force for supporting the conservation, intellectual property management, and inheritance of intangible heritage in conventional Chinese physical activities. It is also a solid foundation for the innovative inheritance and development of intangible heritage in conventional Chinese physical

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activities. In contemporary times, the mathematization of intangible heritage of conventional Chinese physical activities has become the mainstream practice for major countries in the world to facilitate the safeguarding of intangible heritage of conventional Chinese physical activities and the inheritance of intellectual property management [2]. The intangible heritage of conventional Chinese physical activities, as an important component of the intangible heritage of conventional Chinese physical activities, refers to the athletics craftsmanship and techniques with characteristics of games, education, and competition implemented by various ethnic groups in the process of widely carrying out folk athletics, folk athletics, ethnic conventional Chinese physical activities, etc., as well as the total amount of equipment, physical manufacturing processes, and exhibition spaces involved when implementing these craftsmanship and techniques. The digital conservation of intangible heritage of conventional Chinese physical activities refers to the process of systematically preserving, revitalizing, and recreating the technical behaviors, physical equipment, and exhibition spaces of intangible heritage of conventional Chinese physical activities through digital collection, recording, storage, display, and dissemination [3].

From the existing research results, digital exploration of the intangible heritage of conventional Chinese physical activities mainly focuses on three areas [4]: (1) digital collection and storage research, as illustrated by the compilation of digital lists of intangible heritage of conventional Chinese physical activities, digital reconstruction and scanning, digital recording and archiving, etc; (2) Exploration of digital preservation management, as illustrated by digital information organization, digital information retrieval, etc; (3) Research regarding the development and utilization of intangible heritage of conventional Chinese physical activities, as illustrated by the introduction of local tourism apps, the advantages of digital media, and the impact relationship with local stakeholders, mainly focuses on application research, with a greater emphasis on optimizing specific application environments in the digital process. On the other hand, the research findings on the digital application in intangible heritage of conventional Chinese physical activities in China show two paths: theoretical application exploration of "Chinese conventional physical activities intangible heritage database and related types of applications" and theoretical application exploration of "digital Chinese conventional physical activities intangible heritage+digital society". The former focuses on theoretical and applied exploration of the establishment of Chinese conventional physical activities intangible heritage database, metadata classification, data preservation and retrieval, etc; The latter pays more attention to the integration of digitalization of intangible heritage of conventional Chinese physical activities at the social level, as illustrated by the legal rights and interests of digitalization of intangible heritage of conventional Chinese physical activities, dissemination issues, modernization issues, etc [5]. It mainly focuses on theoretical research and pays more attention to the theoretical issues of the internal elements and external social impact of digitalization of intangible heritage of conventional Chinese physical activities. Currently, academic exploration of the mathematization of intangible heritage in conventional Chinese physical activities mainly focuses on the following three aspects [6]: (1) in terms of digital dissemination, emphasizing the safeguarding strategies and dissemination paths for the digitization of intangible heritage in conventional Chinese physical activities; (2) In terms of digital empowerment, explore the path of mathematically empowering the innovative inheritance and development of intangible heritage in conventional Chinese physical activities; (3) In terms of digital inheritance practice, this work explores the practical path of digital inheritance and development of intangible heritage of conventional Chinese physical activities from theoretical perspectives as illustrated by technology, organization, internal and external environment (TOE) framework, and new quality productivity. Existing research indicates that digital techniques is reshaping the paradigm of the inheritance of intangible heritage of

conventional Chinese physical activities from offline to online, expanding the real space for the survival and development of intangible heritage of conventional Chinese physical activities [7]. Especially with the deep embedding of digital techniques, the intangible heritage of conventional Chinese physical activities has broken through the original intergenerational inheritance structure of regional dependence and centered on inheritors, and turned to a digital practice space that spans fields and time and space, triggering a profound transformation in the spatial form of intangible heritage of conventional Chinese physical activities.

Domestic and foreign research suggests that digital techniques have a certain protective effect on the intangible heritage of conventional Chinese physical activities at all levels, and also points out the opportunities and challenges that mathematical technology brings to the intangible heritage of conventional Chinese physical activities. However, exploration of the overall internal structure of intangible heritage of conventional Chinese physical activities through digitization is relatively rare. The intangible heritage of conventional Chinese physical activities, as a cultural project with profound and significant value, must have its inherent structural support to withstand the impact of time, war, and other cultural ecology. How does this internal structure maintain stability? What are the promoting effects of digital techniques on the internal structure of intangible heritage of conventional Chinese physical activities? As a broad concept, what are the branches of digital techniques that are compatible with the internal structure of intangible heritage in conventional Chinese physical activities? Therefore, the present work focuses on the internal structure of the intangible heritage of conventional Chinese physical activities, and establishes a TAM-TOE model for the digital conservation and intellectual property management system of the intangible heritage of conventional Chinese physical activities in the public domain through exploring digital techniques. This provides a reference for the better layout of digital techniques in the intangible heritage of conventional Chinese physical activities in the future.

2 Related Research

2.1 Current Status of Exploration of the Safeguarding of Intangible heritage and Intellectual Property Management of Conventional Chinese physical activities in the Digital Age

Since the establishment of the China conventional physical activities intangible heritage Safeguarding and Intellectual Property Management Center, the safeguarding, intellectual property management, and diffusion of intangible heritage in conventional Chinese physical activities have gradually advanced, and some satisfactory phased achievements have been made [8]. However, there are also problems of weak safeguarding awareness, simple safeguarding methods, imbalanced inheritance system, inadequate popularization coverage, and lagging dissemination methods [9]. This is largely embodied in the following two aspects:

(1) In terms of digital conservation of intangible heritage of conventional Chinese physical activities. 1) The inheritance system is imbalanced. Inheritance is the fundamental element of the safeguarding of intangible heritage and intellectual property management of conventional Chinese physical activities. However, many inheritors of conventional Chinese physical activities culture are already old, and the number of inheritors is decreasing. Affected by cultural globalization, the younger generation has a lower sense of identification with conventional Chinese physical activities culture, resulting in fewer and fewer people learning and participating in Chinese conventional physical activities cultural heritage initiatives. In addition, some intangible heritage items of conventional Chinese physical activities cannot be used as the main source of livelihood and economic income for inheritors, resulting in many

inheritors leaving the local area to make a living and forgetting the Chinese conventional physical activities culture they have mastered; Even if some inheritors have not left their homeland, they have little time and energy to organize and participate in activities related to conventional Chinese physical activities and cultural heritage. The project team also found through on-site research that some conventional Chinese physical activities and cultural heritage initiatives require high difficulty exhibitions, as many inheritors are old and difficult to demonstrate and perform, which limits their athletics and cultural inheritance; Furthermore, due to the loss of followers, some conventional Chinese physical activities and cultural heritage sites are gradually declining or even disappearing, making it difficult to protect them. In addition, many elderly inheritors are unable to use smartphones and digital products due to factors as illustrated by learning ability, visual and hearing decline. In today's digital age, there is an undeniable technological gap and digital capability weakness, making it difficult to rely on them to facilitate the digital conservation and diffusion of conventional Chinese physical activities and cultural heritage. 2) Lack of protective awareness. Digital conservation is a satisfactory way for people in the new era to protect the intangible heritage of conventional Chinese physical activities that has been fiercely impacted and gradually faded out of the public eye. It is urgent to take advantage of the national implementation of the safeguarding and intellectual property management project for intangible heritage of conventional Chinese physical activities to strengthen the digital conservation and inheritance of conventional Chinese physical activities cultural heritage. However, due to the low participation of the public in the conventional Chinese physical activities and cultural heritage, as illustrated by the implementation of national fitness strategies, people's enthusiasm for promoting health through exercise is increasingly high [10]. Square dancing and fitness exercises, which integrate self-entertainment, fitness, and performance, are popular throughout the country. However, their content is mainly foreign or modern athletics culture, and there is not much involvement in the intangible heritage of conventional Chinese physical activities, which significantly reduces the venues and time for people to participate in conventional Chinese physical activities and cultural activities. In order to cooperate with the safeguarding and intellectual property management of intangible heritage of conventional Chinese physical activities, some local grassroots units have reported national, provincial, municipal (state), and intangible cultural heritage at the county level of conventional Chinese physical activities. However, there is a serious phenomenon of overemphasizing application and neglecting safeguarding (especially weak awareness of digital conservation), which has caused many conventional Chinese physical activities cultural heritage to face serious loss and survival crisis. 3) The safeguarding measures are simple. Through salvage excavation of conventional Chinese physical activities and cultural heritage, a great deal of precious Chinese athletics and cultural treasures as illustrated by instruments, texts, audio and video have been collected. Investigation has found that some units and institutions randomly stack the precious Chinese conventional physical activities and cultural heritage resources as illustrated by instruments, texts, photos, tapes, CDs, etc. in the miscellaneous rooms. Many of them have already grown moldy and damaged, and the safeguarding measures are not only simple, but also seriously lagging behind. The current situation is worrying [11]. Although some universities and libraries have organized and preserved them, over time, these precious conventional Chinese physical activities and cultural heritage resources will inevitably experience paper aging, as well as erosion and distortion of photos, recordings, and videos, seriously affecting their long-term preservation and utilization; Due to limitations as illustrated by storage space and opening hours, these conventional Chinese physical activities cultural heritage resources cannot be fully shared and disseminated, which poses significant obstacles and challenges to the safeguarding and intellectual property management of intangible heritage in conventional Chinese physical activities.

(2) In terms of digital diffusion of intangible heritage of conventional Chinese physical activities. 1) The dissemination method lags behind. Telling the story of China well, spreading the voice of China well, and interpreting Chinese characteristics well "is an important core and spiritual essence of China's foreign communication ideas in the new era. Currently, the main ways for the diffusion of intangible heritage of conventional Chinese physical activities to the outside world include exhibitions at various athletics events. For example, Tai Chi made a stunning debut at the opening ceremony of the 2008 Beijing Olympics, showcasing China's conventional physical activities cultural heritage of "harmony between man and nature" to the world. 2) Narrowing the scope of dissemination [12]. The inheritance and diffusion of conventional Chinese physical activities culture mostly rely on oral transmission and hands-on experience, making the diffusion of conventional Chinese physical activities culture relatively conservative, closed, and lacking universality. Many conventional Chinese physical activities cultures in our country are closely related to local history and cultural environment, and their dissemination is mostly limited to the local area or within the ethnic group, which greatly limits the growth of conventional Chinese physical activities cultural heritage. In addition, there are a great deal of conventional Chinese physical activities and cultural heritage sites in China that are unknown to the public. For example, there are over a hundred types of martial arts in China, but only Tai Chi has been enrolled in the representative list of intangible heritage of Chinese Conventional physical activities by UNESCO. Many types of martial arts are endangered. Overall, the national level Chinese conventional physical activities and cultural heritage initiatives in China have a greater impact and dissemination power than provincial, municipal, and county-level ones. However, due to the lack of new digital platforms for dissemination and display, their external dissemination power is also very limited. 3) The diffusion of intangible heritage of conventional Chinese physical activities by universities. Many universities in our country offer majors and courses in conventional Chinese physical activities. Confucius Institutes, as an important platform for cultural exchange between China and foreign countries today, have also opened up new paths for the diffusion of China's national conventional physical activities cultural heritage [13].

The above dissemination methods have indeed facilitated the digital diffusion of conventional Chinese physical activities culture, but they have also highlighted many problems: 1) Conventional Chinese physical activities culture is rich in content and diverse in types, while the dissemination on the above platforms is mainly focused on martial arts, with less diffusion of conventional Chinese physical activities cultural heritage as illustrated by Korean springboard. 2) The conventional Chinese physical activities culture enjoys a certain reputation internationally, but there are still no conventional Chinese physical activities events in the Olympic Games, a world-renowned athletics event. Taekwondo and Judo, both of which are cultural heritage of conventional Chinese physical activities in the East, have a certain historical connection with Chinese conventional physical activities. However, they have successfully expanded their influence through various forms of dissemination, as illustrated by cultivating outstanding disseminators, using organizational communication, entering school physical education courses, and emphasizing both theoretical and digital communication. Taekwondo and Judo have not only become popular worldwide, but have also been included as official Olympic events. 3) Although the world's first Confucius Institute was established in Seoul, opening up a new path for the international diffusion of conventional Chinese physical activities culture, due to lack of experience and outdated methods, there have been phenomena as illustrated by slow dissemination speed and poor satisfactoriness [14].

2.2 Safeguarding and Inheritance Value of Intangible heritage of Conventional Chinese physical activities in the Digital Age

The safeguarding and inheritance value of intangible heritage of conventional Chinese physical activities in the digital age is largely embodied in the following aspects: (1) promoting the inheritance of intangible heritage of conventional Chinese physical activities in digital form. In the past, the inheritance of intangible heritage of conventional Chinese physical activities was deeply limited by geography and audience. Now, with the empowerment of digital techniques, more people have the opportunity to come into contact with and deeply understand the essence of these conventional cultures [15]. Cross regional cultural exchanges have greatly expanded the scope of diffusion of intangible heritage of conventional Chinese physical activities, enhancing national cohesion and identity. In the process of cultural exchange, its profound connotation highlights the strengthening of national identity and the strong expression of national pride, becoming a key chain connecting the common memory of Chinese people. Protecting and inheriting the intangible heritage of conventional Chinese physical activities is a complementary measure: safeguarding aims to maintain its original appearance and lay a solid foundation for inheritance; And inheritance is the continuation of safeguarding, ensuring that the essence of culture can continue to thrive. (2) Using digital means to reshape the intangible heritage scene of conventional Chinese physical activities. The deep intervention of digital techniques facilitates the precise acquisition and documentation of core elements as illustrated by subtle movement details, rich clothing cultural features, and complex and varied scene layouts in the intangible heritage of conventional Chinese physical activities, allowing viewers to deeply feel the profound cultural heritage and unique artistic charm contained in the intangible heritage of conventional Chinese physical activities in an immersive experience. The digital conservation and inheritance of the intangible heritage of conventional Chinese physical activities should not be limited to shallow organization and documentation of projects using existing mathematical techniques, but should comprehensively and profoundly present the essence of the intangible heritage of conventional Chinese physical activities through dynamic and systematic means, to ensure the preservation and development of the essence of the intangible heritage of conventional Chinese physical activities. Based on the specific conditions of intangible heritage of conventional Chinese physical activities in different regions, digital means are used for deep transformation, restoration, and reproduction, in order to accurately capture and satisfactorily inherit the dynamic characteristics of intangible heritage of conventional Chinese physical activities. (3) Adopting digital methods to safeguard the intangible heritage of conventional Chinese physical activities. The intangible heritage of conventional Chinese physical activities is a crucial component of the conventional culture of the Chinese civilization. Digital techniques have brought fresh momentum to conventional Chinese physical activities culture, reducing the threat of oral traditions and folk etiquette being cut off due to lack of records, and ensuring the authenticity of athletics cultural values is properly preserved. (4) Using digital methods to showcase the diffusion of intangible heritage of conventional Chinese physical activities [16]. The intangible heritage of conventional Chinese physical activities with regard to athletics represents the consensus, aesthetic pursuit, and value concepts of different ethnic groups in athletics culture, and represents the concentrated presentation of national spiritual traits. Digital techniques can build diversified display media, allowing visitors to experience the unique charm of conventional Chinese physical activities in person. Digital means can also facilitate innovation in the business model of intangible heritage projects in conventional Chinese physical activities, adding new growth points to the conventional Chinese physical activities industry [17]. Thanks to the digital age, relevant data and literature on intangible heritage of conventional Chinese physical activities

have been collected and preserved in an orderly and complete manner, satisfactorily enhancing the public awareness and cultural diffusion of intangible heritage of conventional Chinese physical activities.

2.3 The necessity of digital conservation and diffusion of conventional Chinese physical activities cultural heritage

The necessity of digital conservation and diffusion of conventional Chinese physical activities and cultural heritage is largely embodied in the following aspects [18]: (1) it helps conventional Chinese physical activities and culture overcome survival crises. In the past, the safeguarding and diffusion of intangible heritage of conventional Chinese physical activities mainly involved excavating, organizing, recording, collecting, and displaying the cultural heritage of conventional Chinese physical activities among the people. However, due to the lack of satisfactory safeguarding measures, over time and environmental changes, these precious Chinese conventional physical activities and cultural heritage materials inevitably exhibit phenomena as illustrated by mold, damage, and distortion, making them unable to be preserved for a long time. In the digital age, not only can conventional Chinese physical activities and cultural heritage resources be digitally recorded, preserved, and displayed, but they can also be innovatively protected and disseminated, providing more convenient technical support and operational platforms for them. From this, it can be seen that the employment of modern digital media for the digital conservation and diffusion of China's conventional physical activities and cultural heritage can not only actively facilitate the dissemination, inheritance, and development of ethnic conventional physical activities culture, but also enhance our understanding of ethnic Chinese conventional physical activities culture, and provide maximum assistance for the survival crisis of China's conventional physical activities and cultural heritage today. (2) Realize the modernization value of conventional Chinese physical activities culture. Chinese conventional physical activities cultural heritage is the living memory of conventional culture and the mother of the growth of the athletics industry. Digital conservation and inheritance of it are necessary for the growth of the industry. In the current era of 'no digital, no life', we need to seek breakthroughs, actively innovate, combine the intangible heritage of conventional Chinese physical activities with digital techniques, present different conventional Chinese physical activities projects in a digital way, intuitively reveal the internal logic of their global development, in line with the direction of digital interaction and marketing communication, help internationalize the intangible heritage of conventional Chinese physical activities, realize the modernization value of conventional Chinese physical activities culture, provide unlimited innovation and development space for its industrialization and marketization, and inject new impetus into local economy. (3) Facilitate the preservation and development of conventional Chinese physical activities culture. With the advent of modern digital techniques and the era of mass communication, the long-term preservation and widespread dissemination advantages of digital techniques can provide more convenient, intelligent, and high-capacity storage space and sharing platforms for conventional Chinese physical activities and cultural heritage resources. In the digital age, utilizing modern digital platforms, devices, and technologies to digitize and compile the intangible heritage of conventional Chinese physical activities, reinterpreting and interpreting its cultural connotations, and linking it with modern life, will endow the intangible heritage of conventional Chinese physical activities with a new discourse system. At the same time, the display, sharing and diffusion of Chinese conventional physical activities cultural heritage through the Internet and new media can not only facilitate cross-cultural dialogue among the public of different cultures, quickly catch the eyes of people, especially young people, and generate resonance, so that China's extensive and profound conventional physical activities cultural heritage is easily loved and accepted by the public; It

can also enable the information resources of intangible heritage of conventional Chinese physical activities to be more widely and satisfactorily utilized, supporting the conservation, inheritance, and development of intangible heritage of conventional Chinese physical activities. Table 1 shows the comparison of the core advantages between conventional safeguarding and digital conservation.

Table 1: Comparison of Core Advantages between Conventional Safeguarding and Digital conservation

Safeguarding dimension	Conventional safeguarding mode	Digital conservation mode	Improve satisfactoriness
Storage method	Paper, magnetic tape, optical disc (easily damaged, attenuated)	Cloud storage, blockchain, distributed backup (perpetual)	Resolve physical damage and distortion issues
Scope of dissemination	Regional limitations, oral transmission and personal experience	Cross temporal, network wide dissemination, and new media coverage	Exponential expansion of dissemination scope
Inheritance method	Inheritor demonstration, limited audience	VR/AR/XR immersive, virtual apprenticeship system	Lowering the learning threshold and expanding the audience
management efficiency	Slow retrieval and difficult sharing	Database standardization and intelligent retrieval	Significant improvement in resource integration and sharing efficiency

3 TOE system framework for digital conservation and intellectual property management of intangible heritage of conventional Chinese physical activities

3.1 Internal mechanism

The mechanism of digital conservation of intangible heritage of conventional Chinese physical activities refers to the transformation of safeguarding organizations, enterprises, government agencies, etc. related to intangible heritage of conventional Chinese physical activities from the conventional safeguarding mode to the current safeguarding of intangible heritage of conventional Chinese physical activities through digital means [19]. The main body of the active safeguarding of intangible heritage of conventional Chinese physical activities needs to use big data analysis methods to monitor market dynamics and audience demand, and based on audience feedback, launch personalized and differentiated products and services to achieve a good situation where safeguarding and utilization complement and facilitate each other. The internal mechanism diagram of digital techniques enhancing the safeguarding and inheritance of intangible heritage is shown in Figure 1.

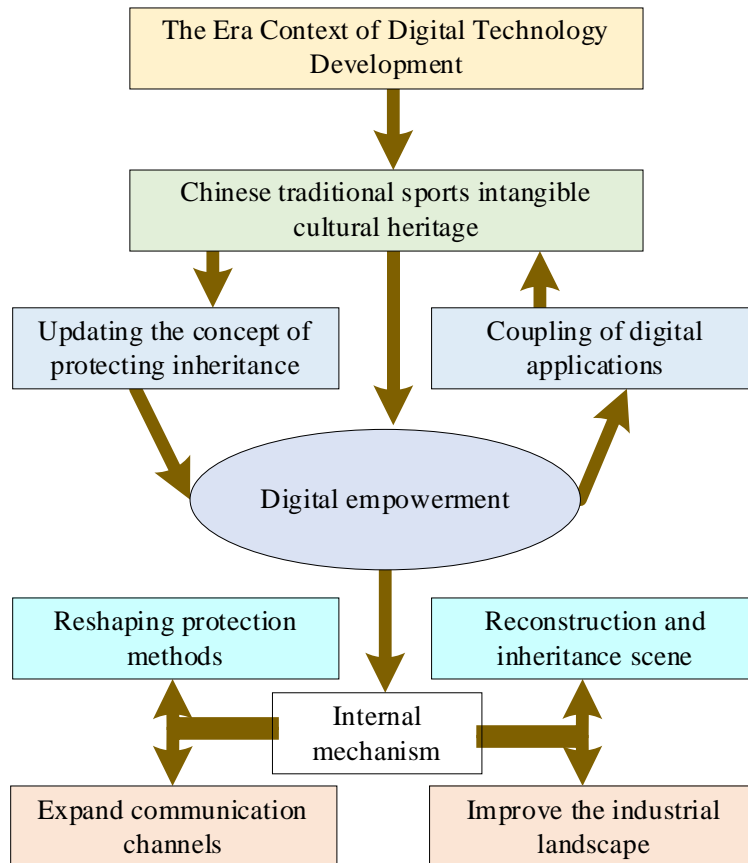


Figure 1: The Mechanism of Digital techniques Empowering the Safeguarding and Inheritance of Intangible heritage

The essence of digital techniques, as a cluster of modern intelligent technologies, lies in the computation and programming of cultural information and data elements [20]. Currently, emerging intelligent technologies represented by 5G, blockchain, and augmented reality are driving the transformation of the safeguarding of intangible heritage and intellectual property management in conventional Chinese physical activities from a conventional model to a "technology empowered governance paradigm".

(1) The digital platform facilitates the diffusion of intangible heritage of conventional Chinese physical activities. The international communication strategy transforms the intangible heritage of conventional Chinese physical activities into a governance medium for cross civilization dialogue, relying on digital techniques to break the centralized structure of conventional communication and establish a multi subject collaborative cultural digital ecosystem. At the platform level, the digital gene library of intangible heritage of conventional Chinese physical activities integrates massive multimedia resources, satisfactorily promoting the global diffusion of intangible heritage of conventional Chinese physical activities. In terms of educational communication, the virtual simulation laboratory for intangible heritage of conventional Chinese physical activities achieves immersive experience and interactive learning through digital techniques, satisfactorily solving the time and space limitations and technical barriers of conventional communication. With the help of intelligent matching, a digital master apprentice network for core skill inheritance has been established, and the number of students has significantly increased. With regard to commercial communication, the scale of China's overseas gaming market has exceeded 100 billion yuan for five consecutive years, becoming an important breakthrough in cultural globalization communication. The increasing

integration of Chinese conventional physical activities intangible heritage elements into game content has prompted overseas players to actively explore related cultures. According to data from the Steam platform, game products containing elements of conventional Chinese physical activities intangible heritage continue to receive positive reviews [21]. By building a "digital cultural community" mechanism that integrates virtual and real elements, cultural barriers are broken through and cultural commonalities are deepened.

(2) The digital scene reconstruction of the inheritance of intangible heritage of conventional Chinese physical activities. At the technical level, VR technology satisfactorily breaks down physical spatial isolation, allowing participants to experience conventional scenes in virtual space. AR technology focuses on overlaying virtual information in the real environment, creating new scenes that integrate reality and virtuality, realizing the embodied inheritance of intangible heritage skills in conventional Chinese physical activities, and significantly enhancing cultural identity and emotional connection. In addition, XR technology, with its multimodal interaction capability, has built a new path for the inheritance of intangible heritage in conventional Chinese physical activities through a "perception behavior" closed loop, promoting the formation of a multimodal teaching system for intangible heritage in conventional Chinese physical activities [22]. It upgrades inheritance from one-way teaching to immersive interactive learning, and allows users to interact with intuitive gestures to disassemble learning equipment structures, significantly optimizing learning outcomes.

(3) The digital reconstruction of the information storage paradigm for intangible heritage of conventional Chinese physical activities. The inheritance system of intangible heritage of conventional Chinese physical activities is facing the risk of intergenerational rupture, and there is an urgent need to establish a new paradigm for preventive safeguarding [23]. Through the cutting-edge technology chain of "multimodal information collection intelligent data processing digital form reconstruction", digital transformation is achieved by extracting the ontology information of Chinese conventional physical activities intangible heritage. Relying on blockchain distributed storage, establish a database of Chinese conventional physical activities intangible heritage resources, build a digital platform, and ensure the permanent existence and intelligent retrieval of resources. Regarding the endangered intangible heritage project of conventional Chinese physical activities, XR technology is used to restore residual image data and establish a cultural memory regeneration system that spans time and space. Digital techniques can be reconstructed from four dimensions: 1) In the security dimension, post quantum cryptographic algorithms provide security against quantum computing attacks for cultural gene libraries; 2) In terms of time dimension, blockchain based distributed ledger technology ensures intergenerational continuity of cultural data; 3) In the spatial dimension, a geographically distributed redundant backup mechanism is adopted; 4) At the carrier dimension, cloud storage technology satisfactorily avoids the physical attenuation problem of conventional storage media through a de materialization architecture.

(4) The digital reshaping of the intangible heritage format of conventional Chinese physical activities. Digital techniques rely on the four-dimensional collaborative mechanism of "production mode innovation - communication system reconstruction - property rights safeguarding strengthening - value chain derivation" to drive the modernization transformation of China's conventional physical activities intangible heritage. The key to multidimensional empowerment of mathematical technology lies in establishing a dynamic balance between technological availability and cultural subjectivity. Through the four-dimensional collaborative mechanism, the intangible heritage of conventional Chinese physical activities has successfully transformed into a modern cultural and economic form that combines economic vitality, innovation tension, and dissemination satisfactoriness [24]. Its development paradigm provides satisfactory solutions for the safeguarding of intangible heritage of conventional Chinese

physical activities.

3.2 TOE Theoretical Model

At present, the TOE theory is mainly applied in the fields of digital techniques adoption and digital intelligence empowerment in the safeguarding and intellectual property management of intangible heritage in conventional Chinese physical activities. As an important part of public cultural services, the TOE theory provides a reasonable explanatory framework for systematically exploring the action logic of digitalization of intangible heritage in conventional Chinese physical activities in the digital age. Therefore, The present work focuses on three dimensions: technology (internal foundation), organization (action subject), and environment (external guarantee), forming a theoretical framework (Figure 2).

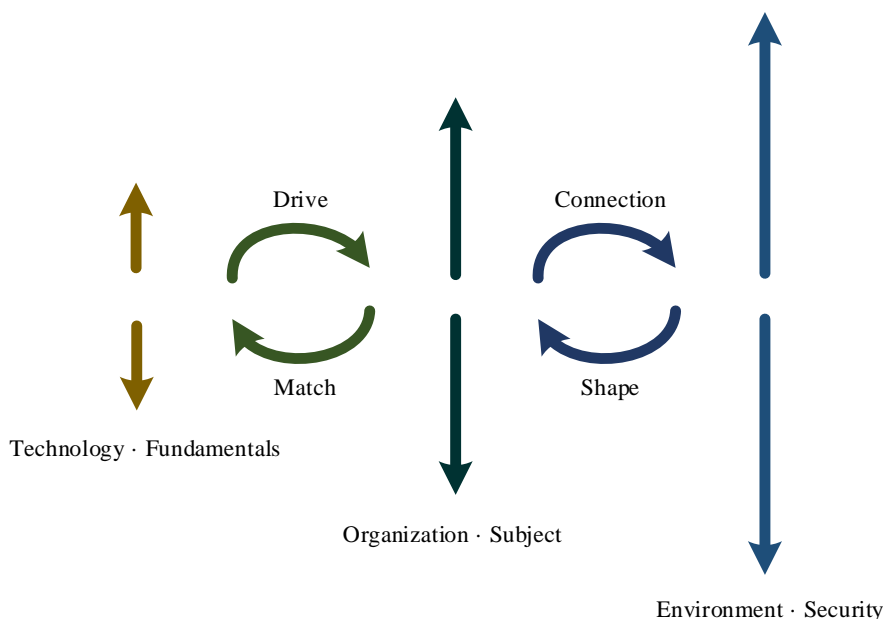


Figure 2: TOE System Framework for Digital conservation and Management of Intangible heritage

Organizational dimension, including government, social organizations and other actors, among which inheritors include representative inheritors and Chinese conventional physical activities intangible heritage practice communities, jointly promoting the digital development of Chinese conventional physical activities intangible heritage; The technological dimension, including digital imaging, metaverse, human-computer interaction and other digital technologies, serves as the foundation for the digitization of intangible heritage of conventional Chinese physical activities, providing impetus for digital applications and innovation; The environmental dimension, including policy implementation, cultural aesthetics, and other aspects, affects the current trend of digitalization of intangible heritage of conventional Chinese physical activities [25]. Based on this theoretical framework, analyze the current development status and implementation path of digitalization of intangible heritage of conventional Chinese physical activities from three dimensions: technology, organization, and guarantee. The basic formula of TOE theory is as follows:

$$DigiAdoption = f(Tech, Org, Env) \quad (1)$$

where, DigiAdoption is the level of adoption for the digital conservation of intangible heritage in conventional Chinese physical activities; Tech is the technical dimension (compatibility, availability, security); Org is the organizational dimension (subject collaboration, resource investment, and involvement of inheritors); Env is the environmental dimension (policy, market, cultural atmosphere).

3.3 TAM-TOE Model

Due to the systematic and complex nature of the safeguarding of intangible heritage and intellectual property management in conventional Chinese physical activities, its achievements not only need to adapt to the dynamic changes in the external environment, but also need to pass the compatibility test of the existing engineering technology system to ensure the compatibility and feasibility of the technology [26]. The Technology Acceptance Model (TAM) can provide an important theoretical framework for this article. In this regard, this article combines TAM with TOE to satisfactorily integrate macro and micro perspectives, dynamic interactions of different behavioral levels and influencing factors in the adoption of technological innovation, and constructs a unified TAM-TOE implementation path for the safeguarding of intangible heritage of conventional Chinese physical activities and intellectual property management. Figure 3 shows the TAM-TOE pathway framework for the safeguarding and management of intangible heritage.

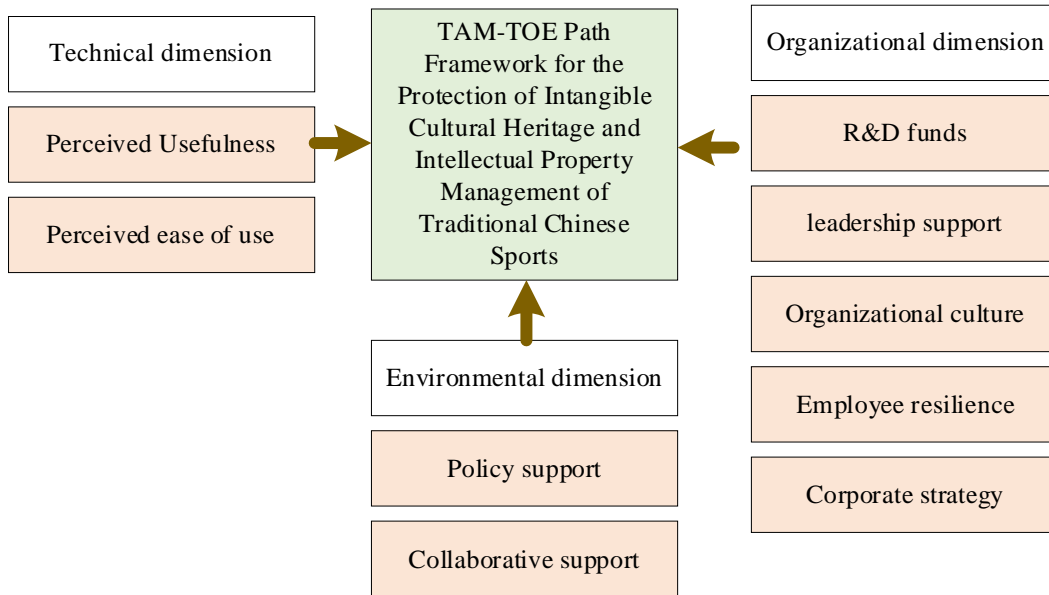


Figure 3: TAM-TOE Path Framework for the Safeguarding and Management of Intangible heritage

The core formula of TAM technology acceptance model is as follows:

$$UsageIntention = \beta_0 + \beta_1 PU + \beta_2 PEOU \quad (2)$$

where, UsageIntention refers to the willingness to use digital conservation; PU stands for Perceived Usefulness; PEOU stands for Perceived Ease of Use; β_0 , β_1 , β_2 are regression coefficients.

Furthermore, the TAM-TOE integration model formula can be obtained as follows:

$$DigiSystem = \beta_0 + \beta_1 Tech + \beta_2 Org + \beta_3 Env + \beta_4 PU + \beta_5 PEOU + \varepsilon \quad (3)$$

where, DigiSystem is the level of digital conservation and intellectual property management system construction for athletics intangible heritage; ε is the random error term.

Based on the TAM-TOE framework and existing research, this article identifies and analyzes the influencing factors of the safeguarding of intangible heritage of conventional Chinese physical activities and intellectual property management from the dimensions of technology, organization, and environment [27].

(1) Classification design of intangible heritage database of conventional Chinese physical activities under digital management methods. The establishment of the Chinese conventional physical activities intangible heritage database needs to follow the unified standards of digitization and informatization, standardization and normalization, systematization and cooperation, which can satisfactorily manage and inherit the Chinese conventional physical activities intangible heritage. In the process of building a database of intangible heritage of conventional Chinese physical activities, it is necessary to attract professional talents from other fields, which requires both informatization and digitization, as well as standardization and normalization. One way is to establish a standardized database, develop unified data standards and classification systems, and achieve systematic management of intangible heritage resources of conventional Chinese physical activities. Secondly, a multi-dimensional information digital integration system can be established to comprehensively collect complete data on the types, development trends, cultural values, and other related aspects of intangible heritage of conventional Chinese physical activities. Thirdly, by establishing a digital conservation system, we can fully explore the cultural connotations of the intangible heritage of conventional Chinese physical activities, and continuously meet the needs of dynamic safeguarding, creative transformation, and innovative development of the intangible heritage of conventional Chinese physical activities. Fourthly, an open and shared information platform can be established, and a cross departmental and cross regional data sharing mechanism can be established.

(2) Innovative development of intangible heritage of conventional Chinese physical activities in the digital industry. Conventional Chinese conventional physical activities intangible heritage safeguarding and intellectual property management rely more on static forms as illustrated by written records and image preservation, with single methods, low dissemination efficiency, and insufficient interactivity. Digital conservation can break down information silos and greatly improve the speed and accuracy of information storage, retrieval, analysis, and organization by aggregating various information resources of conventional Chinese physical activities intangible heritage, achieving seamless sharing and collaborative management of information. Not only can it optimize the allocation of intangible heritage resources in conventional Chinese physical activities, but it also supports personalized viewing and access, allowing people to query information of interest at any time and place using smartphones, greatly accelerating the dissemination efficiency of intangible heritage in conventional Chinese physical activities. Through diversified information platforms and intelligent tools, audiences can plan ideal travel routes based on their personal interests, significantly improving travel efficiency, allowing more tourists to access and understand local tourist attractions and knowledge of conventional Chinese physical activities intangible heritage, and expanding the diversified development path of the digital industry model of conventional Chinese physical activities intangible heritage.

(3) The integration of intangible heritage resources of conventional Chinese physical activities in digital scenarios. The distribution of intangible heritage projects in conventional Chinese physical activities is relatively scattered. The present work utilizes digital techniques to summarize and extract the common cultural elements of Chinese conventional physical

activities intangible heritage projects, and uses digital modeling methods to organize information on Chinese conventional physical activities intangible heritage resources, simulating the distribution pattern and development trajectory of Chinese conventional physical activities intangible heritage projects; Then, through the employment of digital spatial scenarios, the intangible heritage resources of conventional Chinese physical activities were integrated, deeply integrating the scattered intangible heritage resources of conventional Chinese physical activities in different regions. The organic combination of conventional safeguarding and digital dissemination channels provided an innovative integration method for the intangible heritage of conventional Chinese physical activities. The digital display platform meets the needs of people to independently understand and learn cultural content of interest anytime and anywhere, which is conducive to promoting the integrated development of athletics culture and athletics industry, and helping to innovate and develop the intangible heritage of conventional Chinese physical activities.

(4) The sharing path of intangible heritage resources of conventional Chinese physical activities in the form of digital communication. The dissemination model based on regional culture has significant spatial limitations in modern society and requires the employment of digital information technology platforms to achieve satisfactory breakthroughs in the diffusion of conventional culture. One is to expand the dissemination scope of intangible heritage projects of conventional Chinese physical activities through various new media tools; The second is to create a series of digital display platforms as illustrated by digital exhibition halls, breaking through the physical space limitations of conventional displays; The third is to use high-precision collection and standardization methods to systematically archive the images and textual materials of the intangible heritage of conventional Chinese physical activities; The fourth is to use virtual reality (VR) technology to on-site restore and recreate the many intangible heritage and historical sites of conventional Chinese physical activities along the Grand Canal. The fifth is to break through geographical and time constraints through online education courses, and remotely impart knowledge and skills related to the intangible heritage of conventional Chinese physical activities. The comprehensive application of these digital communication methods has significantly enhanced the influence of the intangible heritage of conventional Chinese physical activities.

4 Measures to facilitate the safeguarding of intangible heritage of conventional Chinese physical activities

The empowerment of intelligent diffusion of Chinese conventional physical activities intangible heritage resources mainly focuses on resource collection and recording based on digital techniques, as well as database construction, to achieve intelligent design of Chinese conventional physical activities intangible heritage resources and optimize the intelligent dissemination channels of Chinese conventional physical activities intangible heritage resources [28].

(1) Improve the collection of digital resources for intangible heritage of conventional Chinese physical activities. In the process of intelligent dissemination and safeguarding of intangible heritage resources in conventional Chinese physical activities, the most basic work is largely embodied in the collection of related resources, which is also the key to ensuring that the later recording can be improved and standardized. Record the training process of the inheritor and related personnel, and demonstrate the cooperation and tacit understanding in team competition. Especially in athletics, all routines should be recorded, and in competitive athletics, the process of the competition should also be filmed and recorded. Carry out digital

intelligent recording and organization of oral records, and preserve precious images of each inheritor and their skills through digital collection forms as illustrated by oral videos, self practice videos, inheritance teaching videos, and review videos, including digital data of national level representative inheritors of intangible athletics culture included in the rescue record project. This is a digital resource collection and recording standard developed from the perspective of big data and intelligent safeguarding of intangible heritage of conventional Chinese physical activities. It helps researchers and practitioners of intangible heritage of conventional Chinese physical activities to accurately grasp and deeply explore the professional characteristics of intangible heritage of conventional Chinese physical activities, and facilitates systematic and scientific collection work.

(2) Establish a digital classification system for intangible heritage of conventional Chinese physical activities. In the safeguarding and intellectual property management system of intangible heritage of conventional Chinese physical activities, the establishment of the database of intangible heritage of conventional Chinese physical activities has also made significant progress in contemporary times. Based on the analysis of relevant databases established by the Ministry of Culture and Tourism, relevant provinces and even some county-level management departments, the digital data management of intangible heritage of conventional Chinese physical activities in archives is largely embodied in two categories: retrieval platforms and experience platforms. The above two types of platforms, which include intangible heritage resources of conventional Chinese physical activities, have basically expanded to relevant promotion and safeguarding institutions as illustrated by the Chinese Conventional physical activities' Intangible heritage Network, virtual museums, and digital museums of conventional Chinese physical activities intangible heritage across the country. There are also some provinces, cities, or associations that share the intangible heritage of conventional Chinese physical activities in the form of websites, sharing data and information on intangible heritage resources of conventional Chinese physical activities in different regions and types. All of these provide a good platform for the establishment of a digital classification system for the management of intangible heritage resources of conventional Chinese physical activities.

(3) Integrating virtual reality technology into the intangible heritage of conventional Chinese physical activities. The information processing of intangible heritage resources in conventional Chinese physical activities is largely embodied in the integration of virtual reality technology, the joint development of 3D modeling and simulation technology, and multimedia technology, which enables it to have efficient and high-definition panoramic image technology [29]. On the dissemination platform of intangible heritage of conventional Chinese physical activities, the emergence of high-capacity storage devices, the popularization of network bandwidth technology in 3D exhibition halls, the promotion of digital glasses, and the growth of advanced big data management have all greatly improved the transformation, dissemination, and promotion of intangible heritage resources of conventional Chinese physical activities. The integration of virtual reality technology in information processing has brought revolutionary changes to the preservation and diffusion of intangible heritage resources in conventional Chinese physical activities. With the support of this digital techniques, the safeguarding and intellectual property management of intangible heritage in conventional Chinese physical activities are easier and more convenient to obtain information than online encyclopedias, and also provide more vivid cultural experiences.

(4) Strengthen the platform for showcasing and disseminating intangible heritage of conventional Chinese physical activities. Reasonably utilizing artificial intelligence technology will greatly reduce the negative effects brought about by the empowerment process of digital techniques. By integrating with artificial intelligence methods, it will continuously reflect the

human side. By establishing a platform for showcasing and disseminating intangible heritage of conventional Chinese physical activities, the integration of "artificial intelligence language processing tools" and "language related projects of intangible heritage of conventional Chinese physical activities" can be further combined. This combination not only meets the cognitive needs of ordinary people, but can also achieve customization of high-end and specific services through deep technology learning. To a certain extent, minority languages can also be translated into Chinese or other languages, allowing for free switching between language systems. Through the integration and utilization of big data and intelligent virtual reality technology of intangible heritage of conventional Chinese physical activities, the public can also experience a sense of immersion in the diffusion of knowledge and information about intangible heritage of conventional Chinese physical activities. This is the key to establishing a platform for displaying and disseminating intangible heritage of conventional Chinese physical activities, achieving the goal of information sharing of intangible heritage of conventional Chinese physical activities, and is also one of the main empowerment paths for intelligent diffusion of intangible heritage resources of conventional Chinese physical activities.

(5) Establish the concept of "participatory digital conservation" for intangible heritage of conventional Chinese physical activities. The key to empowering the intelligent safeguarding and diffusion of intangible heritage resources in conventional Chinese physical activities is to establish a harmonious participation mechanism between resource owners and inheritors, further empowering them to "participate in the establishment of digital culture and express their own cultural attitudes", in order to truly realize the concept of "participatory digital conservation". The popularization of "participatory digital conservation" will mobilize relevant resource owners and inheritors to continuously participate in the process of digital conservation and inheritance, and fully empower them with a voice in this process, promoting their active participation in the design and development of digital products related to communication activities, including conventional Chinese physical activities intangible heritage. The participatory development in the dissemination process of intangible heritage of conventional Chinese physical activities mainly includes the following points: 1) Through participatory "empowerment", the discourse power of owners and inheritors is protected, further mobilizing their enthusiasm and initiative to participate in the digital conservation of intangible heritage of conventional Chinese physical activities, and promoting the diffusion of intangible heritage of conventional Chinese physical activities; 2) Based on their own living environment and cultural logic, owners and inheritors of intangible heritage resources in conventional Chinese physical activities will "establish a digital classification and evaluation system that is in line with their own culture" through consultation and discussion with data programmers. 3) In the process of participation, they will "enhance the sense of home and subjectivity that participants did not have or were overlooked. In short, the popularization of the concept of" participatory digital conservation "will further ensure the dominant position of project owners and inheritors in the production of intangible heritage in conventional Chinese physical activities, while also highlighting their subjectivity and equal negotiation rights in the process of digital conservation.

5 Conclusion

The present work focuses on the digital conservation and intellectual property management system construction of intangible heritage of conventional Chinese physical activities in the public domain. By introducing the TAM-TOE model, the implementation path of the digital conservation and intellectual property management system is analyzed in depth from three dimensions: technology, organization, and environment. By introducing the TAM-TOE model, the study successfully integrated macro and micro perspectives in the adoption of technological

innovation, providing a unified theoretical framework and practical path for the digital conservation and intellectual property management of intangible heritage of conventional Chinese physical activities. In addition, the study also proposed the concept of "participatory digital conservation", emphasizing the dominant position of resource owners and inheritors in the process of digital conservation, providing new ideas for promoting the innovative inheritance and development of intangible heritage of conventional Chinese physical activities.

The present work suggests that there are still many directions worth exploring for the digital conservation and intellectual property management of intangible heritage of conventional Chinese physical activities: (1) With the continuous development of digital techniques, how to further enhance the adaptability and satisfactoriness of digital conservation technology will be the focus of future research. (2) How to build a more comprehensive digital conservation system and facilitate the deep integration of digital conservation and intellectual property management is also an urgent problem to be solved. (3) Strengthening the updating and popularization of the digital conservation concept for intangible heritage of conventional Chinese physical activities, and promoting the establishment of a mutual promotion mechanism between culture and digital techniques, are also important directions for future research. (4) The concept of "participatory digital conservation" proposed in the present work needs to be continuously verified and improved in practice to better guide the digital conservation and inheritance of intangible heritage of conventional Chinese physical activities.

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