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Digital Cultural Heritage Archives: Conceptual Analysis and Preliminary Framework Construction

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Abstract

Grounded in UNESCO's World Heritage framework and China's cultural digitization strategy, this paper systematically examines the limitations of existing concepts such as relic archives and intangible cultural heritage archives, proposing a four-dimensional framework: "heritage ontology archives, conservation process archives, conservation unit archives and secondary-processed archival products." This framework integrates multi-modal data records of tangible, intangible, and born-digital cultural heritage, achieving an organic unity between static attributes and dynamic evolution of cultural heritage. Furthermore, it outlines a tiered construction approach involving multi-stakeholder collaboration among governments, regions, cultural heritage institutions, and archival professionals. The research demonstrates that the digital cultural heritage archive system not only provides theoretical support for existing conservation practices but also activates knowledge production and value transformation capabilities through archival datafication, promoting a paradigm shift from "passive recording" to "active governance".It offers archival science solutions for the national cultural big data system.

1. Introduction

The interdisciplinary nexus between archival science and cultural heritage has generated substantive scholarly discourse. China's archival domain has developed operational frameworks for relic documentation and intangible cultural heritage archives, yielding a constellation of heritage-related archival concepts. However, current scholarship remains constrained by mono-disciplinary approaches to heritage typologies, failing to construct holistic architectures for digital-era cultural heritage archives. As scholars critically observe, while Chinese heritage policies mandate archival creation, inadequacies like substantive ambiguities persist regarding documentation parameters and standardization protocols undermine responsiveness to the complexities of digital heritage preservation (He and Liu, 2025).

The digital epoch presents unprecedented challenges for cultural heritage stewardship: multi-modal data governance, techno-cultural contextual preservation, and dynamic value actualization. Grounded in the epistemic intersection of archival science and heritage studies, this research examines digitally-enabled multi-modal data regimes and polycentric governance frameworks. It ultimately proposes theoretical models and methodological protocols to ensure sustainable preservation and value generation for digital cultural heritage assets.

2. The Relationship Between Cultural Heritage and Archives in the Digital Era

2.1 The Embeddedness of the Archival Life-cycle in the Holistic Process of Digital Cultural Heritage Preservation

As the focal object of archival work, cultural heritage aligns profoundly with the core logic of archival management "acquisition, organization, preservation, and access" in its digital preservation practices. Traditional high-speed scanners, high-resolution digital cameras, 3D scanning technologies, and AI-powered oral history collection tools, along with automated classification, clustering, and contextual linking of digital archives, have significantly expanded the breadth and depth of cultural heritage digitization. These advancements enhance the scale, quality, and utility of subsequent digital archives. The establishment of cloud-based cultural heritage data centers and the application of big data and block chain certification technologies adeptly accommodate the voluminous and heterogeneous nature of digital archival data, offering frameworks for constructing trustworthy storage systems.

At the management level, multimodal data integration and metadata standardization drive refined governance of digital cultural heritage archives. Starting with conceptual reference models like CIDOC CRM in the GLAM (Galleries, Libraries, Archives, Museums) domain, various institutions have developed context-specific resource description models. These include the Records in Contexts Conceptual Model (RiC-CM) by the International Council on Archives, the IFLA Library Reference Model (IFLA LRM) by the International Federation of Library Associations, the Europeana Data Model (EDM) by Europeana, and the Categories for the Description of Works of Art (CDWA) by the Getty Museum (Chen, 2023). These models adapt to diverse heritage characteristics, enhancing interoperability through standardized frameworks. Semantic technologies such as ontology-based knowledge bases and knowledge graphs enable intelligent retrieval systems, improving the discoverability and utilization efficiency of digital cultural heritage resources. This foundation supports subsequent applications of virtual and augmented reality in digital exhibition and experiential contexts, facilitating a value transition from physical restoration to knowledge reproduction.

2.2 Archive-Based Digital Memory Expands the Boundaries of Digital Cultural Heritage

Archives occupy a central role in the valuation and memory construction of digital cultural heritage. Archive-based digital memory transcends the physical and medium constraints of traditional archives through digital technologies, transforming archival resources into dynamic digital cultural heritage. Within heritage recognition systems, archives serve as both the cornerstone of successful World Heritage nominations and arbiters of historical disputes. Whether during technical evaluations by UNESCO experts or post-inscription impact assessments, the completeness and security of archival records, provided by archival institutions, are critical metrics (Ma and

Sui, 2025). For unrecognized cultural resources, archival mechanisms function as a "cultural safety net," preserving marginalized heritage. This safeguarding not only prepares evidence chains for potential future recognition but also systematically maintains cultural genetic diversity, preventing cultural discontinuity.

While mainstream heritage criteria emphasize historical periodization, artistic integrity, or social influence, vast repositories of localized knowledge and declining traditional practices require archival methods for their vitality. On a deeper cultural-political level, archiving cultural heritage aims not only to rescue endangered traditions but also to reactivate their connected social memories (Liang, 2024). As a "digital palace of cultural memory," (Feng, 2020) digital memory dissolves physical divisions among archival types and custodial systems, converting books, records, audiovisual materials, and oral histories into a unified "genetic memory bank." Technologies like 3D modeling, VR/AR, and data visualization transform static documents into interactive digital narratives, inviting public participation in memory co-creation and elevating individual memories to collective heritage.

Thus, rooted in archives and innovating through technology and theory, digital memory redefines the essence and scope of digital cultural heritage. First, Digital memory animates heritage, turning historical artifacts into evolving entities. For instance, the designation of DDS (De Digitale Stad) as the first born-digital heritage exemplifies this by reconstructing Dutch internet culture, allowing public interaction with its 4.0 version. (Qi, 2025); Second, digital cultural heritage has transcended the confines of formal recognition processes like "World Heritage nomination," evolving into a pivotal instrument for social memory governance; Third, It shifts heritage from institutional monopolies to public commons. The Gaoqian Ancient Village project exemplifies this through its "Front-end website, back-end database" architecture, simultaneously enables professional researchers to explore profound archival connections while serving general users through visual storytelling.

2.3 Archival Datafication Innovates Paradigms for Digital Cultural Heritage Development

Archival datafication, as a paradigm shift in heritage development, hinges on transcription, enhanced description, contextual linking, and vector processing to achieve machine-readable, analyzable, and semantically interoperable data resources (Yang, Liu and Qi, 2022). This process unlocks latent archival value. For example, knowledge graphs constructed from Beijing's Central Axis heritage archives, via entity extraction, alignment, and relational mapping, support advanced research and utilization (Guan and Zhao, 2021).

The generation of “cultural heritage data elements” marks a transformative shift. These elements, characterized by foundationality, fluidity, and recombinability, serve as metadata for cross-platform integration and narrative recombination. The Suzhou Silk Archives project illustrates this: its dual-layer ontology design enables semantic interoperability, dynamically reconstructing silk craftsmanship narratives through metadata like "historic events-actors-physical entities." (Niu, Huang and Jia, 2023) This elemental approach replaces physical-dependent models with data-driven innovation: In knowledge production, linked data fosters dynamic narrative networks; In exhibition practices, curatorial shifts from static displays to narrative-driven spatial experiences; In industrial applications, Data elements empower precision cultural creativity, such as digitized patterns revitalizing traditional crafts for contemporary IP development(Wang, Wu and Song, 2023). In sum, archival datafication restructures digital heritage value chains by cultivating data elements, unleashing combinatorial potential and innovation momentum.

3. Discrimination of Related Basic Concepts of Cultural Heritage Archives

3.1 Cultural Relics Archives

The existing concept of "cultural relics archives" was formed under the drive of the practical needs (especially the protection of immovable cultural relics) in the early stage of the cultural heritage management cause of the People's Republic of China. It is a file with material cultural heritage as the core. The key consensus formed includes that cultural relics archives are a collection of information, whose content goes beyond the simple description of cultural relics themselves, includes various activities and management processes of cultural relics, and is an indispensable basic work in the protection and management of cultural heritage. However, the current definition of "cultural relics archives" is too broad and inconsistent. For example, the "series of work related to cultural relics" lacks clear definition standards, and only focuses on material cultural heritage. The information recording model naturally tends to static and tangible objects, ignoring the relationship between cultural heritage and the environment and other types of cultural heritage.

3.2 "Four Essentials" Archives

The "Four Essentials" archives generated by cultural relics protection units at all levels in the "Four Essentials" work refer to cultural relics archives with protection scopes, detailed records, clear markers, and special management institutions. They record and reflect materials directly formed in the cultural relics protection work of protection units and with preservation value, serving as necessary conditions for archaeological excavation, protection, maintenance and research of cultural relics. Among them, record archives are an important component of the "Four Essentials" archives, clarifying and refining the "Four Essentials" archival work. Cultural relics record archives include physical carriers of national key cultural relics protection units and related documents and materials, with the main content divided into two categories: scientific and technical materials and administrative management documents, which are respectively classified into main volumes, auxiliary volumes, reference volumes and other types (Lu, 2024). Cultural relics record archives cover a wide range of contents, almost encompassing all situations of cultural relics and all business work of cultural relics protection units such as classification, protection, management, maintenance, exhibition and research (Cui, 2012).

In summary, the "Four Essentials" archives are a fundamental system for the management of cultural relics protection units in China. Their concepts have the advantages of legality, mature system and comprehensive content design, providing a solid archival foundation for decades of heritage protection work in China. However, its conceptual framework is rooted in the paper-based archival management logic of the pre-digital era. Facing the revolutionary impact of digital technology, the deepening of multi-cultural heritage protection concepts and the new social needs for heritage utilization, its lagging nature has become increasingly prominent.

3.3 Intangible Cultural Heritage (ICH) Archives

Due to the material dependency of intangible cultural heritage, its expression and transmission rely on certain material carriers or media for people to accept and perceive(Zhao and Wang, 2007). Therefore, the archival protection of intangible cultural heritage—studying how to transform intangible cultural heritage into tangible records through archiving ("creation of tangibility from intangibility") and how to protect these "creative achievements" from an archival perspective—has become a key topic in ICH protection. This has given rise to the concepts of ICH archives and ICH archive resource construction. A systematic review of existing research identifies two representative definitional orientations:

1. Carrier-based Record Orientation
This defines ICH archives as the sum of multi-modal records generated throughout ICH activities. While this definition excels in comprehensiveness, it fails to resolve the contradiction between living dynamics and fixed records — whether static recordings of dynamic performing arts still retain the essence of ICH remains debated (Zhao and Wang, 2007).

2. Administrative Process Simplification Orientation
This narrows ICH archives to documentation for ICH listing applications (Feng, 2013), with some studies reducing ICH archiving to "the process of providing supporting materials for listing."(Wang, 2022) This confines archive contents to administrative documents such as application forms, expert review opinions, and protection plans. Although operationally convenient for management, this orientation severely undermines the cultural value of archives, ignores the cultural context of ICH, and reduces living culture to an administrative appendage of listing work.

3.4 Heritage Listing Archives

As a key credential for certifying the value of cultural heritage, heritage listing archives deserve shared attention in various cultural heritage protection studies. However, their theoretical construction has long been confined to the context of intangible cultural heritage (ICH) listing. However, since 2024, listing cases such as the Beijing Central Axis inscribed on the World Heritage List, the Spring Festival added to the Representative List of the Intangible Cultural Heritage of Humanity, and more documentary heritage inscribed on the International Memory of the World Register have revealed that heritage listing archives need to break through the single dimension of ICH, cover a broader range of cultural heritage types, and deepen the adaptability of listing archives for different heritages.

3.5 Born-Digital Cultural Heritage Archives

As mentioned earlier, digital archives can manifest as integral preservation units for the technical-cultural complexity of born-digital cultural heritage. They serve both as direct carriers of specific digital cultures and as original evidence of digital social activities. Thus, the concept of born-digital cultural heritage archives is inseparable from born-digital cultural heritage itself: many forms of the latter exist as born-digital archives, and born-digital resources undergo archiving for preservation first, followed by cultural heritage selection.

It should be noted that with the continuous emergence of new digital technologies and carriers, the types of digital heritage will expand accordingly, including software source code, research data, social media records, and artificial intelligence records. The relationship between archives and these digital resources, as well as the definition of born-digital cultural heritage archives, warrants further discussion.

In summary, while domestic and international studies have initiated explorations into cultural heritage archives for specific categories, a unified conceptual system remains absent. To achieve coherent dialogue between local and global discourses, it is necessary to critically examine the ideological underpinnings of existing heritage frameworks and uphold the principle of equal attention to material, intangible, and digital heritage in localized practices. The following section will attempt to construct a Chinese indigenous cultural heritage archive system based on existing research, elaborating on the interrelations of its various components.

4. Construction of the Conceptual System of Digital Cultural Heritage Archives

4.1 Cultural Heritage Ontology Archives: the "Gene Bank" of Civilization

Cultural heritage ontology archives refer to systematic records established around the cultural heritage entity or practice itself, aiming to record the basic features of cultural heritage in a multimodal and all-round manner.

4.1.1 Material Cultural Heritage Ontology Archives: Movable Cultural Relics: Taking ceramics, bronze wares and other movable cultural relics from various historical periods, as well as immovable cultural relics such as stone inscriptions and ancient buildings as examples. The ontology archives of movable cultural relics should clarify the identification information of the cultural relics, and describe their physical characteristics (material and technology, shape and size, decoration and patterns), historical information (age, origin and circulation), and preservation status (current status description, testing and analysis data).

Immovable Cultural Relics: Compared with movable cultural relics which are small in size and easy to divide in shape and quality, immovable cultural relics are easily associated with the spatial environment and adjacent cultural relic groups, and their archive descriptions are more complex, with obvious differences in the recording contents of different types of cultural relics. In addition to basic identification, physical characteristics, historical information and preservation status, auxiliary information such as geographical location and spatial relationship, carving contents and built - in cultural relics need to be added. Taking ancient buildings such as palaces and temples as examples, the ontology archives need to take into account both the spatial environment and the building itself. Outwardly, it describes the geographical location and surrounding environment of the building, as well as the position of the single building in the group, axis relationship and spatial composition. Inwardly, it introduces the architectural form and pattern, structural composition, building materials, decorative arts, and the fixed statues, inscriptions, etc. in the building.

4.1.2 Intangible Cultural Heritage Ontology Archives: The description objects of intangible cultural heritage ontology archives should at least include the ten categories of national intangible cultural heritage in China, which are: folk literature, traditional music, traditional dance, traditional drama, quyi, traditional sports, recreation and acrobatics, traditional art, traditional craftsmanship, traditional medicine, and folklore. The content should clarify the project identification and basic

information, core practice content and forms of expression, including the description of practice processes and technologies/techniques, core content and forms of expression, survival environment and cultural space, inheritors and inheritance genealogy, historical origin and development, and the meta information of archives. Compared with the ontology archives of material cultural heritage, which focus on the static description of "things", the ontology archives of intangible cultural heritage pay more attention to the presentation of "people"'s practices, "processes" and the maintenance of "relationships", so as to clearly record the specific contents and practices of the ten intangible cultural heritages, and focus on describing the cultural space on which they depend. Through multi-dimensional and dynamic means, it provides a systematic basis for understanding the living mechanism of intangible cultural heritage and supporting its sustainable inheritance.

4.1.3 Digital Cultural Heritage Ontology Archives: Digital cultural heritage records various cultural activities and cultural phenomena of mankind in the data era. Since most digital heritage is directly born on the Internet, network cultural heritage is an important form of its expression, recording the process of social memory generation and change in the Internet era (Qi, 2025). Therefore, in addition to recording the original state and constituent elements of the born - digital cultural heritage, the ontology archives should also restore the cultural context where it is located. The content should include: basic identification, data ontology, technical environment, and the social relationship graph faced by the heritage.

The core of cultural heritage ontology archives is to faithfully, comprehensively and meticulously answer "what the cultural heritage object itself is" and "how the current situation is", which is the most fundamental basis for subsequent research, protection, restoration, display or management work. The application of multi-modal technologies in the digital era has greatly improved the accuracy, breadth and depth of recording, enabling the ontology archives to more three dimensionally and scientifically "freeze - frame" and "restore" the basic features of cultural heritage. The value of such archives is reflected in the following aspects: As the underlying data source for cultural heritage protection, the ontology archives provide a scientific basis for subsequent protection activities; By integrating multimodal data such as texts, images, 3D models, and audio - videos, the ontology archives break through the limitations of a single carrier, realize the three - dimensional presentation of cultural heritage, and provide intuitive support for subsequent academic research or public understanding of complex heritage; Since cultural heritage does not exist statically, its natural aging, human intervention or environmental changes need to be continuously tracked. The update mechanism of the ontology archives ensures the timeliness of the data and forms dynamic "living archives". Therefore, the construction of ontology archives needs to follow the principles of standardization and openness. Standardization can ensure the unity of relevant heritage data formats and facilitate cross-institutional sharing. Openness reserves compatible space for future technological iterations to avoid data failure due to outdated technology.

4.2 Cultural Heritage Conservation Process Archives: a Reproducible "Chain of Actions"

Cultural heritage conservation process archives refer to systematic records generated throughout the entire lifecycle of cultural heritage conservation, reflecting the comprehensive workflow of preservation efforts. Their core function is to provide traceability, verifiability, and sustainable support for heritage conservation, embodying the interactive relationship among "people-technology-heritage."

The conservation of tangible cultural heritage focuses on the continuity of physical objects, requiring precise documentation of their condition and scientific interventions such as health assessments, monitoring, care, and restoration, as well as value transformation. The resulting archives of tangible cultural heritage conservation can be categorized into four types: survey and documentation archives, inspection and maintenance archives, digital reconstruction archives, and research and dissemination archives. These serve to clarify the conservation object and its environment, preserve the evidence chain of conservation measures, advance the digitization of cultural relics, and facilitate the contemporary transformation of historical value.

The archival protection of intangible cultural heritage should also begin with surveys, involving the investigation, registration, recording, and archiving of various currently prevalent forms of intangible cultural heritage, representative works, and outstanding inheritors. Collected materials must be organized by relevant experts and scholars to clarify the lineage, scope, and representative figures of the heritage, followed by appraisal and certification based on research (Qin, 2007). Due to the dynamic nature of intangible cultural heritage, follow-up materials on specific skills, rituals, or activities should be promptly supplemented, with enhanced promotion, research, and utilization of phased achievements. Accordingly, the archives of intangible cultural heritage conservation process are classified into four categories: survey and documentation archives, maintenance and appraisal archives, digital transformation archives, and research and dissemination archives. These aim to document the current state of the conservation object, certify its value while dynamically maintaining it, enable informational transformation and dissemination, and strengthen the promotion and utilization of intangible cultural heritage.

The conservation of born-digital cultural heritage also undergoes processes such as digital archaeology and data restoration, while ensuring the credibility and sustained accessibility of these processes. Therefore, the conservation process archives should include: digital archaeology archives, data restoration project archives, trusted preservation archives, and revitalization and utilization archives. The case of DDS demonstrates that user communities serve as a critical archival source for reconstructing cultural heritage, and the process archives must also include records of crowdsourcing agreements and contributor rights acknowledgment.

In summary, the conservation of tangible heritage emphasizes the evidentiary chain of physical restoration, intangible heritage focuses on the living lineage of transmission, and digital heritage relies on the integration of technology and culture. The archives of cultural heritage conservation processes document the decision-making, implementation, and monitoring activities throughout the entire lifecycle of heritage preservation. They reflect multi-stakeholder collaboration and technological iteration, forming a traceable and reproducible repository of experiential knowledge that enables the cross-generational and cross-regional transfer of conservation wisdom.

4.3 Cultural Heritage Conservation Unit Archives: the "Organizational Network" of Authority and Responsibilities

Unlike archives that directly document the state of cultural heritage or specific conservation processes, the core of conservation unit archives lies in recording the organization’s own allocation of authority and responsibilities, functional execution, and organizational evolution. While the core operational activities of institutions managing different types of heritage may vary, as organizations fulfilling public management functions, their archives can generally be classified into two categories: operational archives (core) and administrative archives.

Operational archives directly document the execution of an institution’s conservation functions and the evolution of its authority and responsibilities, reflecting its fundamental purpose,protecting cultural heritage, as well as its legal mandates, professional decision-making processes, and historical shifts in conservation strategies. These archives possess both administrative standardization and operational continuity. Specific contents include: Legal and regulatory foundations defining institutional authority and responsibilities; Formulation of conservation policies and rules; Core operational decisions and approvals; Records of operational mechanisms; Historical policies and operational developments.

Administrative archives, on the other hand, support institutional functioning and reflect the organization’s holistic profile, ensuring lawful and compliant operations while providing foundational support in human resources, finances, and logistics. Over longer timeframes, they serve as primary evidence for studying the institution’s structural evolution, internal management culture, changes in resource allocation, and indirect impacts on core operations, thus holding certain historical research value. Specific contents include: Party affairs and organizational development; Human resource management; Financial management; General services, logistics, and infrastructure; Safety management; Comprehensive administration and external relations.

In summary, operational and administrative archives together constitute the “organizational memory” of cultural heritage protection institutions, embodying both their professional mission and administrative rigor while providing contextual support and historical research value. This framework applies to institutions managing different types of cultural heritage, with variations only in the specialized terminology and content details generated by specific operational activities.

4.4 Secondary-Processed Cultural Heritage Archival Products: "Innovative Terminals" for Value Release

The core of cultural heritage protection lies in the excavation of heritage value. Secondary-processed cultural heritage archive products refer to derivative achievements that are systematically sorted, creatively transformed, and innovatively developed based on original cultural heritage archives (ontology records, protection processes, institutional archives, etc.) through traditional or digital technical means. They aim to achieve in-depth excavation of cultural value, diversified communication, educational popularization, public participation, or sustainable utilization.

Traditional cultural heritage archive products transform original cultural heritage archives through non-digital means, focusing on physical carriers and offline communication. They have a long development cycle, weak user interactivity, relatively fixed development methods, but strong authority and high public recognition. They can be divided into academic research support type, knowledge education communication type, and cultural creativity derivation type. Digital cultural heritage archive products are the result of in-depth processing relying on "data-state" resources (images, audio-video, 3D models, texts, GIS, structured data). They have fast development and iteration, strong interactivity, borderless communication, and are easy to achieve personalization and immersion. They are currently the direction of cultural heritage value recreation and can be divided into knowledge integration and retrieval type (database/knowledge base), immersive narrative and experience type, creative interaction and co-creation type, and intelligent tool empowerment type.

In summary, secondary-processed cultural heritage archive products can be divided into different product forms according to their clear value objectives. The framework itself is applicable to all types of cultural heritage, but it has its own adaptability in specific product production. For example, virtual restoration is suitable for material cultural heritage, with a certain degree of flexibility.

4.5 Relationships Among Different Entities in the Cultural Heritage Archive System

The four-dimensional conceptual system of digital cultural heritage archives does not exist in isolation, but forms an organic whole through data interaction, functional collaboration, and value transformation. This is because, on the one hand, different types of cultural heritage are inherently and formally interrelated and interdependent. For example, traditional music is associated with scores, and traditional medicine is linked to classics. Not all cultural heritage can be simply categorized into specific types, as there are complex composite heritage types—such as industrial cultural heritage, which includes both material elements (factories, workshops) and intangible elements (production techniques).(Yang, Chen and Xia, 2024) On the other hand, data flows among different types of cultural heritage archives. For instance, cultural heritage protection process archives connect ontology and protection unit archives, generating new ontological status data. Thus, the dynamic relationships among entities include but are not limited to:

4.5.1 Cultural Heritage Ontology Archives as the "Gene Bank" can provide:

Data Source for Protection Processes: Ontology archives provide basic parameters for census archiving, monitoring maintenance, and digital reconstruction in protection processes. Monitoring data and evaluation results generated during protection must be synchronized to modules like "preservation status" and "survival status" in ontology archives.

Basis for Protection Unit Functions: The heritage types in ontology archives determine the functional division of protection units, while heritage attributes provide a compliance basis for defining their rights and responsibilities.

Multi-modal Material and Credibility Support: They supply diversified materials for secondary-processed products and ensure their credibility.

4.5.2 Cultural Heritage Protection Process Archives as the "Action Chain" can provide:
Dynamic Closed Loop with Ontology Archives: Protection process archives form a dynamic loop with ontology archives, updating ontological data with protection outcomes.

Process Collaboration with Protection Unit Archives: Protection decision-making and approval must follow the business process norms in protection unit archives, while protection effectiveness serves as performance feedback for administrative evaluations.

Narrative Logic and Data Support for Secondary Products: The complete evidence chains and data in process archives provide narrative frameworks or deep processing for decision support in secondary products.

4.5.3. Cultural Heritage Protection Unit Archives as the "Organizational Network" can provide:
Regulation and Information Interaction: Institutional function documents specify the collection subjects of ontology archives and management authorities for process archives. Aggregated data from ontology and process archives updates policy planning in protection unit archives.

4.5.4. Secondary-Processed Cultural Heritage Archival Products: "Innovative Terminals" for Value Release can provide:
Dependence, Sublimation, and Reverse Drive: These products rely on and sublimate the first three types of archives while driving their construction. Gaps identified in product development urge supplementary collection for ontology archives and enhanced tracking in process archives. User feedback optimizes business processes in protection unit archives.

The four-dimensional archive framework forms a closed loop through the collaborative mechanisms of "ontology truth-preservation, process traceability, responsibility demarcation, and digital activation", shifting cultural heritage protection from "passive rescue" to "active governance". In the establishment and management of specific cultural heritage protection archives, choices should be made according to heritage characteristics, enabling archives to empower the full chain of cultural heritage "protection-management-utilization".

5. Hierarchical Construction of Digital Cultural Heritage Archive System

The construction of a cultural heritage archive system is essentially a knowledge production practice, which needs to take archival work practices in specific scenarios as the starting point. Through continuous accumulation of local knowledge, repeated verification of operational norms, and dynamic adjustment of protection strategies, a universal methodological system is finally formed. Therefore, the construction of cultural heritage archives must start from practice, sublimating scattered experience fragments into a structured knowledge network at different levels such as national, regional, cultural heritage institutions, and archival fields, and ultimately achieving the hierarchical construction of the archive system from quantitative to qualitative changes.

5.1 National Level: Top-Level Design and Rule Formulation
At the national level, uniformity, standardization, and sustainability of the system can be ensured through policy and regulatory frameworks, standard system development, and national platform support. China has already introduced the National Cultural Digitalization Strategy, which aims to establish basic cultural digital infrastructure and service platforms by the end of the 14th Five-Year Plan period and build a national cultural big data system by 2035, achieving a panoramic presentation of Chinese culture and nationwide sharing of digital cultural achievements. Building on this foundation, specialized legislation for cultural heritage archives can be refined. Tailored Digital Cultural Heritage Archive Management Measures should be formulated to address the distinct characteristics of tangible, intangible, and born-digital cultural heritage, standardizing the entire process of archival collection, storage, and utilization.

Integrating international frameworks such as CIDOC CRM and RiC-CM with local practices, multimodal data description standards should be developed to establish a unified national metadata standard for digital cultural heritage archives. The cultural heritage inventory system should also be enhanced—for instance, expanding the coverage of the China Archival Documentary Heritage List from its current three-tier system (national, regional, local) to a four-tier system (global, regional, national, provincial), using the UNESCO Memory of the World Register as a reference. This expansion would promote the implementation of provincial lists in underserved regions and foster more culturally representative nomination projects.

Additionally, ministries such as the Ministry of Culture and Tourism, National Archives Administration, and Ministry of Science and Technology should collaborate to establish a National Cultural Heritage Archive Data Center, enabling data interoperability and sharing among institutions like the National Cultural Heritage Administration, Intangible Cultural Heritage Centers, and archives. This initiative could draw on successful international models, such as UNESCO’ s International Centre for Documentary Heritage (ICDH) in Cheongju, South Korea, which is developing a Global Digital Platform for Documentary Heritage to create a cross-regional cultural heritage information network.

5.2 Regional/Provincial and Municipal Governments: Coordination and Regional Promotion
Provincial and municipal governments need to formulate implementation rules for cultural heritage archives in combination with local characteristics and resources, coordinate regional resources, build collaboration platforms, and provide financial and infrastructure support to supervise the implementation of national policies. Specific measures include:

Developing local digital cultural heritage archive plans to prioritize key heritage objects and archiving workflows.

Facilitating in-depth collaboration among regional GLAM institutions (Galleries, Libraries, Archives, Museums) to create shared mechanisms for archive co-construction and access.

Launching regional digital memory projects (e.g., Beijing Memory, Shanghai Memory) to integrate entity, process, institutional archives, and derivative products, transforming them into cultural landmarks.

Allocating special fiscal funds to support digitization, multimodal data capture, and platform maintenance by local heritage institutions, while subsidizing cloud storage and high-performance computing infrastructure to reduce technical barriers and costs.

5.3 Cultural Heritage Protection Institutions: Action Implementation and Archive Production

As the most direct and primary builders and responsible subjects of cultural heritage protection archives, institutions should be responsible for the specific collection, organization, management, update, and preliminary utilization of archives. Key steps include:

Establishing internal archive management systems that define the scope, responsible departments, workflows, quality standards, storage protocols, update mechanisms, and access rules for the four archive types (especially the first three).

Embedding archival practices into daily conservation, research, and management workflows. For example, the Dunhuang Academy innovatively developed a cultural heritage ontology archive based on object classification, linking textual records, photographs, rubbings, 3D models, and audiovisual materials to the physical heritage (e.g., caves, artifacts, manuscripts) they document. This approach enhances research and exhibition of historical and cultural contexts. (Sun, Zhu, and Liu, 2025)

5.4 Archival Field: Professional Support and Collaborative Governance

National comprehensive archives at all levels, professional archives, archival societies, and university archival majors should fully participate in the protection of archives and cultural heritage, providing professional theoretical, methodological, standard, and technical guidance, and undertaking the long-term preservation, appraisal, and utilization of some core archives to promote cross-disciplinary collaboration and carry out professional research and talent training. Specific actions include:

Participating in the research, formulation, and implementation of national and local archival policies, such as metadata standards, cataloging rules, preservation strategies, and data management frameworks.

Offering professional consultancy, solution design, quality assessment, and training for heritage institutions.

Advancing archival management methods and semantic technologies for multimodal data, born-digital resources, and process evidence chains.

Conducting cutting-edge research on digital cultural heritage archive theory, ethics, and strategies, while organizing academic conferences and workshops to bridge the archival and heritage sectors.

6. Conclusion

This study constructs a four-dimensional cultural heritage archive system based on the UNESCO cultural heritage framework and combined with China's protection practices, revealing the core role of archives in the full-life cycle management of cultural heritage. Among them, cultural heritage ontology archives, as the "gene bank", record the physical attributes and cultural connotations of heritage through multi-modal data, providing a basic data source for protection; protection process archives form an "action chain", relying on technical means to trace the whole process of protection practices and precipitate reusable knowledge assets; protection unit archives construct an "organizational network", standardizing institutional rights and responsibilities and adapting to governance changes in the digital era; secondary-processed cultural heritage archive products become "innovation terminals", realizing the socialized communication of heritage value through data derivation and user-oriented development. The study further proposes that the construction of the system needs to rely on a technology-driven multimodal data management mechanism and the collaborative governance of multiple subjects to promote the paradigm shift of archives from backstage management to value creation.

This study only preliminarily builds the theoretical framework of the cultural heritage archive system. The specific composition of various archives still needs to be further refined by cultural heritage protection institutions and professional scholars in protection practices, clarify the real obstacles of different regional and types of heritage in the archiving process, expand the research scenarios of the relationship between archives and cultural heritage, and unite cross-disciplinary forces to produce implementable operation guides for various archive constructions, so as to provide more targeted solutions for the standardized construction and sustainable governance of cultural heritage archives.

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