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Developing a metadata elements set for digital archives of Chinese restoration techniques: A scoping literature review

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Abstract Metadata elements sets are widely used to describe the information resources comprising digital archives of tangible and intangible cultural heritage. Chinese restoration techniques are precious traditional craftsmanship, which have received much attention on practical protection instead of the information resource management. The list of Chinese intangible cultural heritage includes five restoration categories, including bronzes, ancient clocks, ancient buildings, and ancient ceramics. However, research on metadata related to information resources management remains limited. This study aims to review information regarding metadata descriptions utilized in digital archives for traditional craftsmanship and formulate a set of metadata elements for ancient restoration techniques. A scoping review was conducted, encompassing 440 peer-reviewed articles from four databases (Scopus, ScienceDirect, CNKI, and IEEE Xplore), along with 61 policy documents, occupational standards, and implemented cases retrieved from key websites (e.g., official organizations and digital archives and digital libraries). The frequencies of each craftsmanship's core metadata element among the screened thirty-five studies have been analyzed from the perspective of Institutional Metadata and Non-institutional metadata. We survey a method for developing a metadata elements set for digital archives of ancient restoration techniques based on the Dublin Core Element Set (DC) and the Adoption and Documentation Standard of Traditional Craftsmanship of Chinese ICH (ADSTC-CICH). And developed a metadata elements set for Chinese restoration techniques with this method. Then map the scope, challenges, and practices of these initiatives. Future research can either focus on the metadata elements set developing method or apply this metadata elements set to other types of craftsmanship to promote the safeguarding of intangible cultural heritage.

Keywords: traditional craftmanship, intangible cultural heritage, ICH

1. Introduction

Safeguarding intangible cultural heritage (ICH) is essential to support cultural diversity and guarantee sustainable development. Traditional craftsmanship is a significant category of ICH according to both the Convention for the Safeguarding of Intangible Cultural Heritage (UNESCO, 2022) and the Chinese classification comprising 13 categories of ICH (Wang, 2006; Yuan & Gu, 2009; Cheng et al., 2011). Restoration and imitation of cultural relics reflect the spirit of Chinese traditional culture and ancestral wisdom (Zhou et al., 2015) given that potters, metalsmiths, and craftspeople have developed traditional craftsmanship through utensil manufacturing and production (Yu & Yang, 2014).

Since 2008, five categories of restoration techniques have been listed as Chinese ICH: bronzes, ancient clocks, ancient buildings, and ancient ceramics (China Intangible Cultural Heritage Protection Center, 2018). Furthermore, 13 items have been included on the list of representative national ICH. The traditional restoration techniques referenced in this paper refer to the five categories above.

Several facilities and institutes promote the enactment of the Convention and enthusiastically implement digital preservation. Digital archives have become the most common ICH preservation strategy (Han & Zhou, 2022). A policy framework has been outlined, which applies to the three main stages in a digital resource's life cycle, namely collection, storage, and development (Tie, 2019). The digital database is also the foundation for virtual reality and image identification systems, thus helping to build a digital environment for dynamic ICH (Yang & Lu, 2020). Memory institutions (i.e., galleries, libraries, archives, museums) have been organizing ICH information (ICHI) using metadata description and metadata schemas since the 1990s (Chiranthi & Shigeo, 2018; Sugimoto et al., 2018). Metadata are used for the storage and management of ICHI during inventorying and documentation (Xu, 2021). The most common metadata description modes are categories for the

description of works of art (CDWA), Dublin code (DC), and the Visual Resources Association (VRA) Data Standards Committee (Niu, 2022).

Digital archives and database development in Europe experienced rapid growth alongside UNESCO's Memory of the World (MoW) Programme. One prominent example is Europeana, a digital library established by the European Union and renowned for its vast information resources. Europeana boasts records of over 10 million cultural and scientific artefacts, presented in diverse formats to cater to users' preferences. At the heart of Europeana's information aggregation lies the Europeana Data Model (EDM). Additionally, as a digital archive specializing in Intangible Cultural Heritage (ICH), the i-Treasures ICH database offers a freely accessible collection of multimodal data extracted from various rare forms of ICH. This repository encompasses video, audio, depth, motion capture data, and other modalities (Grammalidis et al., 2016). Well-known ICH digital platforms associated with memory institutes include Europeana Sounds (Europe), Flanders (Belgium), Etnografie italo-svizzere (Italy–Switzerland border cooperation), and the Archive of Ethnography and Social History of Lombardy Region (AESS), among others.

In China, several memory institutes and individual facilities have adopted ICH metadata schema based on institutional and non-institutional metadata. Given the diversity, dynamism, and invisibility of ICH (Liu, 2012), digitization of traditional restoration techniques should emphasize the excavation and presentation of the restoration process. Previous research mainly focused on visualization, usability, and interactive application of restored relics based on virtual reality technology (Rao et al., 2021). However, a digital database for traditional restoration techniques is virtually non-existent, which contradicts the goal of safeguarding these traditional treasures. Rare information on metadata elements can be collected from a 3D virtual reality learning platform constructed from (Ming et al., 2023).

This research aimed to review recent literature on metadata to identify an elements set for traditional restoration techniques. Although experts have widely identified and explored ICH metadata and digital archives, a review focused on safeguarding traditional restoration techniques from a metadata perspective was lacking. Hence, we conducted a scoping review to clarify key concepts relevant to the metadata approach to traditional restoration techniques based on metadata research related to traditional craftsmanship. Given the unique characteristics of individual ICH, there can be no single, unified ICH metadata elements set. In this review, we sought a method to develop a metadata elements set for digital archives of ancient restoration techniques and map the scope, challenges, and practices of these initiatives.

This review addresses the following key questions:

RQ1. What metadata elements set has the digital archiving of traditional craftmanship implemented?
RQ2. How can a metadata elements set for digital archives on ancient restoration techniques be developed?

2. Materials and Methods

Arksey and O'Malley provided the original framework for scoping reviews in 2005, followed by specifications by Levac et al. (2010) and Peters et al. (2015). This scoping review followed the Joanna Briggs Institute's (JBI) systematic scoping review guidelines (Peters et al., 2015) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The process was designed to be reproducible and consists of four sequential steps: (1) identification, (2) screening, (3) eligibility, and (4) data capture. The identification step is described in Section 2.2, screening and eligibility are addressed in Section 2.3, and data capture comprised data extraction and quality assessment, as described in Section 2.4.

2.1. Inclusion criteria

These criteria presents a clear review process and indicate that a scoping review should draw upon specific sources (Peters et al., 2015). Given this research field's cross-disciplinary nature and the rapid pace of change observable in metadata archiving, we adopted (Challen et al., 2012) search strategy, which encompasses traditional publication databases, policy documents, gray literature, and digital archives. As scoping reviews require the identification of all relevant literature regardless of the study design, the search process should be iterative and reflexive to ensure comprehensive coverage of the literature (Arksey & O'Malley, 2005). During the preliminary screening stage, topics related to metadata on ancient restoration techniques were scarcely found in electronic databases. Consequently, the search strategy was iterative before the identification stage. Moreover, a scoping review has a broader scope than traditional systematic reviews and employs more expansive inclusion criteria (Munn et al., 2018). As a consequence, the include criteria extend to studies on metadata applied in ICH.

Peer-reviewed articles meeting the following criteria were considered: (1) The discussion pertains to the application of metadata in ICH digital archiving; (2) categories of digital resources applicable to digital ICH archiving are based on metadata description; and (3) the discussion includes metadata description of traditional craftsmanship. Policy documents and digital archives related to metadata description of ICH or traditional handicraft were also included. A search was conducted for English and Chinese articles published in peer-reviewed journals between October 2003 and March 2024. The start date of the search

was the publication year of the Convention for the Safeguarding of Intangible Cultural Heritage (UNESCO, 2003). Some implemented global initiatives may still be relevant or expired, but they were also considered.

2.2. Search strategy

The scoping review initially targeted electronic databases, specifically Scopus, ScienceDirect, China National Knowledge Infrastructure (CNKI), and IEEE Xplore. We utilized subject headings, titles, abstract keywords related to metadata and ICH, and/or keywords associated with traditional restoration techniques and craftsmanship, employing Boolean logic tailored to each database. It's worth noting that the search scope was broadened to encompass ICH metadata, as the article keywords related to craftsmanship metadata only indicated ICH. The search was conducted on 28 March 2024.

For the gray literature, we used the deep web technology search engine scienceresearch.com (Goirand et al., 2021) and manually searched the key websites of official organizations and digital archives and digital libraries involved with safeguarding ICH. Websites were searched between March 20 and 25, 2024. Policy documents were searched on government websites using a combination of the keywords “metadata,” “traditional craftsmanship,” and “ICH.” The search was performed as systematically as possible within each website’s capabilities. The metadata elements set for traditional restoration techniques was collected from Chinese memory institutes, including national, provincial, and municipal digital libraries and archives. Given that limits must be placed on the date range and number of databases searched for practical reasons, reviews can miss relevant papers (Arksey & O’Malley, 2005). All results were collected and compiled in Excel. Our search yielded 502 records.

2.3. Study selection

Figure 1 summarizes the documents obtained at each stage, according to PRISMA (Moher et al., 2009). The search results from the Excel table were imported into EndNote citation management software (version X3.8). Eighty-nine articles were removed due to duplication. All titles and abstracts obtained through the search strategy underwent eligibility review. Additionally, reference lists were scrutinized for pertinent articles. Among the excluded articles (318 in total), many did not provide information on metadata usage, focused on different aspects of ICH (e.g., folklore or dance), discussed metadata schemes and ontologies, employed condition-specific strategies, lacked full-text availability, and/or were not in English or Chinese. The full texts of the remaining articles were independently reviewed by both authors, adhering to the inclusion and exclusion criteria to minimize reporting bias (Peters et al., 2015). Thirty-five studies of metadata elements set on metadata and traditional craftmanship were included in the final analysis.

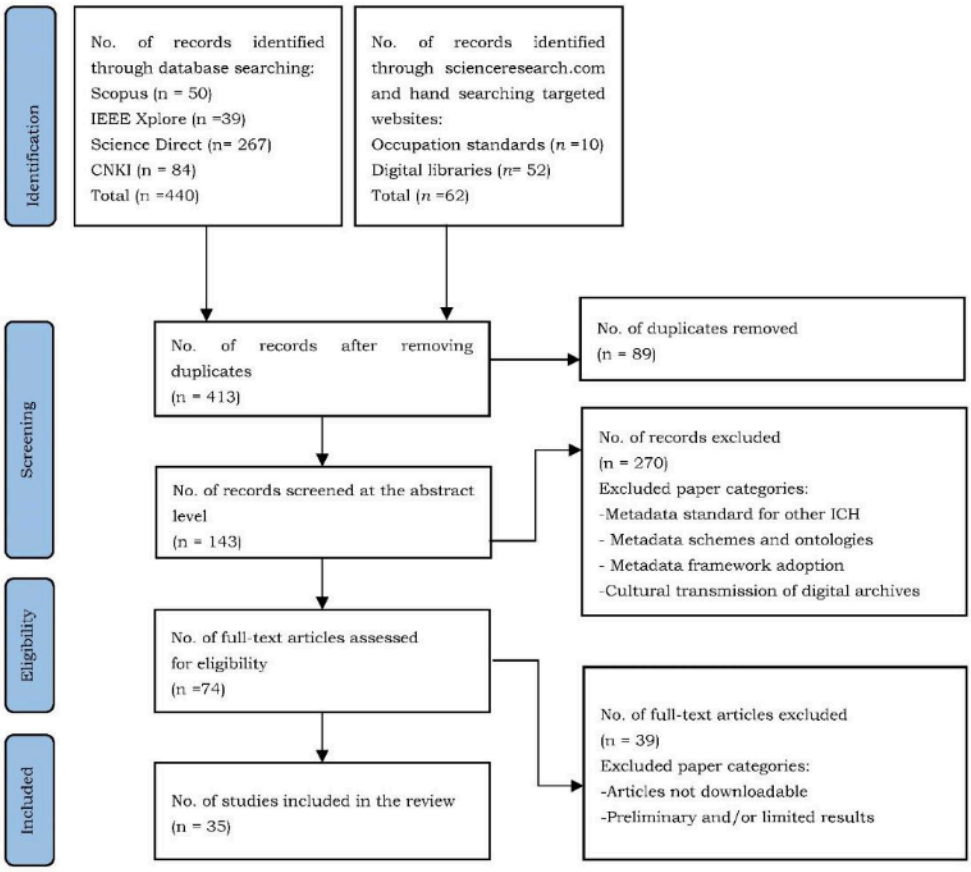

Figure 1 PRISMA flow diagram.

2.4. Data extraction and quality assessment

Several metadata elements sets have been adopted globally. However, the choice of metadata elements set depends on the implementing subject, such as organizations, institutes, and individuals. Memory institutions' digital archives typically include metadata about each item, while individuals and other organizations have their own metadata for depicting ICH/CH objects and their instantiation, which may not align with the metadata standards used by memory institutions. Therefore, metadata can be categorized into institutional and non-institutional metadata (Chiranthi & Shigeo, 2018). Therefore, the 35 studies on metadata included in this review were also categorized into the two aforementioned classifications. Quality assessment of the articles and cases was conducted by independent reviewers using JBI critical appraisal tools tailored to each of the different types. Any disagreements were resolved through discussion. The results were utilized to assess the quality of the literature only, and not as an exclusion criterion due to the exploratory nature of the scoping review.

3. Results

Our search of databases and websites retrieved a total of 502 samples. After removing duplicates, the number of unique samples was reduced to 413. Subsequently, the full text of 74 samples (17.92% from the database and targeted website search) was screened. Among these, 39 (52.7%) were deemed ineligible, while 35 met the inclusion criteria. According to Chiranthi & Shigeo (2018), institutional metadata is generally created for a single item collected by a memory institution, non-institutional metadata is not created by a memory institution. Therefore, occupation standards (11.42%) and memory institutions (34.28%) correspond to institutional metadata, while research articles (54.28%) correspond to non-institutional metadata (see Table 1). Accordingly, this section will be divided into two viewpoints and performed with in-depth analysis gradually: a) items demonstrating the ICH institutional metadata (the foundation for non-institutional ones), which help to demonstrate the metadata implementation background, and b) items analyzing metadata for digital archives of traditional craftsmanship listed as ICH, concluding the existing metadata elements set for craftsmanship.

Table 1 The classification of selected 46 articles as well as occupation standard and official websites.

Categories		Numbers(n=35)
Institutional Metadata	Occupation standard	4 (11.42%)
	Memory institution (digital museum e.g.)	12 (34.28%)
Non-institutional metadata	Research article	19 (54.28%)

3.1. Institutional metadata of ICH

The ultimate goal of all Memory Projects and digital archives is to store, safeguard, and transmit digital resources by collecting and sorting images, photos, manuscripts, and records related to important historical events, people, the memory of endangered ethnic groups, and traditional memory (Xu, 2021). In the past two decades, ICH has gained momentum thanks to official institutional support (i.e., governmental, transnational, and local agencies such as The International Council of Museums, the World Intellectual Property Organization, and national ICH inventories) (Ziku, 2020). Institutional metadata are generally created for a single item collected by a memory institution (Chiranthi & Shigeo, 2018). However, these metadata are described using highly standardized but limited contextual information (Chiranthi & Shigeo, 2018).

The i-Treasures ICH dataset (http://www.i-treasures.eu) represents a comprehensive approach to the safeguarding and transmission of ICH through its multi-model approach. It offers a freely accessible collection of multimodal data derived from various forms of rare ICH. This dataset includes video, audio, depth, motion capture data, and other modalities (Grammalidis et al., 2016). The intangible knowledge related to ICH is transformed into multimedia data fusion and semantic media interpretation using multimodal sensing technology. In the i-Treasures Final Report, Filareti from the Centre for Research and Technology Hellas in Greece emphasized the comprehensive metadata description included in this ICH dataset. This description encompasses: a) an overview of general information about the specific ICH sub-use case, b) data recording details (such as artists/experts involved, location, capture time, provider, etc.), c) the experimental sensor setup and protocol used for data recording, and d) detailed descriptions of the recorded dataset files, including their data format (Filareti, 2017).

The Memory of the World (MoW) Program of UNESCO, which has been carried out in various countries around the world since 1992, have provided new opportunities for the ICH safeguarding (Xu, 2021). The Memory Project of China has been thoroughly examined in this research, given its focus on Chinese ICH. The study covered 52 Memory Projects, consisting of 1 national-level project and 49 municipal-level projects. The findings reveal that some of these Memory Projects lack user-oriented official websites, while others provide online information that does not encompass ICH. Although some ICH information can be found in platforms like Zhejiang Memory, China Memory, and Hong Kong Memory, the construction of websites lacks a unified metadata standard, leading to fragmented islands of information (Yang, 2014). As the main role of memory institution, public libraries and museum of China have constructed the public service system progressively, providing ICH information service both for online and offline.

It's observed that while numerous cities and regions in China are carrying out Memory Projects covering economic, educational, social, cultural, and other aspects, they are less focused on non-heritage resources. The content of these projects is often broad and scattered across various platforms, lacking systematic organization and comprehensive representation of non-heritage resources. Specifically, three main deficiencies are identified in developing non-heritage digital resources within the current Memory Projects.

In November 2023, the first version of Digital safeguarding of the intangible cultural heritage—Digital resources collection and description has been launched by Ministry of Culture and Tourism, People's Republic of China (MCTPRC, 2023), which is the first national standard on digital safeguarding of ICH in China. This specification was carried out by Chinese National Academy of Arts from 2011. According to the specification documents, ICH is divided into 11 categories, including traditional craftmanship and folklore, among others. Some Chinese memory institutions have implemented the information acquisition criteria and relative metadata standards for ICH before this specification, but enforcement has not been strict.

Some Chinese national research projects, including the National Social and Science Foundation Project, are dedicated to safeguarding ICH standards but often lack enforcement. These standards are difficult to locate, and project websites may be inaccessible for extended periods. For instance, the Digital Library Standard and Specification Construction website has been unreachable. While documentation is crucial for digitally storing valuable information, ensuring long-term accessibility is equally important (Alemneh, 2009). Consequently, UNESCO has highlighted the "Dive in" section of its website (https://ich.unesco.org/en/dive), which facilitates innovative and dynamic searches and visualizations. Sophisticated query and visualization tools for related multimedia documentation should be accessible the given the assets' complex nature.

Consequently, cross-platform ICHI sharing and management is difficult, and this may even lead to isolation of ICH data resources (Du, 2018). Among Chinese digital libraries, archives, and virtual museums, there is a notable lack of compatibility in terms of ICHI related to the same object. In some cases, there are even instances of incompatibility and a lack of integration due to inconsistent metadata standards. Digital archives have been the primary focus of Chinese ICHI construction at the municipal, provincial, and national levels. Most of these archives present ICHI in the form of text, images, and videos, each reflecting distinctive regional features rather than focusing on a specific ICH theme. Additionally, these platforms often lack interactive features and user-oriented designs. However, as of 2021, a quarter of these digital spaces were inaccessible (Xu, 2021). According to Chen (2018), these databases of digital archives lack national uniform standards, leading to disunity among databases regarding naming and metadata. Zoannos et al. (2023) has asserted that these are worldwide problems.

3.2. Non-institutional metadata of ICH

Memory Projects have played a crucial role in rescuing and safeguarding aging, damaged, and vanishing human records, thus providing invaluable information resources for the conservation of intangible cultural heritage (ICH). By organizing cultural inheritance activities and establishing orderly organizations, these initiatives have effectively documented comprehensive bearer records and disseminated intangible culture widely. The term "non-institutional metadata" refers to metadata not generated by a memory institution but rather by entities such as tourism websites. Non-institutional data encompass both item-centric and thematic (subject) levels (Chiranthi & Shigeo, 2018). Such metadata are mostly based on well-standardized institutional metadata, the principal components of traditional handicraft information resources.

Yang & Lu (2020) developed the Image Metadata Elements Set for Peking Opera Facial Make-Up, a make-up technique listed as ICH. They also surveyed known bearers and produced a documentary about the make-up technique. He has indicated that 3D modeling and an interactive platform for Peking Opera characters could transmit intangible culture to new generations. Furthermore, Xu (2021) emphasized the importance of transforming the dynamic ICH process from invisible to visible. Additionally, traditional craftmanship bearers have played an essential role in instantiation and should be considered for inclusion among the metadata categories. Yao & Liang (2022) interviewed a bearer of Lingnan Hui Su, a type of handicraft for architectural decoration, and recorded related progress with reference to firsthand sources. All the digitized information obtained from the Hui Su bearer was categorized and is available online as one of the eight significant modules of the Lingnan Hui Su digital museum.

A change in emphasis regarding the ICH description scope according to the different categories of ICH objects is forthcoming. Niu (2022) has expressed the belief that the metadata approach to traditional craftmanship should consider information documented in ontologies and archives to reflect the comprehensive properties of traditional craftmanship. She reused DC, CDWA, and VRA in the traditional craftsmanship metadata elements set, with 47 core categories and 92 subcategories. The descriptive information was divided into archive content, ICH program, artwork, parameter, security, citation, management, and documentation.

Reusing the DC core element in traditional craftmanship metadata description is common. For example, Hu et al. (2021) reused DC to describe 109 craftmanship photographs related to weaving, dyeing, and embroidery within the construction of digital museum named Lanmama Ethnic Minority Apparel Museum. These ICHI can be browsed and searched on the website using the metadata elements set. Unfortunately, their descriptions do not provide information about the other elements' significance nor define any characteristic conceptual elements. Furthermore, Xu (2021) developed a metadata elements set for Ou Su and reused 12 DC elements including semantic features and especially stakeholders such as bearers, researchers,

guardians, and applicants. Resultantly, a resource description framework (RDF) was established. Additionally, Wang & Wang (2017) and Du (2018) developed a metadata elements set for the paper cutting technique and included 18 and 14 core metadata elements, respectively. Compared with Wang & Wang (2017), Du (2018) mainly focused on art information resources related to the paper cutting technique.

In the process of safeguarding handicraft cultural heritage, it's crucial to acquire information through literature review, field investigation, and visiting bearers, as well as collecting relevant information in various formats such as text, pictures, audio, and video. Moreover, comprehensive craftsmanship information could be organized according to type, quantity, historical context, distribution, current situation, development process, inheritance chain, and existing problems. Modern scientific and technological advancements have promoted the establishment of digital archives and big data platforms based on such ICHI (Yao & Liang, 2022).

Some scholars pay more attention to the metadata models or metadata scheme then metadata elements set; however, related information could be collected as reference as well. In the research on Tujia culture listed in ICH, Zeng et al. (2022) information resource model, also mentioned the core elements of this ICH, element, bearer, geographic location, type and related information; the sub elements were also recommended in this research, but incomplete. Zeng et al. (2022) presented the related typical project of Tujia culture, which is hardly concerned within others' research. For instance, Tujia woodcarving is a carving technique, Ice Wine production is Tujia fancy food, Tujia brocade is a manufacture technique, and so on. Ye et al. (2018) reused the 13 Dublin Core Element in DC elements set, defined an metadata elements set with 66 core elements and expend elements for Hanxiu, an ICH craftsmanship in Wuhan, China. Unfortunately, this element set was not open for public access. For the inheritance of traditional migrant craftsmanship, Ji & Xue (2021) constructed an efficient analysis model to test different database. The structure of the model is constructed based on the metadata mode with metadata nodes. The system will generally identify the current storage load during the data storage process with this model to prevent the master-slave structure from interfering with node failure.

Chiranthi and Shigeo focused on developing a metadata model for organizing digital archives for tangible cultural heritage (TCH) and intangible cultural heritage (ICH). They proposed a CHDE (Cultural Heritage in Digital Environment) model to describe the conversion process for both TCH and ICH between digital space and physical space. This model aims to organize digital archives and identify entities to be described in metadata about ICH objects and their digital surrogates (Chiranthi & Shigeo, 2018). Sugimoto et al. (2018) suggested to collect descriptions about ICH to link their entities and digital surrogates (e.g., dance, music, and craftsmanship) with instrumental metadata aggregation model. Shigeo et al. (2022) presented the core entities of the MADB and JDTA data models, which could help develop metadata schemas for digital archives and databases and improve their interoperability across domains. Zoannos et al. (2023) proposed different types of data and metadata standards/frameworks used for record and visualize ICH data result in confusion in how to maintain them in the future. They also suggested utilizing blockchain technologies (BT) to store the global ICH effectively by creating a decentralized worldwide network between the heritage stakeholders.

To address the first research question, a total of 35 studies were reviewed, comprising 16 studies on institutional metadata sourced from occupation standards and official websites, along with 19 articles on non-institutional metadata obtained from literature databases. These studies provided insights into the metadata elements set under investigation.

4. Discussion

To explore the implementation of metadata elements in the digital archiving of traditional craftsmanship, the frequency of occurrence of each core element in the metadata set was analyzed based on data from 35 studies in peer-reviewed literature and digital archives. This analysis, detailed in Table 2, provides insights into how metadata elements have been utilized in digital archiving and the selection of core elements for various forms of ICH. Pairs of reviewers independently extracted data from the eligible studies using a data extraction table developed for this study. This table served as a classification system to group the elements. Before extraction, a list of metadata elements and common terms was identified, considering that metadata core elements may be defined differently across initiatives. The criteria of the metadata element list (see Appendix A) is established by integrating categories drawn from Dublin Core Element Set (DC) and Adoption and Documentation Standard of Traditional Craftsmanship of Chinese ICH (ADSTC-CICH) (MCTPRC, 2023) as the traditional restoration techniques mentioned in this study is an Chinese ICH. The list of screened 18 metadata elements has shown in Appendix A and conducted in Appendix B for the data extraction. The core element from the most to the least represented and each core element's percentage is given in Table 2. A pilot of the data extraction form was conducted for usability before the full extraction. The data extracted were comprised of metadata categories and implemented subject. Some metadata elements set in the compilation may be outdated or ill defined; however, they are nonetheless included because they are being advocated by a global initiative.

4.1. Core metadata elements for digital archives of traditional craftmanship

The extracted data contained 18 metadata core elements related to traditional craftmanship, including Subject, Convention, Archive Data, Typical Project, Commercial Production, Historical Site, Material, Tool, Process, and

Conservation/Treatment History, and so on (see Appendix B for the full list). They focus on characteristics of the craftsmanship technique and attributes of the digital archive. Table 2 shows that the most frequently (100%) adopted metadata core element was Subject, which refers to the basic information about this ICH, such as title, creator, and identifier, suggesting that official organizations and individual scholars are convinced of the basic descriptions' essentiality to ICH. ICH is endangered or has already gone missing, especially creator-oriented ICH. This hinders the proper integration of media archives in memory institutions (Ziku, 2020). Unlike TCH, ICH refers to practices, representations, and expressions associated with individuals, communities, and groups (UNESCO, 2022).

Table 2 The core element from most to least represented and its percentage.

Core Element Category	Frequency of occurrence	%
Subject	25	100
Coverage	22	88
Craftmanship/technique	21	84
Bearer	20	80
Conservation/Treatment History	19	76
Organization	19	76
Material	18	72
Archive Data	16	64
Process	15	60
Date	14	56
Convention	10	40
Format	10	40
Genre	9	36
Typical Project	9	36
Tool	8	32
Rights	8	32
Commercial Production	6	24
Historical site	3	12

The degree of adoption of the other nine metadata elements completing the top ten, namely Coverage, Craftmanship/Technique, Bearer, Conservation/Treatment History, Organization, and so on, ranged from 88% to 56%. The meaning of each metadata element should be clearly defined in light of the several meanings applicable in different environments. Coverage (88%) means the "particular geographic information of a work of handicraft or its instantiation." Craftmanship/Technique (84%) refers to "manufacturing techniques, processes, or methods." A bearer (80%) is defined as the bearer of specific ICH under the Chinese Intangible Cultural Heritage Law. A creator should be documented and archived. Conservation/Treatment History (76%) refers to the historical origin, knowledge of which leads to better understanding and thus study of the historical and cultural background of ICH. Organization stands for the ICH declaration agent and organization institute.

The Bearer (80%) is another critical factor for protecting ICH is its dynamism. It mainly depends on inheritance, in particular whether the folk artists who have mastered relevant techniques have indicated their willingness to pass on their knowledge and skills. Li et al. (2021) investigated Hunan Province bearers, which led to the construction of a bearer information database that has contributed to the ongoing inheritance and development of ICH in Hunan Province. Moreover, in light of the existing ICH-related problems facing Hunan Province, a metadata sub-elements set for bearers has been established, including code, gender, nationality, birth, category/project, level, sub-project, location, designation, artistry, and background. Additionally, the research suggested that potential bearers can learn the handicraft process if it is presented virtually using VR/AR technology.

The elements related to craftsmanship include Material (72%), Process (60%), and Tool (32%). The relevant processual elements and the materials, utensils, and techniques comprising the process reflect the characteristics of ICH techniques. As craftsmanship's diversity, dynamism, and invisibility (Liu, 2012), it is significate to present the its' progress from the metadata description perspective. These four elements are included in the Adoption and Documentation Standard of Traditional Craftsmanship of Chinese ICH (ADSTC-CICH) (MCTPRC, 2023). Unfortunately, these elements have received scant attention. Some element definitions are the same as those of TCH, such as Date, Convention, Rights, and Historical site. Format refers to "information about the size, shape, scale, and dimensions of a digital work of handicraft or its instantiation." Supplementary information about traditional craftmanship is significant as well, for instance, Genre, Commercial Production.

4.2. Developing a metadata elements set for digital archives of ancient restoration techniques

Unlike traditional archival metadata schemes, this scheme can comprehensively describe the characteristics of traditional restoration archive resources. This is primarily evident in the element design of project and work information. Each element in a metadata set should be derived from investigation results available on national or provincial ICH websites and declarations in ICH projects, effectively capturing basic information and bearer information. The sticking point in establishing a database of restoration technique characteristics has been setting the metadata. Xu (2015) summarized three steps for developing a metadata elements set for ICH craftmanship: a) clarify the characteristics, b) indicate the attribute elements, and c) set the core metadata categories. The diversity and uniqueness of traditional restoration need to be fully considered in order to accurately reveal the relationships between the knowledge content and resources related to traditional restoration techniques.

The reuse of DC for traditional craftmanship listed as ICH is the most common method, as it is the universal standard for descriptive information on the Internet (Li et al., 2021; Xu, 2021). However, such a universal set still cannot describe the specific characteristics and attributes of diversified ICH. This highlights the importance of artwork-related elements (e.g., Craftmanship/Technique, Coverage, History) that contribute to comprehensive descriptive ICHI. Niu (2022) took a highly interesting approach to comprehensively and comprehensively exploring the metadata elements set for traditional craftmanship from an integrated perspective by screening low-scoring elements using the Delphi method (Macdonald et al., 2000). This remarkable work would be ideal for implementation in digital archiving and could contribute to the development of a metadata elements set for restoration techniques. Each restoration handicraft is produced and evolved in a specific environment, which should be represented among the metadata elements. Furthermore, protecting restoration handicraft should not be approached from a narrow, restricted perspective but with consideration for the overall culture (Yao & Liang, 2022).

According to the characteristics of traditional restoration skills, Coverage, Craftsmanship/Technique, Process, Material, Tool, and Bearer should be considered core elements for describing cultural knowledge from experts' perspectives. At the core of recording bearers lies the acquisition of information regarding traditional handicraft techniques (Liu, 2021). Therefore, these sources related to craftsmanship are acknowledged as core metadata. The following elements describe additional information on ceramic restoration techniques, such as Conservation/Treatment History, Organization, Rights, Date, Archive Data, and Format. Besides, both Genre and Typical Project are common indicators of restoration techniques, as proposed by Zeng et al. (2022) and Cui (2011). The last element in Table 2, Historical Site, has been deleted from the metadata elements set for ancient restoration techniques.

Furthermore, digital sources such as video, images, text, and networks should be considered for presenting restoration techniques. Registration of various media (e.g., photos, videos, text, 3D reconstructions) would be helpful for ICH cataloguing, organization, archiving, and presenting cultural items in a digital space (Carboni & De Luca, 2016). Video recording is the most appropriate method compared to text and images, which make it difficult to illustrate traditional techniques in detail. Archive data are generally structured using metadata (Baca, 2016), facilitating the retrieval of information about a digital item. Additionally, semantic links between elements should be created to avoid conveying only a limited understanding of the interrelationships among performance, objects, and their meanings in a specific context. Implicit knowledge can be inferred from the original records, which can then be augmented to represent and reveal a richer network of relationships between the elements.

Digital Record, which describes the digital acquisition of images, video, 3D models, and other multimedia, will be added to the elements set. Digital data refers to the “digital acquisition of images, video, 3D models, motion capture, and other multimedia forms.” In principle, ICH cannot be digitized; only its instantiations can. Sugimoto et al. (2018) asserted that dynamic artifacts (e.g., theater plays, etc.) listed as ICH can have multiple instantiations and that these instantiations are helpful for building a digital archive of dynamic artifacts. This metadata elements set for video recording bearers could be partially adopted as a subcategory of digital record-making. Finally, a primary metadata elements set for ancient restoration techniques is shown in Table 3.

4.3. Challenges in implementing the digital archiving of traditional restoration techniques

The representation of complex relationships among various pieces of ICH information in the form of text, graphics, images, video, 3D modeling, and other multimedia is a challenge. Tan et al. (2012) proposed an ICH metadata structure with a three-data hierarchy comprising record-, feature- and semantic-based multimedia information. This multimedia semantic model, established based on the Center for Intercultural Documentation Conceptual Reference Model (CIDOC-CRM), describes ICH entities and addresses the issue of multimedia data heterogeneity. The CHDE model distinguishes ICH entities and their instantiations in digital archives (Sugimoto et al., 2018). A straightforwardly adaptable application example of CHDE is the Kandy Esala Perahera festival (ICH).

Regarding further work, a metadata elements set for traditional restoration techniques could be constructed as metadata schemas and ontologies, an information aggregation model, and a semantic framework. These would provide a universal standard for memory institutions. They are designed to be a common language, allowing cultural knowledge domain experts to formulate user requirements for information systems, thereby facilitating interoperability among different sources

of cultural heritage information at the semantic level (Giannoulakis et al., 2018). According to scholars, information aggregation enables data interoperability, global accessibility of diverse informational content, semantic searching, linking to and sharing content, data enrichment, data reuse, and information longevity, among other benefits (Hyvönen et al., 2012).

Table 3 Primary Metadata Elements Set for ancient restoration techniques.

No.	Core Element
1	Subject
2	Convention
3	Archive Data
4	Typical Project
5	Commercial Production
6	Digital Record
7	Material
8	Tool
9	Process
10	Conservation/Treatment History
11	Craftmanship/technique
12	Inheritance
13	Genre
14	Organization
15	Coverage
16	Rights
17	Date
18	Format

Another challenge is that some bearers have not yet realized the necessity of ICH protection and are still opposed to cooperating with the safeguarding work undertaken by governments and related departments. The main reason for this phenomenon is their fear of losing their unique skills or family secrets (Kong & Zhao, 2020). Regrettably, precious handicraft and cultural value are lost when bearers cannot clearly define their position and responsibility. In the past decades, some ICH bearers have tried to break the feudal way of thinking by providing guidance and encouragement in conjunction with relevant departments; they brought their crafts to schools and the streets but did not participate in workshops. Unfortunately, most bearers still adhere to old-fashioned ideas, complicating efforts to digitize dynamic ICHI resources.

In terms of organizational cooperation mechanisms, several facilities operate various Chinese ICH archives, but they are developing unevenly in technology and lack unified technical standards and data editing criteria, resulting in management problems and limitations on the sharing of ICHI (Kong & Zhao, 2020). Furthermore, the rights and responsibilities of various subjects are unclear, and cooperation in actual development work is lacking. Given the continuous development of digital technology, elements are complex and changeable, making it crucial for all subjects to have clear rights and responsibilities and full cooperation. Moreover, colleges and universities are the driving force behind academic research in the field of digital museums, while research institutes and major museums play a key role in conducting academic research on digital museums (Hou et al., 2022).

The limitation of this study is that the criteria for a suitable metadata standard for description can also be extracted from CDWA and VRA metadata standards since some artworks produced as a result of restoration skills are handicrafts and collections with historical and cultural value. Therefore, to some extent, to represent the diverse properties of traditional craftsmanship within information documented in ontologies and archives, the metadata approach should be reconsidered for specific study.

In a nutshell, this paper achieves the second research question by evaluating the core metatdata elements extracted from the 35 studies in Section 3. The challenges in implementing the digital archiving of traditional restoration techniques are also analyzed. This study provides a potential metadata scheme for traditional restoration techniques safeguarding.

5. Conclusions

This paper presents a scoping review summarizing information about the metadata description implemented in the digital archiving of traditional craftsmanship and the development of a metadata elements set for digital archives of ancient restoration techniques. The literature analysis revealed an ICHI institutional metadata elements set, examined the metadata elements set for digital archives of traditional craftsmanship listed as ICH, and summarized the core metadata elements for digital archives of traditional craftsmanship. Eighteen core metadata elements related to traditional craftsmanship were

extracted based on both institutional and non-institutional metadata. Each element's degree of adoption in the research field was discussed.

The results provide references for developing a metadata elements set for restoration techniques. Considering the forms and characteristics of traditional restoration techniques listed as ICH, this paper proposed a metadata elements set for restoration techniques based on the DC and ADSTC-CICH metadata standards. Finally, this metadata elements set can also be applied to other types of craftsmanship with further validation research. Cross-pollination among archival science, computer science, multimedia design, and traditional arts promises to yield comprehensive ways to tackle the formidable issue of transmitting ancient restoration techniques.

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Ethical Considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

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