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Safeguarding Vietnamese Traditional Musical Instruments in the Digital Era: A Cultural Management Perspective

Dang Thanh Tang
Hong Duc University, Vietnam

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ABSTRACT : Safeguarding Vietnamese traditional musical instruments in the digital era requires management of more than physical objects or isolated digital files; the relevant unit is a living heritage ecosystem comprising instruments, sound, skills, knowledge, context, and communities of practice. Objective: This study examines how digital technologies can support the safeguarding of Vietnamese traditional musical instruments and develops a cultural management framework for linking digital resources with living heritage continuity. Methods: A structured narrative review was combined with policy analysis. The analytical corpus comprised 42 bibliographically verified sources: 36 journal articles, 2 conference/book chapters focused directly on Vietnamese traditional instruments, 3 Vietnamese legal or policy documents, and 1 international normative instrument. Sources were synthesised according to the safeguarding object, digital function, community role, governance issue, and continuity outcome. Results: Four recurring management tensions were identified: data richness but contextual poverty; open access but weak rights control; engaging experiences but reduced authenticity; and wider reach without guaranteed transmission. The study proposes a 5C framework comprising Community, Context, Connectivity, Control, and Continuity. Conclusion: The 5C framework shifts evaluation from the quantity of digital files to the quality of relationships among data, heritage bearers, context, rights, and practice. It provides a basis for database management, interpretation, education, access governance, and the assessment of safeguarding outcomes in Vietnam.

KEYWORDS: traditional musical instruments, cultural management, intangible cultural heritage, digital transformation, digital safeguarding, heritage governance, Vietnam

1. INTRODUCTION

Traditional musical instruments constitute a form of heritage with a dual structure. The instrument itself exists as a material object with particular materials, dimensions, craft techniques, and traces of use; however, its cultural value can be understood fully only when it is connected with sound, performance technique, repertoire, memory, ritual, performance space, and the communities that continue to practise it. This understanding is consistent with the 2003 UNESCO Convention, which defines intangible cultural heritage as the practices, representations, knowledge, and skills that communities recognise as part of their heritage, together with the instruments, objects, artefacts, and cultural spaces associated with those practices (UNESCO, 2003). Safeguarding a musical instrument therefore cannot be reduced to conserving an artefact or storing an audio recording. The management object is the evolving relationship among people, knowledge, material objects, and context.

In digital environments, the range of safeguarding tools has expanded rapidly. Three-dimensional scanning and modelling can document physical form; high-quality audio and video can record performance techniques; metadata and ontologies can connect people, instruments, places, and repertoire; and immersive technologies and digital media platforms can extend interpretation, learning, and public access. Recent reviews show that digital heritage work has moved beyond storage towards a broader chain of activities that includes collection, organisation, identification, reconstruction, exhibition, education, and cultural innovation (Boboc et al., 2022; Wei et al., 2026). In Vietnam, digital preservation research similarly identifies opportunities for access, storage, and dissemination alongside limitations involving infrastructure, ethics, finance, and institutional capability (Phuong, 2026).

The domestic policy environment is increasingly supportive of this transition. The Cultural Development Strategy to 2030 emphasises the application of science, technology, and digital transformation in cultural development; the Programme for Digitisation of Vietnamese Cultural Heritage, 2021-2030, calls for the construction, standardisation, integration, and use of digital heritage data; and the 2024 Law on Cultural Heritage, effective from 1 July 2025, updates the legal basis for safeguarding and promoting heritage values in a new context (National Assembly, 2024; Prime Minister, 2021a, 2021b). As the legal framework and digital infrastructure expand, the management question is no longer simply whether heritage should be digitised. It concerns what should be digitised, according to which standards, who has decision-making authority, and which criteria can determine whether digitisation actually contributes to safeguarding.

Evidence from Vietnam indicates that variables associated with cultural management directly influence how heritage is understood and sustained. Interpretation quality at architectural heritage sites is associated with responsible visitor behaviour (Ha et al., 2026); heritage storytelling can enrich experience and perceived value (Nguyen & Nguyen, 2026); and conservation awareness can be strengthened when community

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participation and behavioural change are activated (Nguyen, 2025). Heritage memory, cultural identity, and attachment to place are also associated with sustainable cultural tourism development (Vu & Nguyen, 2026), while community feedback provides an important input for evaluating heritage communication (Phuong & Lam, 2025). Research on marine cultural heritage in Thanh Hoa further shows that conservation effectiveness is shaped by the interaction of heritage-based products, human resources, infrastructure, community participation, and policy support (Hung & Tuyen, 2026). Although these studies do not all concern musical instruments directly, they converge on one principle: safeguarding value depends on interpretation quality, participation, institutional coordination, and the continuity of relationships between heritage and community, not merely on the existence of a digital product.

The problem becomes more specific when these insights are compared with research directly addressing Vietnamese traditional instruments. Studies by Ma and colleagues demonstrate the technical feasibility of automated recognition, three-dimensional modelling, ontologies, and lightweight computational models for Vietnamese instrument data (Ma et al., 2024a, 2024b). These are important technical foundations, but major cultural management questions remain unresolved: whether a digital model can preserve social context and embodied technique; who validates names and variants; how access and reuse rights are governed; and whether data are returned to serve master artists, learners, and cultural institutions. The gap therefore lies in integrating technological capability with the governance principles of living heritage.

Against this background, the study addresses two research questions. RQ1: What major management opportunities and risks arise when the digitisation of traditional musical instruments is approached through the logic of living heritage? RQ2: What management framework can connect digital data with community, context, rights, interoperability, and the continuity of practice in Vietnam? The study makes three contributions. First, it redefines the safeguarding unit from the "digital file" to the "instrument ecosystem". Second, it systematises four governance tensions that can reduce safeguarding value even when a project is technically successful. Third, it proposes the 5C framework - Community, Context, Connectivity, Control, and Continuity - as a management layer operating throughout the heritage-data lifecycle.

2. LITERATURE REVIEW

2.1. Traditional musical instruments as a living heritage ecosystem

The living heritage perspective fundamentally changes the unit of analysis in safeguarding. Under a collection-oriented logic, an instrument may be described by name, material, dimensions, date, and photographs. Under a practice-oriented logic, the record must extend to timbre, posture, hand or breath techniques, tuning, local variants, makers, performers, circumstances of use, narratives, community rules, and transmission relationships. These are not supplementary annotations to the object; they are conditions that enable users to understand the instrument as a cultural practice. Community-centred approaches to safeguarding intangible cultural heritage emphasise precisely this relationship among objects, knowledge, and heritage bearers (Tan et al., 2026; UNESCO, 2003).

Research on technology in Indigenous and community contexts further suggests that a digital record has sustainable meaning only when communities can participate in defining its content and presentation. Meighan (2021) shows that technology contributes more effectively to Indigenous language revitalisation when it is tied to intergenerational transmission and community needs; Nijdam (2023) demonstrates that digital storytelling can support the continuity of Indigenous knowledge when production is carried out with cultural subjects. Although these studies address different heritage forms, they support a transferable principle: digital data are not neutral. Choices about selection, naming, linking, and presentation always embed an interpretation of heritage.

For Vietnamese traditional musical instruments, this study defines the "instrument ecosystem" through five interconnected layers: (1) the morphology and materials of the instrument; (2) sound and repertoire; (3) making and performance techniques; (4) meanings, narratives, social functions, and spaces of use; and (5) heritage-bearing communities and transmission relationships. This five-layer structure is not intended to replace musicological classification. Rather, it provides a sufficiently broad management unit for assessing the completeness of a digital record. Projects may prioritise particular layers, but the complete omission of any layer should be a deliberate and explained choice rather than an accidental consequence of technical constraints.

2.2. From documentation to interpretation, access, and participation

The digital heritage literature shows that technology now performs functions extending well beyond storage. Wei et al. (2026), in a review of 102 studies, identify five broad stages in the digital safeguarding of intangible cultural heritage: data collection and organisation, classification and recognition, digital reconstruction, exhibition and education, and cultural innovation. Boboc et al. (2022), reviewing augmented reality applications in cultural heritage, likewise identify uses in three-dimensional reconstruction, digital museums, education, tourism, user experience, and intangible heritage. Together, these strands confirm that safeguarding value lies not in any single technology but in the chain of functions that technology supports across the heritage lifecycle.

At the experience level, research on immersive environments shows that presence, authenticity, perceived benefits, and conditions of use are associated with user behaviour. He and Qin (2024) find that cultural heritage experiences in metaverse environments can be related to intentions for offline experience; Ye et al. (2025) show that adoption of digital intangible heritage depends on configurations of multiple conditions rather than on a single factor; Wen et al. (2023) identify several drivers of AR/VR acceptance and use at heritage monuments; and Di Dalmazi et al. (2024) clarify the role of presence and physiological arousal in behavioural responses to immersive experiences. Lai et al. (2025) further show that the perceived benefits and risks of digital cultural heritage platforms can shape intentions for offline cultural participation. From a safeguarding perspective, Oladokun et al. (2024) view immersive environments as a means of extending heritage access, while Lee and King (2025) emphasise practitioner participation, responsible representation, and intellectual property in AR/VR applications for intangible heritage. Zhu et al. (2023) also identify perceived authenticity as an important link in augmented-reality heritage experiences.

Digital communication performs a further function by expanding storytelling and interaction. Wang et al. (2025) show that the effective dissemination of intangible cultural heritage on short-video platforms emerges from configurations of content, interaction, and media characteristics, while Zhang and Xu (2024) emphasise embodied experience in digital heritage reading and social-media communication. The case of Muqam art demonstrates that GIS, virtual reality, and new-media platforms can support access and engagement with intangible heritage (Sun,

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2025). Chen et al. (2026) synthesise digital communication strategies for intangible cultural heritage while also highlighting challenges involving authenticity, commercialisation, and accessibility. Wider reach, therefore, cannot be treated as the sole indicator of safeguarding success.

Within cultural institutions, digital transformation also depends on organisation and user capability. Yang et al. (2025) show that museum digitisation can support preservation, sharing, education, and public participation, but requires coordination among infrastructure, content, and experience. In Vietnam, Nguyen and Bui (2025) report that public-library users value cultural heritage information but that actual use remains limited; subsequent research indicates that heritage-information promotion remains fragmented and requires better coordination between digital channels, traditional channels, and cultural partners (Nguyen & Bui, 2026). These findings reinforce the argument that digitisation should be managed as a chain of cultural services rather than merely as a technology project.

2.3. Interpretation, memory, community, and sustainable value in Vietnam

A recent body of Vietnamese research provides direct evidence of the importance of interpretation and storytelling. Ha et al. (2026) show that the quality of architectural heritage interpretation at the Imperial Citadel of Hue is associated with responsible tourist behaviour, with personal norms operating as a mediating mechanism. Nguyen and Nguyen (2026) approach heritage storytelling through experience and value co-creation, showing how interactive technology and narrative structure can enrich experiences at heritage destinations. For the management of traditional musical instruments, these findings imply that visual or audio data become cultural resources only when they are placed within an interpretive structure that helps users understand who produces the sound, the practice to which it belongs, and why it matters.

Community and identity form a second layer. Nguyen (2025) identifies local resident participation as an important factor in the formation of heritage conservation awareness in Hanoi. Vu and Nguyen (2026) show that heritage memory, cultural identity, attachment to place, and community participation are all connected with sustainable cultural tourism development. Phuong and Lam (2025) emphasise community feedback as a component in evaluating heritage communication effectiveness. Research on marine cultural heritage in Thanh Hoa similarly demonstrates that conservation effectiveness depends on the interaction of community participation, human resources, heritage products, infrastructure, and policy mechanisms (Hung & Tuyen, 2026). These results suggest that digital platforms for musical instruments should not function as one-way content broadcasters; they need mechanisms through which heritage bearers can validate, supplement, correct, and respond to information.

The creation of livelihoods or economic value is not inherently opposed to safeguarding, but it needs to be located within a structure that returns cultural benefits to communities. Research on brocade weaving in northern mountainous areas of Vietnam shows that the use of traditional craft values for distinctive tourism development needs to be linked with community relationships, product quality, and appropriate promotion (Pham et al., 2025). A similar principle can apply to musical instruments in performance, education, cultural tourism, and creative products: public expansion is sustainable only when it does not obscure cultural subjects, flatten local differences, or detach products from the knowledge systems that produced them.

The Vietnamese evidence therefore points to three closely connected management dimensions: interpretation quality, meaningful participation, and value continuity. This provides an important basis for moving digital safeguarding research from the question of whether technology can perform a task to the question of which management model enables technology to serve cultural objectives appropriately.

2.4. From community participation to cultural data governance

Recent international research is moving from participation understood as consultation towards co-design and co-governance. Nikolakopoulou and Koutsabasis (2025) show that co-design remains underused in digital heritage, even though meaningful participation requires users and communities to contribute to idea formation, content selection, and experience development. Zhang et al. (2024) develop an assessment framework for youth digital participation in heritage management, emphasising digital citizenship capability, opportunities for contribution, and stage-based evaluation. Ginzarly and Teller (2025) propose a people-centred approach to social media and heritage resilience, further clarifying the need for co-creation rather than one-way dissemination.

Rights become increasingly important when data can be copied, connected, and reused outside their original context. Rachman (2024) shows that digital spaces can enable local community initiatives in heritage safeguarding, while Saputra (2025) identifies tensions involving authority, access, cultural data sovereignty, and platform ethics in Indonesia. These issues are especially relevant to traditional instruments, where an audio recording or a technique video may simultaneously function as educational material, research evidence, and knowledge whose circulation is subject to community rules.

From the perspective of digital preservation in Vietnam, Phuong (2026) identifies both the opportunities and limitations of smart technologies, ranging from three-dimensional digitisation and metadata to cloud storage, while also highlighting the need for investment, policy, and interdisciplinary coordination. When combined with research on communities, libraries, and heritage communication, this suggests that an appropriate management framework must answer five questions at the same time: who the cultural subjects are; which context must be retained; how data should be connected; how rights are governed; and whether the final outcome strengthens the capacity for continuing the practice.

3. MATERIALS AND METHODS

3.1. Research design

The study used a qualitative design combining a structured narrative review with policy analysis. This approach was selected because the research questions lie at the intersection of several bodies of literature - intangible cultural heritage, digital heritage, cultural governance, communication, education, experience, and policy - while direct research on the digital management of Vietnamese traditional musical instruments remains limited. The aim was not to estimate a pooled effect size, but to identify recurring management patterns, compare them with the Vietnamese institutional context, and construct a conceptual framework that can be operationalised.

The review focused primarily on publications from 2021 to 28 August 2026, with an exception for the 2003 UNESCO Convention because it provides the core normative foundation for the concept of safeguarding intangible cultural heritage. Vietnamese policy documents were selected according to their direct relevance to cultural development, heritage digitisation, and the current legal framework. Three additional Vietnam-based

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studies were included in the final synthesis because they provide directly relevant evidence on marine cultural heritage conservation and on applied capability and institutional ecosystems in culture-oriented higher education (Hung & Tuyen, 2026; Tran, 2024a, 2024b).

3.2. Search, selection, and source verification

The search used English and Vietnamese keyword groups organised around four clusters: (i) digital safeguarding/digital preservation of intangible cultural heritage; (ii) traditional musical instruments and digital preservation; (iii) community participation/co-design/cultural heritage governance; and (iv) Vietnam cultural heritage/digital heritage/cultural management. Relevant results were traced to publisher pages, DOI records, or official portals. For legal and policy documents, document numbers, dates of issuance, and validity were checked against the Government legal-document portal or UNESCO sources.

A source was included if it met at least one of the following conditions: it provided a framework or evidence concerning the digital safeguarding of intangible cultural heritage; analysed experience, communication, participation, or digital heritage governance; provided direct evidence from Vietnam relating to interpretation, memory, community, heritage information, or digital preservation; addressed institutional capability relevant to cultural management and practice-based implementation; or directly studied Vietnamese traditional musical instruments. Sources were excluded if they were only distantly related to technology in general, lacked verifiable bibliographic information, duplicated other material, or did not contribute to the cultural management questions.

After screening, the analytical corpus comprised 42 sources: 36 journal articles, 2 conference/book chapters focused directly on Vietnamese traditional musical instruments, 3 Vietnamese legal or policy documents, and 1 UNESCO normative instrument. Journal articles therefore accounted for 85.7% of all sources, and most were published between 2023 and 2026. The source structure is presented in Table 1.

Table 1. Structure of the analytical corpus

Source group	Number	Role in the analysis	Examples
Journal articles	36	Evidence on digital heritage, community participation, interpretation, communication, governance, institutional capability, and conservation effectiveness	Tan et al. (2026); Phuong (2026); Ha et al. (2026); Hung & Tuyen (2026)
Conference/book chapters	2	Direct technical evidence on Vietnamese traditional musical instruments	Ma et al. (2024a, 2024b)
Vietnamese legal/policy documents	3	Institutional framework for cultural development and heritage digitisation	Decision 1909/QD-TTg; Decision 2026/QD-TTg; Law 45/2024/QH15
International normative instrument	1	Conceptual foundation for living heritage and community participation	UNESCO (2003)

3.3. Analytical and synthesis procedure

Each source was read through five analytical fields: the object regarded as requiring safeguarding; the function performed by digital technology or communication; the role of the community or heritage bearers; the governance issues that emerged; and outcomes related to learning, participation, identity, or continuity of practice. In the first synthesis round, observations were grouped into descriptive themes. In the second round, themes were compared through the relationship between benefits and risks to identify recurring management tensions. The 5C framework was constructed in the final round by linking each problem cluster to a management question applicable across the data lifecycle.

The trustworthiness of the synthesis was strengthened in three ways. First, claims about Vietnam were prioritised against Vietnam-based publications or official documents rather than being inferred entirely from international cases. Second, technical findings were placed alongside community and governance research so that technological performance would not be equated with safeguarding effectiveness. Third, only sources with verifiable bibliographic information and DOI links or official pages were retained. The design generated no primary data and involved no statistical synthesis.

4. RESULTS

4.1. The safeguarding unit comprises five interconnected layers

The synthesis reveals a clear distinction between the "digitisation object" and the "safeguarding object". A digitisation object is usually a specific format such as an image, audio file, video, three-dimensional model, or descriptive text. The safeguarding object, when understood through living heritage, is broader and consists of five interconnected layers: morphology-material; sound-repertoire; making-performance technique; meaning-social context; and community-transmission relationships. No single digital format covers all five layers.

This leads to a requirement for relational completeness rather than completeness measured by data volume. A three-dimensional model may be geometrically precise but lack sound and sound-producing technique; an audio recording may capture timbre but omit movement, performer, or circumstances of use; a video may document technique while still lacking materials, narratives, or usage rights. The value of a digital record therefore increases when data layers can be connected and linked to provenance, cultural subjects, and context.

4.2. Five digital functions for traditional musical instruments

The technologies and digital practices represented in the corpus can be grouped into five functional categories. The first is documentation: creating images, audio, video, three-dimensional scans, and descriptive records. The second is organisation and retrieval: standardising metadata, assigning identifiers, developing ontologies, linking data, and applying automated recognition. The third is interpretation: placing data within narratives, maps, thematic routes, or explanatory structures. The fourth is experience and access: digital museums, augmented and virtual reality, digital libraries, and social media. The fifth is continuity: using digital resources for transmission, learning, practice, performance, cultural tourism, or responsible creativity.

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These categories do not form a hierarchy in which more complex technology is automatically better. Documentation and data organisation provide a foundation for interpretation; interpretation enables meaningful experience; and experience becomes a safeguarding outcome only when it can return to learning, practice, and community life. Table 2 summarises the corresponding safeguarding values and management risks.

Table 2. Digital functions, safeguarding value, and management risks

Functional group	Primary value	Risk under weak management	Management requirement
Documentation	Records form, sound, technique, and narratives	Fragmented files; missing people/context; publication of sensitive content	Contextual metadata; provenance; consent
Organisation and retrieval	Connects and enables searching across multimodal data	Standardisation erases names/variants; incorrect labels	Identifiers; multilingual vocabularies; correction mechanisms
Interpretation	Transforms data into stories and understandable knowledge	Simplification; theatricalisation; local differences become obscured	Clear sourcing; multiple voices; validation by heritage bearers
Experience and access	Expands audiences, education, and interaction	Novelty-seeking; digital divide; views substitute for depth	Audience-appropriate design; pathways to deeper content
Continuity	Supports learning, transmission, performance, and responsible use	Digital resources do not return to practice or communities	Indicators of learning, practice, benefits, and offline participation

4.3. Four management tensions across the data lifecycle

The first tension is data richness but contextual poverty. Technology increases the quantity and detail of digital files, yet the more data are separated from practitioners, places, and social functions, the more difficult it becomes to interpret the record as living heritage. This problem appears across research on digital preservation, interpretation, and heritage communication (Chen et al., 2026; Phuong, 2026; Wei et al., 2026).

The second tension is open access but weak rights control. Digital platforms facilitate education and research, but not all knowledge is appropriate for unconditional access. Literature on communities, co-design, and heritage governance indicates that participation in decision-making, the ability to correct descriptions, tiered access, and attribution are components of responsible governance (Ginzarly & Teller, 2025; Nikolakopoulou & Koutsabasis, 2025; Rachman, 2024; Saputra, 2025).

The third tension is engaging experience but reduced authenticity. Immersive technology and storytelling can increase interaction, but reconstruction or simplification can create the impression that a digital version is the sole representative of a practice. Studies of AR/VR, authenticity, and heritage storytelling indicate that effective experience needs to remain connected with sources, cultural subjects, and interpretive context (Lee & King, 2025; Nguyen & Nguyen, 2026; Zheng, 2024; Zhu et al., 2023).

The fourth tension is wider reach without guaranteed continuity. Views, downloads, and file counts can indicate exposure, but they do not show whether more people learn, whether transmission activities occur, whether offline participation increases, or whether benefits return to communities. Research on digital heritage adoption, offline behaviour, conservation awareness, and community feedback therefore points to the need for outcomes deeper than exposure metrics (He & Qin, 2024; Nguyen, 2025; Phuong & Lam, 2025; Wang et al., 2025; Ye et al., 2025).

4.4. The 5C cultural management framework

From the five layers of the safeguarding object, the five groups of digital functions, and the four management tensions, the study synthesises the 5C framework. Community identifies cultural subjects and their participation rights; Context ensures that data retain cultural relationships; Connectivity enables linking and traceability; Control governs rights, access, and responsibility; and Continuity tests whether digital resources strengthen transmission and practice. These five components are not sequential steps but simultaneous conditions that need to be considered at every stage of a project.

The relationships among the components are complementary. Community without Control may remain at the level of symbolic consultation; Context without Connectivity can produce meaningful information that is difficult to use; Connectivity without Context can link many files while flattening differences; Control without a Continuity orientation can reduce governance to access restriction; and Continuity becomes sustainable only when the other four conditions create data that are meaningful, attributable, and connected to communities.

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Corresponding Author: Dang Thanh Tang

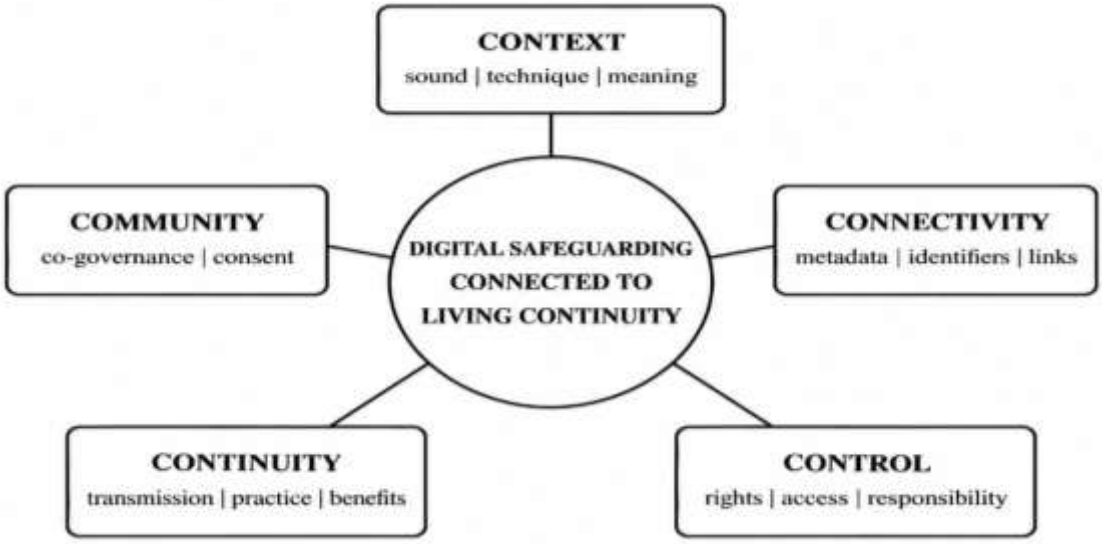


Figure 1. The 5C framework for the digital safeguarding management of traditional musical instruments
Source: Synthesis and proposal of the study.

Table 3. Operational content of the 5C framework

Component	Core management question	Minimum expression in a record/project	Trackable indicators
Community	Who determines content, description, rights, and success criteria?	Validation by cultural subjects; feedback/correction mechanism; clear attribution	Share of records validated; number of feedback items resolved
Context	Do the data preserve relationships among instrument, sound, technique, and meaning?	Links among object, sound, technique, story, and place	Multimodal completeness; share of records with provenance
Connectivity	Can data layers interoperate and be traced?	Consistent identifiers; metadata; cross-links; exchange capability	Share of cross-linked records; number of connected systems/institutions
Control	Who may view, download, modify, reuse, or commercialise the data?	Access conditions; licences; change logs; rights-update mechanism	Share of data with rights status; rights requests processed
Continuity	Do digital resources increase learning and practice capacity?	Learning materials; transmission classes; performance activities; online-offline links	New learners; transmission activities; offline participation

5. DISCUSSION

5.1. Conceptual contribution: from data preservation to continuity management

The findings show a central weakness of digitisation approaches organised around technical outputs: they can measure with great precision what is easy to count while overlooking what determines heritage vitality. Numbers of records, storage capacity, three-dimensional models, and views are necessary for project administration, but they do not by themselves reveal whether communities retain interpretive authority, whether learners can reproduce skills, or whether data are used to sustain practice. The 5C framework adds a management layer that connects technical outputs with the ultimate cultural objective.

This conclusion is consistent with two major strands of research while extending them in an integrated direction. Wei et al. (2026) describe the functional chain of technology in safeguarding intangible cultural heritage, whereas Tan et al. (2026) emphasise synergy between technological depth and the depth of community participation. The 5C framework retains technology as a means while adding three issues that are often treated separately: contextual integrity, data interoperability, and rights control. In this way, "continuity" is not regarded as an activity at the end of a project but as a criterion that guides decisions about which data to collect, who participates, and how platforms are designed.

This approach is particularly important for musical instruments because much of their knowledge is embodied. Sound cannot be separated from movement; movement cannot be separated from material and construction; technique cannot be separated from the learning process; and learning cannot be separated from the social relationship between transmitter and learner. A repository can therefore be highly complete according

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to archival standards while remaining poor in its capacity to support the recovery or continuation of practice if these relationships are not recorded and connected.

5.2. Implications for cultural management in Vietnam

First, management should move from single-format digital records towards multilayer records. A minimum instrument record should include an identifier; common and local names where relevant; materials, dimensions, and construction; multi-angle images or a three-dimensional model where appropriate; sound samples; technique video; craft information; repertoire or function; place; heritage bearers; recording provenance; rights status; and links to related variants. This is not a closed standard but a starting structure through which Context and Connectivity can be integrated from the point of collection.

Second, interpretation should be treated as a management function rather than a decorative layer of a platform. Evidence from Vietnam on the Imperial Citadel of Hue, heritage storytelling, memory, and identity shows that explanation quality and narrative organisation are associated with experience, norms, participation, and cultural value (Ha et al., 2026; Nguyen & Nguyen, 2026; Vu & Nguyen, 2026). For musical instruments, users should be guided from a sound or image towards the maker, performance setting, variants, social role, and practice rules, rather than receiving only a name label.

Third, community participation needs to be designed as a continuing function. Research in Hanoi shows that local participation contributes to conservation awareness and that community feedback can inform the evaluation of heritage communication (Nguyen, 2025; Phuong & Lam, 2025). Evidence from marine cultural heritage in Thanh Hoa also demonstrates that human resources and heritage-based products are more effective when they are connected with community participation and conservation policy (Hung & Tuyen, 2026). Instrument platforms should therefore allow master artists and communities to add local names, correct descriptions, update use status, request access restrictions, and identify variants that central classification systems do not capture.

Fourth, rights management should precede open-data ambitions. Some data may be fully public; some may be view-only; some may be restricted to education or research; some may require conditional access; and some may need to remain restricted according to the decisions of heritage bearers. Such tiering does not contradict broader access. On the contrary, it clarifies institutional responsibility and can build the trust needed for communities to share valuable knowledge.

Fifth, evaluation systems need to incorporate Continuity indicators. Alongside file counts and access statistics, management agencies can track the number of community-validated records, transmission activities using digital resources, learners who move from online access to practice, use in schools and museums, correction requests resolved, and benefit-sharing mechanisms when data support economic activity or cultural tourism. Research on brocade weaving similarly shows that community linkage and value development need to proceed together (Pham et al., 2025).

Universities and other cultural-education institutions can also contribute to this ecosystem through applied training, project development, and partnerships. Evidence from Thanh Hoa University of Culture, Sports and Tourism shows the importance of institutional support, mentoring, access to resources, and practical environments in developing student project capability, while practice-based teaching needs to respond to technological change and product-quality requirements (Tran, 2024a, 2024b). For digital heritage management, this supports a role for universities not only as technology providers but also as spaces where documentation, interpretation, rights awareness, and community collaboration are learned through practice.

5.3. Linking the 5C framework with heritage digitisation policy

The Programme for Digitisation of Vietnamese Cultural Heritage, 2021-2030, establishes a basis for standardising, constructing, and connecting data; the 2024 Law on Cultural Heritage provides an updated legal framework; and the Cultural Development Strategy to 2030 places digital transformation within broader cultural development objectives (National Assembly, 2024; Prime Minister, 2021a, 2021b). The 5C framework can function as a supplementary criteria layer to ensure that data objectives remain connected to living safeguarding goals.

At the central level, priorities include data standards, identifiers, rights principles, interoperability, and evaluation indicators. At local and institutional levels, priorities are context-sensitive collection, sustained relationships with master artists and communities, record updating, and returning data to education and transmission. Universities, libraries, and technology organisations can provide infrastructure, methods, training, and tools, but authority to validate cultural meaning should not be transferred entirely to technical operators. Research on Vietnamese public libraries likewise shows that access to heritage information depends on service organisation, communication, and coordination, not simply on the existence of resources (Nguyen & Bui, 2025, 2026). Applied research in culture-oriented higher education additionally suggests that institutional ecosystems and practice-based training can strengthen the human capability needed to implement these functions (Tran, 2024a, 2024b).

A 5C-compatible workflow can be organised around four control points: before collection, identify cultural subjects and rights; during data creation, record sufficient context and provenance; at publication, ensure interoperability, tiered access, and interpretation; and after publication, measure learning, practice, feedback, and benefits returned to communities. Table 4 translates the 5C framework into a concise management checklist that can be applied to a project or repository.

Table 4. A 5C management checklist across the project lifecycle

Stage	Mandatory question	Minimum management output
Before collection	Who are the cultural subjects? What is the digitisation objective? Which data are sensitive?	Stakeholder list; scope; consent; rights plan
Data creation and description	Have source, context, names, techniques, and relationships among files been recorded?	Metadata; identifiers; provenance; multimodal links

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Stage	Mandatory question	Minimum management output
Publication and use	Who may access or reuse the data? Do users understand whether an item is a record, reconstruction, or interpretation?	Tiered access; conditions of use; source labels; interpretive content
Evaluation and updating	Do data return to learning, practice, and communities? Is there a mechanism to correct records and update rights?	Continuity indicators; feedback; update schedule; benefit report

5.4. Limitations and directions for future research

The study has three limitations. First, it is a structured narrative review rather than a PRISMA systematic review; the corpus therefore should not be treated as exhaustive of all international publications. Second, direct research on Vietnamese traditional musical instruments remains limited within the source set, so part of the argument relies on controlled transfer from research on intangible heritage, museums, libraries, cultural tourism, and applied cultural education. Third, the 5C framework has not yet been tested with primary data from master artists, cultural managers, music researchers, teachers, or learners.

Future research should test the framework within one or two specific instrument traditions, preferably cases with clearly identifiable communities of practice and active digitisation needs. Expert interviews, focus groups, or Delphi studies could be used to evaluate the weighting of criteria; case studies could test rights and metadata workflows; and user evaluation could measure transitions from digital access to learning and offline participation. Such testing would help move the 5C framework from a conceptual model towards an applicable cultural management standard.

6. CONCLUSION

Safeguarding traditional musical instruments in the digital era cannot be evaluated solely by the quantity of data produced. Musical instruments are living heritage in which physical objects, sound, technique, meaning, and community are interdependent. Digital technologies substantially expand the capacity for documentation, organisation, interpretation, and access, but at the same time generate four tensions: abundant data without sufficient context; open access without adequate rights control; attractive experiences that may blur authenticity; and broad reach without guaranteed transmission.

The 5C framework - Community, Context, Connectivity, Control, and Continuity - is proposed to address these tensions within a unified management architecture. Community places heritage bearers within decision-making; Context preserves the relationships that create meaning; Connectivity links data layers and institutions; Control clarifies rights and responsibilities; and Continuity requires digital investment to return to learning, practice, and knowledge transmission. In the context of Vietnam's heritage digitisation programme to 2030, this approach can support a shift from accumulating digital resources towards managing the quality of heritage continuity.

The principal contribution of the study therefore lies not in proposing another technology, but in identifying a different criterion of success: a digital safeguarding project has cultural value when its data remain connected with heritage bearers, context, rights, and the capacity for continuing cultural practice.

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Conflict of Interest

The author declares that there is no conflict of interest.

Research Ethics

This study used publicly available academic sources and policy documents, collected no data from human participants, and involved no animals; therefore, ethical approval and participant consent procedures were not required.

Author Contribution

Dang Thanh Tang: Conceptualization; methodology design; source collection and verification; literature synthesis and analysis; framework development; manuscript writing; review and editing.

Data Availability

The study generated no new primary dataset. All sources used in the analysis are identified in the References.

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Corresponding Author: Dang Thanh Tang

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Corresponding Author: Dang Thanh Tang