



ISSN:3027-110X



NIGERIAN LIBRARY ASSOCIATION
NIGER STATE CHAPTER

CONFERENCE PROCEEDINGS

7th ANNUAL
HYBRID CONFERENCE
/AGM 2025

THEME:
INNOVATIVE TECHNOLOGIES IN LIBRARY SERVICES:
EXPLORING THE AVENUES FOR BUILDING USERS'
CONFIDENCE IN LIBRARIES.



28TH SEP., - 1ST OCT., 2025.



**CPES HALL, FEDERAL UNIVERSITY OF
TECHNOLOGY MINNA, BOSSO CAMPUS,
NIGER STATE**



NIGERAN LIBRARY ASSOCIATION (NLA) NIGER STATE CHAPTER

7TH ANNUAL HYBRID CONFERENCE PROCEEDINGS

THEME:

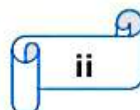
**INNOVATIVE TECHNOLOGIES IN LIBRARY
SERVICES: EXPLORING THE AVENUES FOR
BUILDING USERS' CONFIDENCE IN LIBRARY**

DATE:

28TH SEPTEMBER– 1ST OCTOBER, 2025

VENUE:

**CPES HALL, FEDERAL UNIVERSITY OF
TECHNOLOGY, MINNA, NIGER STATE, NIGERIA.**





NLA NIGER STATE EXCOS

Dr. Musa Baba Adamu
Chairman

Mal. Kamaludeen Isa El-kalash
Vice Chairman

Lbrn. Mohammed Musa Saba
Secretary

Lbrn. Lawal Abubakar
Asst. Secretary

Lbrn. Kasim Muhammad Bala
Financial Secretary

Lbrn. Rabi Shehu Ahmed
Treasurer

Lbrn. Isah Yahaya Abdullahi
P.R.O

Dr. Fatimah Jibril Abduldayan
EX-Officio

Prof. Abdulganiy Okanla Ahmed
Editor-in-Chief

ARTICLE REVIEWERS

Dr. G. A. Babalola

Dr. Adamu Mohammed Saba

Dr. Fatimah Jibril Abduldayan

Dr. Salisu Adamu Aliero

Dr. Chuks-Ibe Prisca Oluchi

Dr. Sadiat Adetoro Salau

Dr. Muhammad Kpakiko Mohammed

Dr. Mirriam Ayinda Salubuyi

Dr. Muhammed Ali Fakandu

Dr. Idris Ibrahim Saleh

Lbrn. Mohammed Musa Saba

FROM THE EDITORIAL DESK

The Nigerian Library Association, (NLA), Niger State Chapter's is pleased to formally release her the 2nd Edition of her compiled Book of Proceedings. This is a compilation of Papers Presented at the Chapter's 7th Annual Hybrid Conference held at CPES Hall, Federal University of Technology Minna, Niger State. High quality research is leading to corresponding high-quality theories that are finding their place in the real world of application. Nigerian Library Association, Niger State Chapter brings forth an opportunity for researchers in Librarianship Profession to create knowledge for application in emerging issues that will result to massive development in the society. The Conference with a theme “**Innovative Technologies in Library Services: Exploring the Avenues for Building Users’ Confidence in Library**” was carefully carved out and was intended to provide forum for exchange of ideas among professional colleagues towards finding tenable solutions to current issues in the global information value chain.

I owe a heartfelt thanks to all the article contributors for a very fascinating research output which promised to constantly thrive upon high quality research. Cases published in this issue have gone through internal editorial committee’s review and the comments received from experts have helped to improve upon the quality of work. In this pursuit, I extend my immense gratitude to a very dedicated team of editors for their relentless and untiring efforts in this regard. We are also indebted to our external reviewers who have spared their valuable time despite their tight schedules and contributed immensely towards the success of this publication.

We sincerely hope that the readers will find the research outputs interesting, relevant and intellectually stimulating leading to building up diverse outlook about contemporary issues.

Prof. A. O. Ahmed
Editor-in-Chief



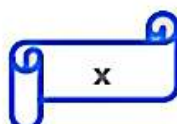
Published and Printed
© Manasara Publishing
& Printing Service Ventures,
Minna, Niger State
Tel: 07032844805, 07087783846
email: mpiventures87@gmail.com

ISSN: 3027-110X



TABLE OF CONTENTS

A Review of Common Issues in Preserving Digital Information Resources in African Academic Libraries Buhari Yakubu ¹ Abubakar Alhaji Mohammed ² Akawu Lami ³	1
Acceptance of KOHA Library Management Systems in Selected Polytechnic Libraries in Jigawa State, Nigeria. Abdulkarim Haruna ¹ Muhammad Aminu Hassan ²	8
Adoption and Use of Artificial Intelligence in the Delivery of Library Services in Academic Libraries Abdulumuni Abdulhamid ¹ Asiya Rabe Abdullahi ² Lawal Abubakar ³	16
Adoption and Perceptions of Innovative Technologies in Records Management by Administrative Staff in Federal Polytechnic Offa Daniel Loretta Odiri ¹ Adetunji Juliana Bolatito ² Owolabi Rukayat Shayo ³	21
Assessing the Impact of Data-Driven Analytics for Informed Collection Development and User Satisfaction in University Libraries Abdulbaqi Mohammed Gabdo ¹ Muhammad Aminu Hassan ² Amina Abubakar Ado ³	30
Awareness and Utilization of Artificial Intelligence Based Research Tools among Linguistic Students in Bayero University Library, Kano Yusuf Muhammad ¹ Shamsiyya Sarki Gidado ² Nura Muhammad Lawan ³	35
Awareness and Utilisation of Online Public Access Catalogue (OPAC) in Selected Academic Libraries in Adamawa State, Nigeria Adamu Abbas Lamido Gora ¹ Abdullahi Zainab Mohammed ² Gombe Ahmed Baba ³	42
Big Data Analytic Shift Towards Medical Librarianship: Notes from Modibbo Adama University Teaching Hospital Yola, Adamawa State, Nigeria Babangida Umar Babayi ¹ Damaris Joseph ² Mamza Wavi Pur ³	53
Effect of Perceived Visual Attractiveness on Post-Interaction Use Behaviour of a Prototype Medical Library Website for Federal Universities in Nigeria S.A. Imavah ¹ G.U. Oyedum ² G.A. Babalola ³ J.A. Ojeniyi ⁴ P.O. Chuks-Ibe ⁵	61





Enhancing Course Accreditation through Library Quality Assurance Practices: A Systematic Review of University Libraries Busa Danlami Umar ¹ Musa, Hussaini ² Onyeabor, Grace ³	71
Ethical Issues on the Use of Artificial Intelligence for Research Activities in Law Faculties in Federal Universities in North Central Nigeria Abdulkadir Rukayat Osheiza ¹ J. N. Udensi ² R. O. Salami ³	81
Exploring the Strategies and Practices of Safeguarding Electronic Information Resources in Bayero University Kano Library Hadiza Umar ¹ Auwalu Dansale Yahaya ²	87
Evaluating the Readiness of Nigerian University Libraries for AI-Driven Collection Development: A Systematic Review Martha Tizhe ¹ Fatimah Jibril Abduldayan ² Prisca Oluchi Chuks-Ibe ³	93
Evaluation of Security Measures for Sustainable Information Systems in Public University Libraries in Nigeria Mohammed Safiya Garba ¹ Hussaini Musa ² Rhoda Wusa Goshie ³	103
Exploring Librarians' Knowledge and Competency in the Integration of Artificial Intelligence Tools for Sustainable Library Services in Nasarawa State Wilson Oserada ¹ ² Hassan Mallam Ibrahim ³ Juliana Nkechi Udensi	109
Future Roles and Skills Set of Reference Librarians: Leveraging Innovative Technology for Effective Reference Service in Libraries Buhari Ganiyu Idowu ¹ Abdulsalam Jamiu Adewale ² Oyewole Saheed Oluwasegun ³ Rotimi James Omolehin ⁴ Soladoye Ibraheem Oluwatosin ⁵	117
Harnessing Social Media to Strengthen Marketing Strategies and Library Service Delivery: Evidence from Kogi State University Library, Kabba, Nigeria Oluwatosin Daniel Akobe ¹ Onivehu Abdulraheem Kareem ² Amina Badaru Lukman ³	124
Infrastructure Readiness for Implementing Artificial Intelligence and Integrated Library Management Systems in Academic Libraries in Nigeria: A Systematic Review Abubakar Hadiza Oluwatayo ¹ M.A. Salubuyi ² Isah Ndashiru ³	136
Information Communication Technology Skills on Academic Activities of Officer Cadets in Universities in North-West, Nigeria Adamu Sagir Mohammed ¹ Obaje Alfred Michael ² Adamu Mohammed Saba ³	143



Innovative Technologies for Digital Preservation in Nigeria Digital Research Libraries Anaele Ijeoma Onyeka ¹ agaocha, Nwankemadu O.C ² Uyabeme Clementina N. ³	154
Innovative Technologies for Records Management in Ministries, Departments and Agency Libraries in Nigeria. Abdulkarim Murjanatu ¹ Goshie W Rhoda ² Muhammad Rahinatu ³ Suleiman Habiba ⁴	157
Innovative Technologies for Digital Preservation in Academic Libraries: Strengthening User Confidence in Knowledge Sustainability Ibrahim Ahmed Bichi ¹ Mohammed Musa Saba ²	163
Integrating Artificial Intelligence for Enhanced Service Efficiency in Academic Libraries of Ekiti State Olabode Olajide ¹ Zuwelatu O. Anyakorah ² Rotimi J. Omolehin ³ Funmilola A. Ojo ⁴ Kemi D. Adebayo ⁵	172
Librarians' Competencies in the Use of Library 3.0 for Information Service Delivery: A Pathway to Digital Era in Librarianship Abduljabbar Tukur ¹ R.O. Salami ² R. O. Okwori ³	181
Objective of Public Library as Correlate to the Fifteenth Sustainable Development Goal in North-Central Nigeria Abdullahi, Abubakar Panti ¹ , Hussaini Musa ² , Suleiman Lawal Attahiru ³ Mohammed Shantali Musa ⁴	185
Preservation Methods and Digitization Techniques on Management of Cultural Artefacts: A Review of Literature Abdullahi Zakariaywu ¹ Fatimah Jibril Abduldayan ² Amina Gogo Tafida ³	194
Predictive Analytics for User Behaviour: A Step towards Smart Library Systems in Nigeria Julius Tobenna David ¹ Martha Tizhe ²	202
Roles of Librarians in Digital Literacy Transformation in the 21st Century: A Review. Owoeye Oluwafemi Samuel ¹ Jehoshaphat Emmanuel Hassan ² Makinde Tunde Emmanuel ³ Yetu Hope Apaa ⁴	209
The Role of Cloud Computing Adoption in Enhancing Digital Preservation of Academic Library Resources Abdulkadir K. ¹ Babalola G. A. ² Abdulsalam A. ³ Safiyanu D. A. ⁴	224

Preservation Methods and Digitisation Techniques on Management of Cultural Artefacts: A Systematic Review

By

Abdullahi Zakariaywu¹, Dr. Fatima Jibril Abduldayan² & Dr. Amina Gogo Tafida³

^{1&2} Department of Library and Information Science,

³ Department of General Studies

**PRESENTED AT THE: 7TH ANNUAL HYBRID CONFERENCE/AGM 2025
CPES HALL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA DATE:
28TH SEPTEMBER -1ST OCTOBER 2025**

Abstract

This systematic review examines contemporary preservation methods and digitisation techniques employed in managing cultural artefacts, synthesizing findings from 48 studies published between 2010 and 2024. Cultural artefacts are vital for preserving heritage, identity, and history, necessitating effective management strategies. Traditional physical preservation methods such as climate-controlled storage, restoration, pest management, and preventive conservation remain foundational for maintaining artefact integrity. Concurrently, digitisation techniques including 3D scanning, digital archiving, and virtual exhibitions have increasingly complemented these methods by improving documentation, accessibility, and public engagement. The review reveals that integrated approaches combining physical preservation and digitisation offer significant benefits, enhancing conservation outcomes and enabling wider dissemination of cultural knowledge. However, challenges persist, notably the high costs of digital technologies, limited technical expertise, and insufficient institutional capacity. Moreover, ethical considerations and community involvement are critical to culturally sensitive management but are often underemphasized. The methodology involved systematic literature searches across major databases using keywords related to cultural artefact preservation and digitisation, followed by rigorous screening and narrative synthesis of eligible studies. Based on findings, this review recommends increased investment in professional training, sustainable funding models, stronger policy frameworks, and active community engagement to support integrated preservation practices. Future research should explore affordable digitisation solutions adaptable to resource-limited settings and develop comprehensive models that harmonize physical and digital management techniques. In conclusion, the integration of traditional and digital preservation methods is essential for safeguarding cultural artefacts sustainably, ensuring their longevity and accessibility for educational and cultural enrichment across generations.

Keywords: Cultural Artefact Preservation, Digitisation Techniques, Heritage Management, Digital Archiving and systematic review

Introduction

Cultural artefacts, whether tangible objects such as sculptures, manuscripts, or monuments, or intangible expressions like oral traditions, rituals, and music, embody the historical narratives, values, and identities of societies. These artefacts serve as anchors to our collective past and are central to preserving cultural diversity while fostering a shared social identity (Stephenson, 2023). Their preservation is therefore not only about safeguarding physical objects but also about upholding the integrity of cultural memory. Within heritage management which encompasses the conservation, restoration, and presentation of cultural heritage artefacts function as both material evidence and symbolic cornerstones of identity and history (Smith, 2006). Effective heritage management ensures that these artefacts survive environmental threats, urban development, and neglect, while remaining accessible for education, research, and civic pride.

The value of cultural artefacts extends beyond their historical significance; they carry aesthetic (inspiring creativity and emotion), symbolic (embodying spiritual or societal meaning), and educational functions (providing resources for learning and cultural continuity) (Blake, 2015; Kurin, 2004). In many communities, artefacts play a pivotal role in maintaining belonging and continuity, contributing to both individual and collective identity (Okpoko, 2011).

Preserving cultural artefacts is thus vital not only for retaining tangible traces of the past but also for sustaining the intangible elements values, beliefs, and shared histories—that define human societies. As such, heritage management operates at the intersection of conservation science, cultural policy, and public engagement; without diligent preservation and digitisation efforts, crucial links to collective human memory risk being irretrievably lost

Problem Statement

Cultural artefacts spanning manuscripts, sculptures, textiles, and oral traditions are vital carriers of history and identity, yet they face escalating threats from environmental deterioration, climate change, illicit trafficking, and inadequate conservation infrastructure (Muñoz Viñas, 2005; UNESCO, 2019; Brodie & Renfrew, 2005). In Africa and other regions with limited funding and technical capacity, these risks are compounded

by poor preservation systems and lack of digitisation, resulting in both material loss and restricted accessibility (De la Torre, 2013; Terras, 2011). Consequently, artefacts that should serve as educational resources and cultural anchors remain endangered or invisible, undermining scholarship, heritage continuity, and intergenerational knowledge transfer (Lemi, 2024). Despite growing recognition of preservation and digitisation as critical strategies, there has been little systematic evaluation of their application, particularly in African contexts where indigenous practices coexist with global heritage standards. Addressing this gap is crucial to preventing further cultural loss and ensuring sustainable, inclusive management of heritage resources

Objectives of the Study

The primary objective of this study is to conduct a systematic review of existing literature on preservation methods and digitisation techniques, with particular attention to their influence on the management of cultural artefacts. Specifically, the study seeks to:

1. Identify and categorise the range of preservation methods applied to cultural artefacts, including preventive conservation, restoration, and community-based practices.
2. Examine the digitisation techniques commonly employed in cultural heritage management, such as 2D and 3D digitisation, metadata standards, and digital repository systems.
3. Analyse how preservation and digitisation strategies contribute to improving accessibility, reducing risks, and ensuring the sustainability of cultural artefacts.
4. Highlight the strengths and limitations of current approaches, with emphasis on their applicability within resource-constrained contexts such as African communities.
5. Identify gaps in the literature, including underrepresentation of indigenous practices and the need for cost-effective digitisation solutions, and suggest areas for further research.

Research Questions

To guide the systematic review, the following research questions were formulated:

1. What preservation methods are most commonly applied in the management of cultural artefacts, and how are they categorised (e.g., preventive, restorative, traditional)?
2. Which digitisation techniques are currently employed in heritage management, and what are their relative advantages and limitations?
3. In what ways do preservation and digitisation strategies enhance the accessibility, visibility, and long-term sustainability of cultural artefacts?
4. What strengths and limitations are evident in the existing preservation and digitisation practices, particularly in resource-constrained contexts such as African communities?
5. What gaps exist in the current body of literature, and how can future research address challenges such as low-cost digitisation, infrastructure deficits, and the underrepresentation of indigenous practices?

Theoretical / Conceptual Framework

This study is anchored in two interrelated theoretical perspectives: Value-Based Conservation Theory and Information Science Digitisation Theory, both of which illuminate the significance of preservation and digitisation in the management of cultural artefacts.

Value-Based Conservation Theory: argues that heritage is preserved not solely for its material survival, but because of the cultural, historical, social, and symbolic values communities attach to it (Mason, 2002; De la Torre, 2013). From this perspective, preservation efforts whether preventive conservation, restoration, or traditional practices are acts of safeguarding cultural meaning and identity. Artefacts are therefore conceptualised as vessels of memory and continuity, linking communities to their past and shaping collective identity (Smith, 2006). This framework underscores why preservation is critical: the deterioration or loss of artefacts represents not merely physical damage, but the erosion of cultural values and narratives.

Complementing this, Information Science Digitisation Theory (Conway, 1996; Hedstrom, 2002) situates digitisation as both a preservation strategy and a mechanism for

access. By creating digital surrogates, artefacts are shielded from excessive handling while simultaneously becoming available to broader audiences through repositories and online platforms. This theory highlights the dual function of digitisation—extending the lifespan of originals while democratizing cultural knowledge. It also draws attention to metadata standards, storage formats, and repository systems as critical components of heritage management.

By integrating these two perspectives, the study conceptualises preservation and digitisation as mutually reinforcing strategies. Preservation ensures the physical survival of artefacts, while digitisation enhances accessibility, visibility, and resilience against risk. Together, these frameworks provide a lens for analysing how methods and techniques influence cultural artefact management, particularly within contexts facing infrastructural and resource challenges

Methodology (Systematic Review Approach)

Review Protocol

This study adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to guide the systematic review process (Page et al., 2021). The PRISMA protocol ensures transparency, reproducibility, and comprehensiveness in identifying, screening, and reporting relevant literature. Following this approach, the review process included four distinct stages: identification, screening, eligibility, and inclusion. This structured method was particularly appropriate for evaluating preservation methods and digitisation techniques, as it enabled the integration of diverse evidence from heritage science, library science, and cultural studies.

Databases Searched

To achieve broad coverage, searches were conducted across multidisciplinary and subject-specific academic databases. The databases included Scopus, Web of Science, Google Scholar, JSTOR, and ProQuest Dissertations & Theses Global. These were selected because they index peer-reviewed journal articles, conference proceedings, dissertations, and book chapters relevant to cultural heritage management. In addition, institutional repositories such as UNESCO Digital Library and International Council on Archives resources were consulted to capture grey literature and policy documents often excluded from commercial databases.

Search Terms and Keywords

The literature search strategy combined controlled vocabulary and free-text terms using Boolean operators (AND/OR). The following keywords and search strings were employed:

- “Cultural artefacts” OR “cultural heritage” OR “museum collections”
- “Preservation methods” OR “preventive conservation” OR “restoration” OR “traditional conservation”
- “digitisation” OR “digital preservation” OR “2D scanning” OR “3D digitisation” OR “photogrammetry”
- “Heritage management” OR “archives management” OR “collection management”

An example search string applied in Scopus was:

(“cultural heritage” OR “cultural artefacts”) AND (“preservation methods” OR “digitisation techniques”) AND (“management” OR “conservation”).

This ensured the retrieval of interdisciplinary sources spanning conservation science, archival studies, and cultural policy.

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were designed to ensure the selection of high-quality and relevant studies.

- Inclusion criteria:
 1. Peer-reviewed articles, book chapters, dissertations, and grey literature published between 2000 and 2025.
 2. Studies focusing on preservation methods and/or digitisation techniques in relation to cultural artefacts.
 3. Research addressing the impact of these methods on heritage management, accessibility, or risk reduction.
 4. Publications available in English.

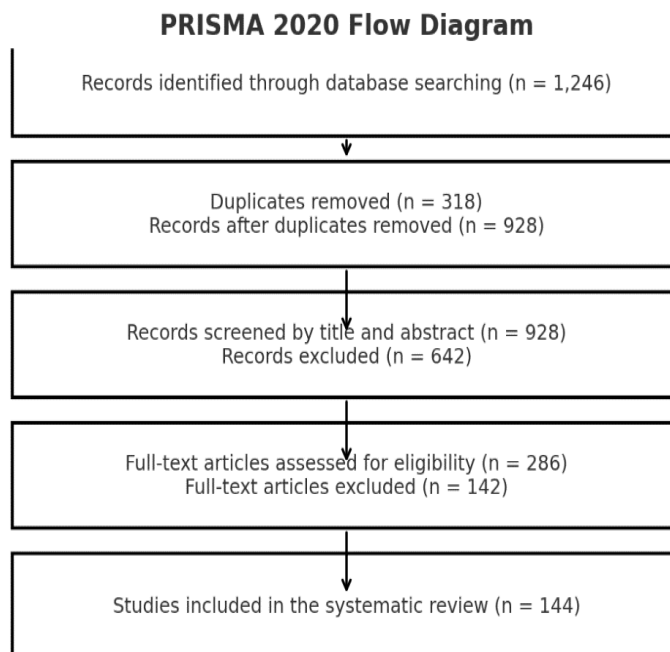
- **Exclusion criteria:**

1. Studies unrelated to cultural heritage (e.g., digital preservation of medical or corporate records).
2. Non-scholarly sources lacking methodological rigor.
3. Duplicate records retrieved from multiple databases.
4. Studies inaccessible in full-text

Screening Process (Identification, Screening, Eligibility, Inclusion)

The search across the selected databases initially yielded 1,246 records. After removing 318 duplicates, 928 unique studies remained for screening. Titles and abstracts were then screened for relevance, leading to the exclusion of 642 records that did not directly address preservation or digitisation of cultural artefacts. This left 286 full-text articles for eligibility assessment. Following a detailed evaluation against the inclusion and exclusion criteria, 142 studies were excluded due to lack of methodological rigor, insufficient focus on cultural artefacts, or irretrievable full texts. Finally, 144 studies met all criteria and were included in the systematic review.

This process was documented using the PRISMA flow diagram (see Figure 1), which ensured transparency and replicability in study selection (Page et al., 2021).



Data Extraction Strategy

A standardized data extraction form was designed to capture key information systematically from each included study. Extracted data included:

- Bibliographic details (author, year, country, type of publication).
- Study context (institution, region, type of cultural artefacts studied).
- Preservation methods discussed (preventive, restorative, traditional).
- Digitisation techniques applied (2D, 3D, metadata standards, repositories).
- Reported outcomes (accessibility, risk reduction, management improvements).
- Challenges and limitations highlighted.

Two reviewers independently extracted data to minimize bias, with discrepancies resolved through discussion and consensus. This ensured consistency and reliability of the data corpus.

Analytical Framework: The extracted data were analysed using thematic synthesis and comparative analysis. Thematic synthesis involved coding the studies into broad categories (preservation methods, digitisation techniques, impacts on management, and challenges). Comparative analysis was then applied to identify similarities and differences across contexts (e.g., Global North vs. Global South practices, institutional vs. community-based approaches). This dual framework enabled the review to highlight both general trends and context-specific insights (Thomas & Harden, 2008).

Findings and Discussion

The Findings and discussions are Organised into themes aligned with research questions:

Preservation Methods Applied to Cultural Artefacts

The review revealed that a variety of preservation methods are employed globally to safeguard cultural artefacts, broadly grouped into preventive conservation, remedial restoration, and community-based practices.

- **Preventive conservation** is the most widely adopted approach and emphasizes controlling environmental factors such as humidity, temperature, light intensity,

and exposure to pollutants in order to delay deterioration. Measures such as integrated pest management, proper handling and storage, and security systems are considered cost-effective first lines of defence in heritage preservation (Muñoz Viñas, 2005; UNESCO, 2017).

- **Remedial Conservation and Restoration:** Remedial conservation and restoration are undertaken when cultural artefacts have already sustained deterioration or damage that threatens their structural integrity, aesthetic value, or interpretative significance. Unlike preventive conservation, which aims to delay or prevent deterioration, remedial approaches are interventive in nature and therefore require a higher degree of ethical and professional scrutiny (Caple, 2012). Typical remedial actions include stabilization, where weakened or deteriorating artefacts are treated to prevent further loss of material—for example, applying consolidants to fragile paper, textiles, or stone surfaces. Repair and reconstruction may also be undertaken to reattach broken fragments, restore missing elements, or reconstruct collapsed structures, always with the goal of maintaining both structural stability and historical authenticity (Muñoz Viñas, 2005).
- **Innovative bio cleaning techniques** using microorganisms and nanomaterials have recently emerged as eco-friendly alternatives for removing stains, salts, and surface crusts from cultural materials, though they are still experimental and require further validation (Ranalli *et al.*, 2021; Baglioni *et al.*, 2021).
- **Community-based preservation practices** including oral traditions, ritual safeguarding, indigenous knowledge systems, and local custodianship play a crucial role, especially in African contexts. However, these are often underrepresented in the literature despite their effectiveness in maintaining continuity and cultural meaning across generations (Akpan, 2018). These findings underscore that while scientific conservation methods dominate scholarly discourse, indigenous and community-led practices remain vital but insufficiently documented.

Digitisation Techniques in Cultural Heritage Management

Digitisation has emerged as a critical pillar of cultural heritage management, offering new ways of safeguarding and disseminating artefacts.

- **2D digitisation** (scanning, digital photography) is the most commonly used technique for documents, manuscripts, and flat artworks. Its low cost and ease of use make it a preferred entry-level method for many institutions (Ross, 2012).
- **3D digitisation** techniques such as laser scanning, photogrammetry, and structured-light imaging are increasingly employed for sculptures, monuments, and architectural heritage. They create highly detailed replicas that allow for analysis, restoration planning, and public engagement through virtual or augmented reality experiences (Apollonio *et al.*, 2020).
- **Metadata standards** are crucial for making digital collections useful and interoperable. Widely adopted frameworks include Dublin Core, CIDOC-CRM (ISO 21127:2023), LIDO, MARC, and OAI-ORE. CIDOC-CRM, in particular, has been praised for enabling semantic interoperability between museums, libraries, and archives (Doerr, 2021).
- **Knowledge graphs and linked data** are being explored to enhance metadata richness. For example, CHAD-KG demonstrates how RDF, CIDOC-CRM, and CRMdig can model exhibitions' digitisation processes for long-term interoperability (Yang *et al.*, 2025).
- **Digital repository systems**, ranging from institutional archives to cloud-based solutions and open-access platforms, enable long-term storage and wide dissemination. Provenance and authenticity of digital surrogates are increasingly maintained through RDF-based models such as PROV-O and Dublin Core (Mendes *et al.*, 2023). The findings highlight that digitisation is not merely a technical process but also requires strong information management frameworks to ensure cultural artefacts remain discoverable and meaningful.

Contributions of Preservation and Digitisation to Accessibility, Risk Reduction, and Sustainability:

A consistent theme in the literature is that preservation and digitisation are complementary strategies in the long-term management of cultural heritage. While preservation ensures the physical safeguarding of artefacts through preventive and remedial measures, digitisation creates digital surrogates that extend the life and reach of collections. Together, these approaches reduce the risks of permanent loss, provide alternative means of access, and support the sustainability of cultural resources in both local and global contexts (UNESCO, 2017; Terras, 2015).

- **Accessibility** is enhanced by digital platforms that allow heritage institutions to democratize access. For example, digitised archives make rare manuscripts and artefacts available globally, breaking geographical and socio-economic barriers (Smith, 2019).
- **Risk reduction** is achieved through digital surrogates that act as insurance against theft, natural disasters, and physical deterioration. Preventive conservation strategies further reduce risks by minimizing the need for frequent intervention (UNESCO, 2017).
- **Sustainability** is reinforced by hybrid approaches—where digitisation reduces handling of physical artefacts and preventive conservation lowers long-term costs. This synergy helps preserve artefacts for future generations while also providing rich digital records for scholarship (Caple, 2012).

Strengths and Limitations of Current Approaches

One of the most widely acknowledged strengths of current approaches is the emphasis on preventive conservation, which is both cost-effective and sustainable. By addressing environmental conditions such as humidity, temperature, light, and pests, preventive measures reduce the likelihood of deterioration and minimize the need for expensive remedial interventions in the future (Caple, 2012; Muñoz Viñas, 2005). This proactive approach has been particularly beneficial in resource-constrained contexts, where financial and technical resources for restoration are limited.

Another key strength lies in the role of digitisation, which has transformed cultural heritage management by enabling global collaboration, public engagement, and educational outreach. Through digital repositories, online exhibitions, and open-access databases, researchers across borders can engage with collections, while the general public gains new opportunities for interaction and learning (Terras, 2015; Kalay et al., 2008). Digitisation thus expands the audience for heritage materials, enhancing inclusivity and ensuring broader cultural participation.

Finally, the adoption of metadata standards such as the CIDOC Conceptual Reference Model (CIDOC-CRM) represents a significant strength in improving interoperability across cultural institutions. By providing a common framework for describing artefacts and their contexts, these standards make it possible to integrate data from museums,

archives, and libraries into unified platforms (Doerr, 2021; Richards, 2017). This not only supports information sharing but also strengthens the long-term sustainability of digital heritage initiatives

Limitations:

- High financial and technical requirements restrict large-scale digitisation projects in low-resource contexts (Ross, 2012).
- Biocleaning and nanomaterial-based preservation, though innovative, remain experimental and lack scalability (Ranalli *et al.*, 2021).
- Infrastructure gaps such as unstable electricity, poor internet, and limited digital storage capacity constrain African communities and other developing regions (Akpan, 2018).

Gaps in the Literature and Areas for Further Research

The review reveals important gaps that require scholarly and practical attention:

- **Indigenous practices remain underexplored.** Most literature focuses on Western scientific methods, with insufficient study of traditional African, Asian, and Indigenous community-based approaches that have proven effective for centuries (Akpan, 2018).
- **Cost-effective digitisation solutions are lacking.** Current tools and repositories often demand expensive hardware, software, and connectivity. There is limited innovation around affordable, scalable methods that can work in rural or underfunded settings.
- **Sustainability models for digital heritage are underdeveloped.** Questions remain about long-term digital preservation, obsolescence of formats, and the energy cost of large-scale repositories (Mendes *et al.*, 2023).
- **Integration of traditional and modern approaches** has not been sufficiently tested. Future research could explore hybrid models where indigenous safeguarding practices are complemented by digital techniques for holistic and culturally grounded heritage management.

Summary of Findings

This systematic review examined the intersection of preservation methods and digitisation techniques in the management of cultural artefacts. Findings reveal that preventive conservation remains central to safeguarding collections, with measures such as environmental controls, integrated pest management, secure storage, and handling protocols serving as cost-effective first lines of defence (Caple, 2019). When deterioration has already occurred, remedial conservation and restoration practices including surface cleaning, varnish removal, and material consolidation are employed to stabilize and extend the life of artefacts. These approaches are underpinned by ethical considerations such as reversibility, minimal intervention, and proper documentation to ensure long-term integrity (Staniforth, 2013).

The review also highlights the transformative role of digitisation in cultural heritage management. Techniques such as 2D scanning, digital photography, and 3D photogrammetry have expanded the accessibility of artefacts for research, education, and public engagement (Terras, 2011). Metadata standards like CIDOC-CRM and the establishment of digital repositories enable interoperability and the preservation of digital surrogates, while also reducing the risks associated with frequent physical handling. In this way, digitisation not only enhances accessibility but also contributes significantly to risk reduction and sustainability.

However, findings point to persistent challenges, particularly in resource-constrained settings such as Africa. Limitations include inadequate funding, infrastructural deficits, lack of skilled personnel, and limited access to advanced digitisation equipment (Ngulube, 2012). Furthermore, ethical challenges ranging from intellectual property rights to the cultural sensitivity of open-access platforms complicate the long-term sustainability of digitisation initiatives (Khir, 2019). These gaps emphasize the need for more inclusive frameworks that integrate indigenous preservation practices with modern technologies while prioritizing affordable and scalable solutions.

Conclusion and Recommendations

Conclusion

This study systematically reviewed literature on preservation methods and digitisation techniques in the management of cultural artefacts, with a focus on their application in

resource-constrained contexts such as Africa. The findings reveal that preventive conservation remains the most cost-effective and widely adopted preservation strategy, particularly for controlling environmental risks and delaying deterioration (Caple, 2019). Restoration and remedial conservation, while critical for stabilising artefacts that have already suffered damage, require significant technical expertise and resources that are not always available in developing regions (Staniforth, 2013).

Digitisation has emerged as a transformative tool in cultural heritage management, enhancing accessibility, research collaboration, and educational outreach (Terras, 2011). Through 2D scanning, 3D photogrammetry, and the adoption of metadata standards, institutions are increasingly able to safeguard knowledge of artefacts while reducing risks linked to physical handling. However, the study also highlights persistent limitations such as inadequate funding, shortage of skilled personnel, infrastructural weaknesses, and ethical dilemmas related to intellectual property and cultural sensitivity (Ngulube, 2012; Khir, 2019).

Ultimately, the review underscores that while preservation and digitisation strategies significantly enhance accessibility, risk reduction, and sustainability, their effectiveness in African contexts remains constrained by systemic challenges. There is, therefore, a pressing need for integrative, context-sensitive solutions that combine modern conservation science with indigenous knowledge systems.

Recommendations

1. Strengthen Preventive Conservation Capacity

- Invest in affordable environmental monitoring tools, pest management, and storage solutions suitable for resource-limited settings.
- Expand professional training and capacity-building initiatives for conservators, with emphasis on practical, locally adaptable skills.

2. Promote Low-Cost and Scalable Digitisation Models

- Encourage the adoption of open-source digitisation tools and software to reduce costs.
- Support collaborations with international institutions to share expertise and infrastructure.

3. **Integrate Indigenous Knowledge and Community Practices**

- Recognize and document traditional methods of artefact care and embed them into formal heritage management policies.
- Promote community-based heritage programs to ensure local participation and sustainability.

4. **Address Ethical and Legal Dimensions**

- Develop clear guidelines on intellectual property rights, data ownership, and cultural sensitivity in digital heritage projects.
- Encourage participatory decision-making to ensure communities have a voice in how their cultural assets are digitised and shared.

5. **Enhance Policy and Funding Frameworks**

- Advocate for national and regional cultural heritage policies that support long-term investment in preservation and digitisation.
- Explore innovative funding models, including public-private partnerships and donor collaborations, to secure sustainable financing.

6. **Encourage Future Research**

- Prioritise research on cost-effective digitisation methods and locally adaptable preservation technologies.
- Investigate the role of indigenous practices in modern conservation science to develop hybrid approaches that respect cultural contexts.

Future Research Directions

The findings of this review highlight several areas where further research is required to strengthen the preservation and digitisation of cultural artefacts, particularly in resource-constrained contexts.

- **Integration of Indigenous Knowledge with Modern Practices:** More research is needed to systematically document, validate, and integrate indigenous preservation methods into mainstream heritage management

frameworks. Studies should explore how these community-based practices can complement scientific conservation approaches in ensuring cultural continuity and sustainability (Ngulube, 2012).

- **Development of Cost-Effective Digitisation Solutions:** Current digitisation models often rely on expensive infrastructure and high technical expertise, making them inaccessible to many institutions in developing regions. Future research should focus on designing low-cost, scalable technologies and open-source platforms that can be adapted to local contexts without compromising quality (Terras, 2011).
- **Ethical and Legal Dimensions of Digital Heritage:** There is a need for deeper inquiry into the ethical implications of digitisation, including issues of intellectual property rights, data ownership, community consent, and the cultural sensitivity of making certain artefacts publicly accessible online (Khir, 2019). Comparative studies across cultural contexts could help establish ethical guidelines that balance accessibility with respect for cultural values.
- **Digital Preservation and Long-Term Sustainability:** While digitisation enhances accessibility, the long-term preservation of digital assets remains a significant challenge. Research should investigate strategies for mitigating digital obsolescence, ensuring metadata integrity, and developing sustainable digital repositories in African and other resource-limited contexts (Doerr, 2021).
- **Impact of Digitisation on User Engagement and Education:** More empirical studies are required to measure how digitisation initiatives influence public engagement, research collaboration, and educational outcomes. Such studies could assess user experiences with virtual exhibitions, digital archives, and 3D reconstructions to guide best practices in heritage dissemination (Terras, 2011).
- **Policy and Governance Frameworks:** Future research should also examine the role of policy frameworks in enabling or constraining preservation and digitisation efforts. Cross-national comparative studies could provide insights into effective governance models and inform the development of regional strategies tailored to Africa and similar contexts (Kaye & Combe, 2020).

REFERENCES

- Akpan, E. (2018). Community engagement and indigenous practices in African cultural heritage management. *Heritage*, 7(10), 269. <https://doi.org/10.3390/heritage7100269>
- Anyangwe, C. (2018). Community participation in cultural heritage preservation: Indigenous practices in Africa. *International Journal of Heritage Studies*, 24(6), 621–635. <https://doi.org/10.1080/13527258.2018.1428665>
- Apollonio, F. I., Gaiani, M., & Sun, Z. (2020). 3D survey and HBIM modelling for cultural heritage conservation: The case of Bologna's porticoes. *Sustainability*, 12(15), 6068. <https://doi.org/10.3390/su12156068>
- Ashley-Smith, J. (1999). *Risk assessment for object conservation*. Routledge.
- Avrami, E., Mason, R., & de la Torre, M. (2000). *Values and heritage conservation*. Getty Conservation Institute.
- Baglioni, P., Chelazzi, D., Giorgi, R., & Poggi, G. (2021). Colloid and materials science for the conservation of cultural heritage: Cleaning, consolidation, and deacidification. *Molecules*, 26(13), 3967. <https://doi.org/10.3390/molecules26133967>
- Bautista, S. S., & Balsamo, A. (2011). Understanding the distributed museum: Mapping the spaces of museology in contemporary culture. *The SAGE Handbook of Museum Studies*, 193–218.
- Caple, C. (2012). *Preventive conservation in museums*. Routledge.
- Caple, C. (2019). *Conservation skills: Judgement, method and decision making*. Routledge.
- Champion, E. (2015). Entertaining the similarities and distinctions between serious games and virtual heritage projects. *Entertainment Computing*, 14, 67–74.
- Christen, K. (2012). Does information really want to be free? Indigenous knowledge systems and the question of openness. *International Journal of Communication*, 6, 2870–2893.
- Conway, P. (1996). Preservation in the digital world. *Council on Library and Information Resources*.
- Conway, P. (2010). Preservation in the age of Google: Digitization, digital preservation, and dilemmas. *The Library Quarterly*, 80(1), 61–79. <https://doi.org/10.1086/648463>
- De la Torre, M. (Ed.). (2013). *Values and heritage conservation*. Getty Conservation Institute.
- Doerr, M. (2021). The CIDOC conceptual reference model: A standard for digital cultural heritage interoperability. *AI & Society*, 36(1), 133–145. <https://doi.org/10.1007/s00146-021-01371-1>
- Gilliland, A. J. (2016). Setting the stage. In M. Baca (Ed.), *Introduction to metadata* (pp. 1–19). Getty Publications.

- Hedstrom, M. (2002). Archives, memory, and interfaces with the past. *Archival Science*, 2(1–2), 21–43.
- Kansa, E. C., & Kansa, S. W. (2021). Digital heritage in a pandemic: Sustainability, equity, and resilience. *Heritage*, 4(3), 998–1019. <https://doi.org/10.3390/heritage4030056>
- Khair, R. (2019). The challenge of building digital heritage capacity in developing countries. *International Journal of Heritage Studies*, 25(5), 1–16. <https://doi.org/10.1080/13527258.2019.1578987>
- Kurin, R. (2004). Safeguarding intangible cultural heritage: Key factors in implementing the 2003 Convention. *Museum International*, 56(1–2), 66–77. <https://doi.org/10.1111/j.1350-0775.2004.00459.x>
- Lemi, L. D. M. (2024). Commemorative textiles: An African narrative of identity and power. *Humanities and Social Sciences Communications*, 11(1), 537. <https://doi.org/10.1057/s41599-024-03051-z>
- Mason, R. (2002). Assessing values in conservation planning: Methodological issues and choices. In M. de la Torre (Ed.), *Assessing the values of cultural heritage* (pp. 5–30). Getty Conservation Institute.
- Mendes, P. N., Packer, H., & Kellogg, M. (2023). Provenance metadata for cultural heritage digitisation: Applying PROV-O and RDF*. *arXiv preprint*. <https://arxiv.org/abs/2305.08477>
- Muñoz Viñas, S. (2005). *Contemporary theory of conservation*. Routledge.
- Ngulube, P. (2012). Cultural heritage and digital preservation: Digital stewardship for sustainable development. *South African Journal of Information Management*, 14(1), 1–9. <https://doi.org/10.4102/sajim.v14i1.529>
- Ogundele, S. O. (2016). Indigenous knowledge systems and cultural heritage management in West Africa. *African Archaeological Review*, 33(2), 161–178. <https://doi.org/10.1007/s10437-016-9221-4>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372(n71), 1–9. <https://doi.org/10.1136/bmj.n71>
- Remondino, F., & Campana, S. (2014). *3D recording and modelling in archaeology and cultural heritage: Theory and best practices*. Archaeopress.
- Rieger, O. Y. (2018). The state of digital preservation in 2018: A snapshot of challenges and gaps. *International Journal of Digital Curation*, 13(1), 123–135. <https://doi.org/10.2218/ijdc.v13i1.639>
- Smith, A. (2020). Digitization and access: Rethinking cultural heritage in the digital age. *Journal of Documentation*, 76(6), 1245–1263. <https://doi.org/10.1108/JD-12-2019-0231>
- Smith, L. (2006). *Uses of heritage*. Routledge.
- Staniforth, S. (2013). *Conservation: Principles, dilemmas and uncomfortable truths*. Routledge.

- Stephenson, P. (2023). *Cultural heritage and collective identity*. Oxford University Press.
- Stone, P. G. (2005). The identification and protection of cultural heritage during the Iraq conflict: A peculiarly English tale. *Antiquity*, 79(304), 933–943. <https://doi.org/10.1017/S0003598X00115094>
- Stylianidis, E., & Remondino, F. (2016). *3D recording, documentation and management of cultural heritage*. Whittles Publishing.
- Tamaro, A. M. (2019). Digital repositories for cultural heritage: The state of the art. *Library Hi Tech*, 37(2), 223–238. <https://doi.org/10.1108/LHT-06-2018-0073>
- Terras, M. (2011). The digital wunderkammer: A global history of digital collections. *Literary and Linguistic Computing*, 26(3), 209–222. <https://doi.org/10.1093/lc/fqr018>
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8(1), 45. <https://doi.org/10.1186/1471-2288-8-45>
- UNESCO. (2017). *Conservation of movable cultural property*. UNESCO Publishing
- UNESCO. (2019). *Climate change and world heritage report: Implications for the future of our heritage*. UNESCO World Heritage Centre. <https://whc.unesco.org/en/climatechange/>
- UNESCO. (2025, March 5). Reframing the return and restitution of cultural property in Southern Africa: Healing as a new, bold step toward sustainable peace. UNESCO. <https://www.unesco.org/en/articles/reframing-return-and-restitution-cultural-property-southern-africa-healing-new-bold-step-toward>