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MAPPING THE DIGITAL FRONTIER: A BIBLIOMETRIC EXPLORATION OF HERITAGE PRESERVATION TECHNOLOGIES

Noor Farhana Alias[1*], Nurul Syala Abdul Latip[2], Noor Hayati Ismail[3], Osama Elrawi[4]

[1] Faculty of Engineering and Built Environment, Universiti Sains Islam Malaysia, Malaysia
Email: 4241071@raudah.usim.edu.my
[2] Faculty of Engineering and Built Environment, Universiti Sains Islam Malaysia, Malaysia
Email: nurulsyala@usim.edu.my
[3] Faculty of Engineering and Built Environment, Universiti Sains Islam Malaysia, Malaysia
Email: noorhayatiismail@usim.edu.my
[4] Faculty of Engineering, Al-Azhar University, Cairo, Egypt
Email: osama@avraonline.com
[*] Corresponding Author

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Abstract:

Academic interest in digital documentation for heritage preservation has intensified due to changes in conservation methods through technological progress. The analysis investigates both the research patterns alongside important contributors and essential subject areas and networking collaborations between scholars. Analysis of peer-reviewed literatures from 2015 to 2025 was conducted through VOSviewer to produce co-citation, co-occurrence and collaboration networks from Scopus database publications. Research productivity continues to increase steadily based on findings which show European universities from Italy Spain and Greece as the prominent contributors. Research areas around 3D scanning and photogrammetry must be considered together with GIS and HBIM while including upcoming immersive technology fields of XR and AI. There remain ongoing challenges within both intangible heritage documentation procedures and the inclusion of outside entities in European research networks. This research extends beyond established topics to investigate how ethical AI management should proceed as well as how to transition future areas of cultural heritage research into VR and AR technology and increase participation across underdeveloped areas. The research provides essential knowledge for experts in digital heritage research as well as policy creators and practice professionals who aim to understand the developing heritage preservation approaches.

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Keywords:

Digital Documentation, Heritage Preservation, Bibliometric Analysis, 3D Scanning, Collaboration Networks, Extended Reality

Introduction

Throughout history civilizations have understood how both physical and non-physical items work together to create links which sustain societal relationships with their ancestral heritage. Rising difficulties from urbanization together with natural disasters and environmental deterioration along with human actions have led to the implementation of advanced preservation solutions. The field of digital documentation that includes photogrammetry and laser scanning and Building Information Modeling (BIM) and Geographic Information Systems (GIS) and Virtual/Augmented Reality (VR/AR) has become an essential approach for modern conservation work. These technological solutions allow researchers to create specific three-dimensional (3D) models as well as virtual replicas that advance research activities and stimulate restoration projects and engage the public. The research investigates heritage preservation technologies through bibliometrics to analyze publication patterns and research groupings and thematic evolutions for future academic and practical needs.

Literature Review

Advances in Digital Documentation Technologies

The preservation of heritage sites underwent significant development due to modern technology which incorporates 3D scanning and photogrammetry together with Virtual and Augmented Reality (VR/AR) immersive functions. Through these methods conservative practitioners can reproduce detailed 3D representations of cultural artifacts without causing damage to the originals (Georgopoulos et al., 2023). Photogrammetry and terrestrial laser scanning deliver essential functions for documenting architectural characteristics of UNESCO World Heritage Sites while the handling of big datasets presents substantial challenges (Webb, 2020). GIS serves as an essential tool for heritage site risk assessment according to Spreafico & Chiabrando (2024) especially within conflict zones. Conventionally difficult levels of digital platform interoperability stand as the primary current challenge (Mazzetto, 2024).

Interdisciplinary Collaboration and Technological Integration

Digital heritage protection demands organizations to collaborate between computer science professionals with archaeological and cultural specialists. The capability of Historic Building Information Modeling (HBIM) for architectural heritage preservation stands validated as described by (Zhang, 2020). Current interdisciplinary groups encounter difficulties in maintaining technical and cultural perspectives at equal levels (Serbouti et al., 2025). (Gîrbacia, 2024) developed automatic systems for damage assessments as a new achievement in the field of Artificial Intelligence. According to Ghaith (2024) the integration of automation in intangible cultural resource management requires careful oversight of human expertise because experts still play a vital role in this process. Lian & Xie (2024) state that we need better cooperation between sectors and increased funding support to overcome existing institutional barriers for interdisciplinary innovation.

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Geographic Disparities and Research Gaps

European institutions generate most research related to digital heritage documentation because they built their research capacities during a historical period of advantage. Muenster (2022) demonstrated how Politecnico di Milano together with the National Technical University of Athens produce the highest number of scholarly publications regarding HBIM and 3D reconstruction. Eurocentric research normally overlooks North American and Asian and South American and African scholarly work because the African and South American regions lack both financial backing and technological means (Xhako et al., 2024). Protecting heritage assets from around the world with equal fairness needs immediate attention (Alshawabkeh & Baik, 2023).

Emerging Trends and Ethical Considerations

The adoption of immersive technology with artificial intelligence analytics steers heritage preservation research as part of its paradigm. Stanga et al. (2023) created a metaverse application which uses XR technology to enhance public contact with heritage sites. An expanding use of machine learning algorithms produces rising concerns about privacy protection and fears regarding programmed decision bias (Maietti, 2023). Alatza et al. (2024) that oral historical records among untraditional cultural items lack proper digital documentation. AI governance systems along with diverse strategies need immediate foundation to foster ethical practice together with cultural context respect (Tryfonos et al., 2021).

Table 1: Summary of Previous Studies on Heritage Preservation Technologies (2015–2025)

Author(s)	Focus Area	Methodology	Key Findings
Spreafico & Chiabrando (2024)	GIS for mapping heritage risks	Geo-mapping	Identified at-risk heritage sites in conflict zones.
Gîrbacia (2024)	AI for damage assessment	AI-based Analysis	Automated heritage damage detection systems developed.
Stanga et al. (2023)	XR for heritage experiences	Metaverse Application	Enhanced public engagement through immersive platforms.
Georgopoulos et al. (2023)	Photogrammetry for UNESCO Sites	Case Study	Improved precision in capturing architectural details.
Tobiasz et al. (2019)	HBIM for conservation	Systematic Review	Demonstrated HBIM's potential in architectural heritage.

Source: Author

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Research Question

Data discovery, collection and presentation depend on the review's main question and objectives and the anticipated deliverables with their intended audience. The following research examines a set of questions.

1. What are the research trends in digital documentation of heritage preservation according to the year of publication?
2. Who and how much has been published in the area regarding the authors, their affiliated organizations and countries?
3. What is the influence and research productivity of the topic?
4. What are co-occurrence, co-citation, and countries' collaborations?
5. Who is the most cited author in the field of heritage preservation technologies?
6. Which are the top contributing publications?

Methodology

Bibliometrics involves the collection, management, and analysis of bibliographic data from scientific publications (De Sousa et al., 2024). It includes descriptive statistics, such as publication years, journals, author classifications (Langlais, 2023), and advanced techniques like document co-citation analysis. Notably, effective literature review and bibliographic analysis require an iterative keyword selection process, literature search, and analysis (Costa, et al., 2023). This study focuses on search term adoption, initial screening, and refinement of results. High-quality journals, often indicated by metrics such as the Scopus CiteScore, were prioritized to ensure theoretical depth and understanding of domain evolution. For this reason, the study relied on the Scopus database for data collection (Badami, et al., 2023), as it provides extensive coverage of peer-reviewed, high-quality academic journals, excluding books and conference proceedings(Pranckutė, 2021; Yan & Zhiping, 2023). While Scopus offers a broad range of journals, its impact is more pronounced in recent publications (Tennant, 2020). Accordingly, articles from 2010 to December 2020 were analyzed, leveraging Scopus's comprehensive coverage of citation and bibliographic records across social sciences, sciences, and humanities, making it the preferred database for this study (Badami et al., 2023; Costa et al., 2023).

Data Search Strategy

The researcher utilized an outline of the screening sequence to identify the most suitable search terms for article retrieval. Research for the study executed a Scopus database online query TITLE-ABS-KEY ((digital AND documentation AND of AND heritage AND preservation)) AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (EXCLUDE (SUBJAREA, "MEDI") OR EXCLUDE (SUBJAREA, "PHAR") OR EXCLUDE (SUBJAREA, "AGRI") OR EXCLUDE (SUBJAREA, "BIOC") OR EXCLUDE (SUBJAREA, "IMMU") OR EXCLUDE (SUBJAREA, "PSYC")) AND (EXCLUDE (DOCTYPE, "er") OR EXCLUDE (DOCTYPE, "re") OR EXCLUDE (DOCTYPE, "cr")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j") OR LIMIT-TO (SRCTYPE, "b") OR LIMIT-TO (SRCTYPE, "p") OR LIMIT-TO (SRCTYPE, "k")) that yielded 726 published results. The search query incorporated two terms, "digital documentation" OR "digital archiving," yet the researchers applied additional filters on heritage conservation. The screening process led to 561 results that were reviewed for article reviews. Finally, only research papers written in English were retained. The bibliometric examination occurred on 531 publications that emerged following

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the last search phrase refinement. The Scopus database examined all its available publications through December 2024 that explored digital documentation as well as heritage preservation.

Data Analysis

Data sets were extracted from the Scopus database between 2015 and December 2025 with PlainText information about the study publication year, publication title, author name, journal, citation and keyword to be analyzed using VOSviewer software version 1.6.15. Analysis and map formation took place through VOS clustering and mapping features within this software program. VOSviewer represents an option for Multidimensional Scaling (MDS) methodology (Donthu et al., 2021) since it shares MDS's goal of item placement within low-dimensional space to depict accurately the relationships between items based on their distances (Baker et al., 2020). In addition, the VOS approach functions differently than MDS as it executes a better method for normalizing co-occurrence frequencies instead of calculating similarity measures like Jaccard indexes and cosine (Bukar et al., 2023), such as the Associatio Strength (ASij), and it is calculated as:

$$ASij \text{ ¼ } \frac{Cij}{Wiwj}$$

According to Donthu et al. (2021), the index calculates the ratio between the actual and expected numbers of co-occurrences of items i and j, if they occur independently of each other. Thus, by reducing the weighted sum of the squared distances between each pair of objects, VOSviewer utilizes this index to arrange items on a map. The LinLog/modularity normalization method was employed, as Baker et al. (2020) highlighted. Additionally, patterns based on mathematical correlations were discovered by applying visualization techniques to the dataset using VOSviewer, allowing for analyses such as co-citation analysis, keyword co-occurrence, and citation analysis.

This index guides VOSviewer in creating a map layout after calculating all weighted item-pair distance reductions. According to Bukar et al. (2023), the LinLog/modularity normalization method was used. In visualizing the data set through VOSviewer, researchers can detect mathematical relationship patterns while performing keyword co-occurrence analysis, citation evaluation, and co-citation assessment. Concurrently, audio keyword co-occurrence analysis, as described by Dubey et al. (2023), indicates how researchers develop their fields, while (Lawal et al., 2025) demonstrated its capability to locate significant subjects across different domains. Hence, by utilizing citation analysis, researchers can track both important research elements and historical development trends of disciplinary main subjects (İri & Ünal, 2024). Furthermore, document co-citation analysis emerges among the most common bibliometric methods (Robledo-Giraldo, Figueroa-Camargo, Zuluaga-Rojas, Vélez-Escobar, & Duque-Hurtado, 2023; Rossini, 2024), which uses network theory for data structure identification based on its results (Rossini, 2024).

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Findings

What Are The Research Trends In Digital Documentation Of Heritage Preservation According To The Year Of Publication?

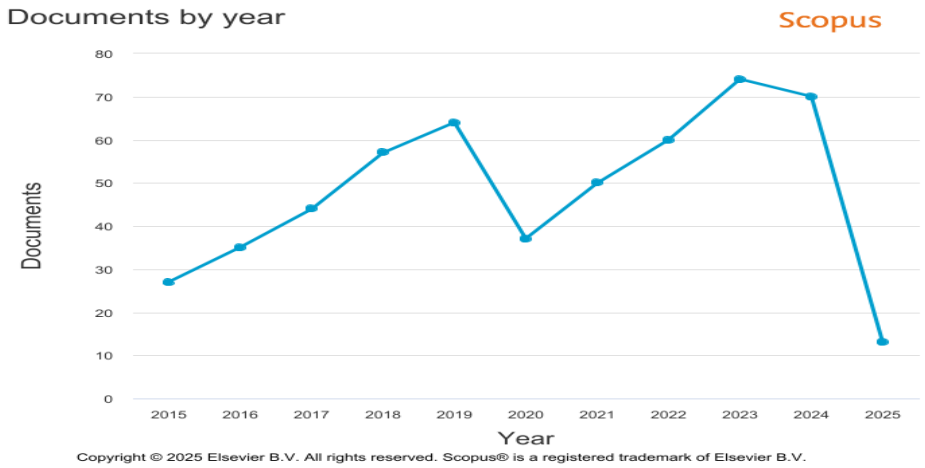

Figure 1: Trend of Research in Digital Documentation of Heritage Preservation by Years

Source: Scopus Database

Table 2: Research Publications (2015–2025)

Year	Documents
2025	13
2024	70
2023	74
2022	60
2021	50
2020	37
2019	64
2018	57
2017	44
2016	35
2015	27

Source: Scopus Database

This bibliometric Figure 1 from Scopus illustrates the yearly publication trends of documents from 2015 to 2025. The figure demonstrates a steady growth in publications from 2015 (27 documents) to 2019 (64 documents) and a promising decrease in 2020 (37 documents). Publication numbers recovered and demonstrated a steady increment, peaking in 2023 (74 documents) and declining slightly in 2024 (70 documents). There is an even more notable exception, around the year 2025 when the number of documents sharply decreased to approximately 13 publications. However, this significant decline in 2025 probably indicates incomplete data for the present year (March 2025) since publications for the rest of the year have not been indexed yet. The copyright notice suggests that this data originates from Elsevier Scopus database, a registered trademark that monitors academic publications in different disciplines.

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Who And How Much Has Been Published In The Area Regarding The Authors, Their Affiliated Organizations, And Their Countries?

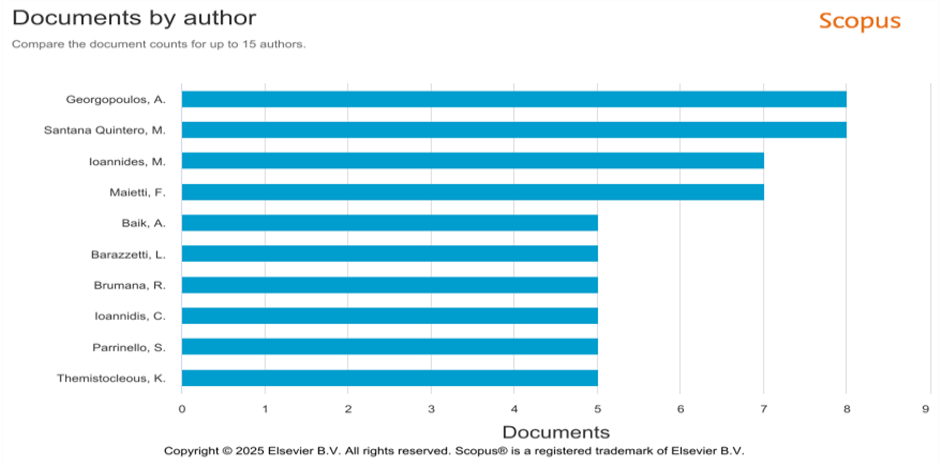

Figure 2: Top Author

Source: Scopus Database

Table 3: Top Contributing Authors

Author	Documents
Georgopoulos, A.	8
Santana Quintero, M.	8
Ioannides, M.	7
Maietti, F.	7
Baik, A.	5
Barazzetti, L.	5
Brumana, R.	5
Ioannidis, C.	5
Parrinello, S.	5
Themistocleous, K.	5

Source: Scopus Database

This Scopus bibliometric diagram displays the total publications made by the top ten authors studying within a particular discipline. Each of the authors, Georgopoulos A. and Santana Quintero M., has published approximately eight times (13%), while Ioannides M. and Maletti F. trail behind (12%). The following six authors have a combined number of five documents (8%) to their name: Baik, A., Barazzetti, L., Brumana, R., Ioannidis, C., Parrinello, S., and Themistocleous, K. The figure successfully demonstrates researcher output through its two-part distribution, separating four prolific academics who produce seven to eight publications (50%) from six researchers with approximately five published works (50%). According to the subtitle, the chart evaluates document counts for 15 authors, yet it displays only ten authors. The bibliometric information helps researchers detect the foremost participants in a specific field. The material derives from Elsevier Scopus database according to its published copyright notice.

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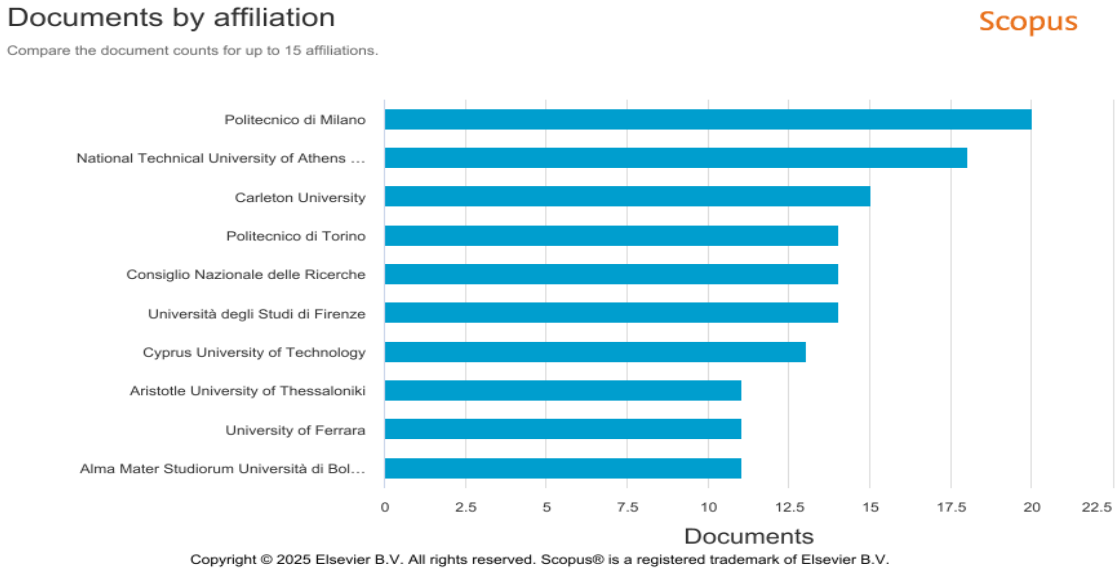

Figure 3: Affiliated Organizations

Source: Scopus Database

Table 4: Top Academic Institutions

Affiliation	Documents
Politecnico di Milano	20
National Technical University of Athens NTUA	18
Carleton University	15
Politecnico di Torino	14
Consiglio Nazionale delle Ricerche	14
Università degli Studi di Firenze	14
Cyprus University of Technology	13
Aristotle University of Thessaloniki	11
University of Ferrara	11
Alma Mater Studiorum Università di Bologna	11

Source: Scopus Database

The number of publications for ten universities is displayed in this Scopus bibliometric visualization. Politecnico di Milano has 20 (14%) and NTUA has 18 (13%) publications. Carleton University has 15 (11%) publications, which is third place, followed by Università degli Studi di Firenze, Politecnico di Torino, and Consiglio Nazionale delle Ricerche with 14 (10%) publications each. Meanwhile, Aristotle University of Thessaloniki, University of Ferrara, and Alma Mater Studiorum Università di Bologna all have 11 (8%) publications, while 13 (9%) are reported with Cyprus University of Technology. A Mediterranean-topic collaborative network with strong North American participation is demonstrated by the visualization, also demonstrating a cluster of Italian university research output (5 out of 10) and a significant quantity from Greek universities (2) and some from Canada and Cyprus.

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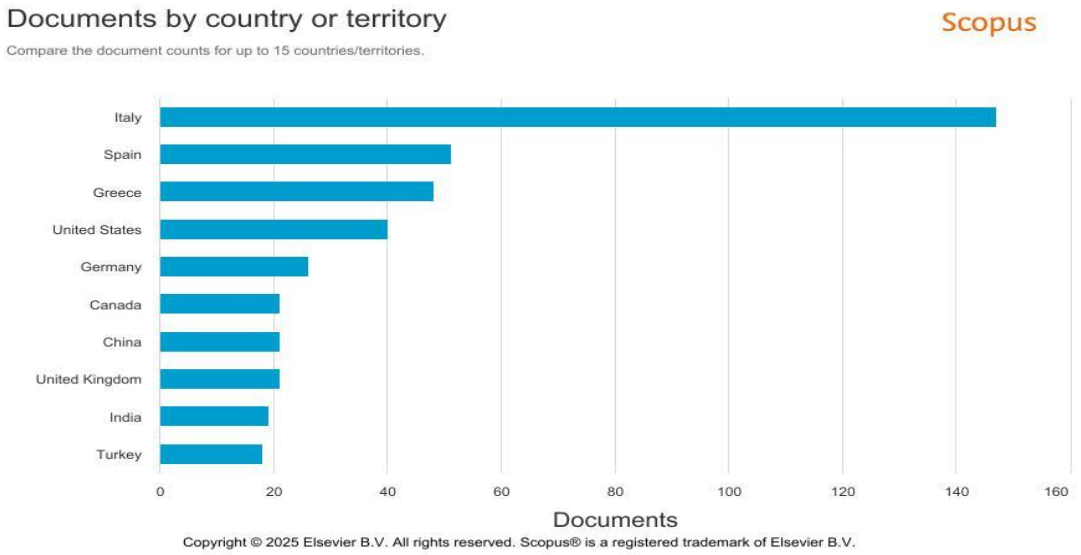

Figure 4: Countries with at Least 18 Papers

Source: Scopus Database

Table 5: Global Contribution

Country	Documents
Italy	147
Spain	51
Greece	48
United States	40
Germany	26
Canada	21
China	21
United Kingdom	21
India	19
Turkey	18

Source: Scopus Database

A bibliometric mapping of the distribution of publications among ten nations, as covered by Scopus, is displayed in Figure 4, providing quantitative evidence of the research intensity of the field. From the data, there is an enormous concentration of scholarly work in Italy (147 documents), which outperforms the performances of all other nations in this area. Accordingly, Spain (51 papers) and Greece (48 papers) form a second cluster, and the United States (US) comes in fourth. Meanwhile, Canada, China, and the United Kingdom (UK) share relatively high research activity (21 papers each), with Germany being mid-range with 26 papers. Lower on their publication list, India and Turkey are some examples of nations with an increasing research presence in this field. This geographic pattern reveals clear patterns of scholarship in research, both in the established hubs of high-quality scholarship and in developing clusters of scholars in the field.

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What Is The Influence And Research Productivity Of The Topic?

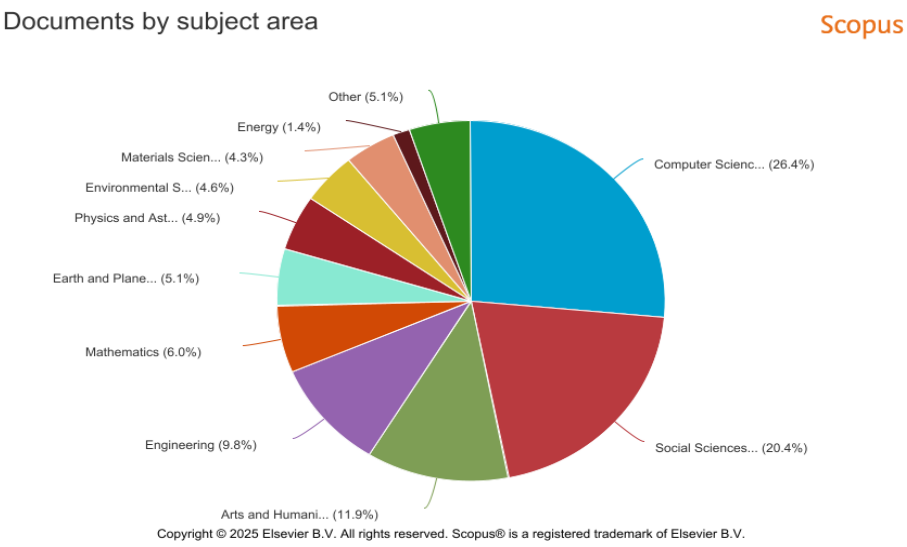

Figure 5: Academic Documents Across Various Subject Areas

Source: Scopus Database

This Scopus pie chart illustrates the distribution of academic articles across various subject classes. Computer Science is at the top with the largest share of 26.4%, followed by Social Sciences with 20.4%. Arts and Humanities lag at 11.9%, and Engineering claims 9.8%. Notably, the remaining fields contribute smaller yet remarkable shares: Mathematics (6.0%), Earth and Planetary Sciences (5.1%), Physics and Astronomy (4.9%), Environmental Science (4.6%), Materials Science (4.3%), and Energy (1.4%). A small portion (5.1%) are from the "Other" categories. The visualization elegantly presents the interdisciplinary nature of the publication dataset and mirrors the prevalence of Computer Science and Social Sciences, comprising nearly half (46.8%) of the total documents. This bibliometric study provides insight into relative research production and scholarly focus across multiple disciplines.

What Are Co-Occurrence, Co-Citation, And Countries' Collaborations?

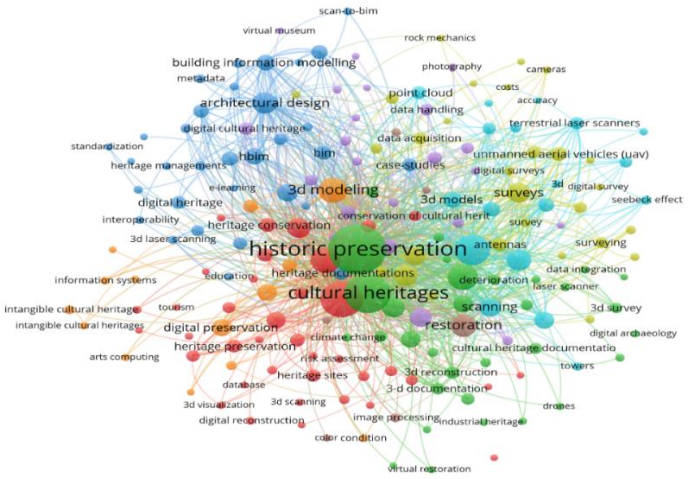

Figure 6: Co-occurrence of the Themes

Source: VOSviewer

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The VOSviewer software generated this illustration by analyzing the research topics within historic preservation and cultural heritage. Inside the image, the node sizes demonstrate the topic's significance, while linking lines indicate connections between research areas. Notably, historic preservation and cultural heritage stand as vital core points represented by the biggest nodes within the illustration. The central themes receive envelopments from smaller connected groups of research domains that are colored blue, green, red, and yellow, respectively. As such, blue nodes link to architectural design alongside BIM and digital cultural heritage, whereas green nodes highlight scanning technologies for restoration activities. Meanwhile, the red nodes link with heritage sites and preservation techniques, and the yellow nodes represent surveying technologies, including unmanned aerial vehicles and terrestrial laser scanners. Data collection technologies, as well as traditional heritage conservation methods, work together with digital technologies and 3D modeling in a comprehensive overview of modern research practices.

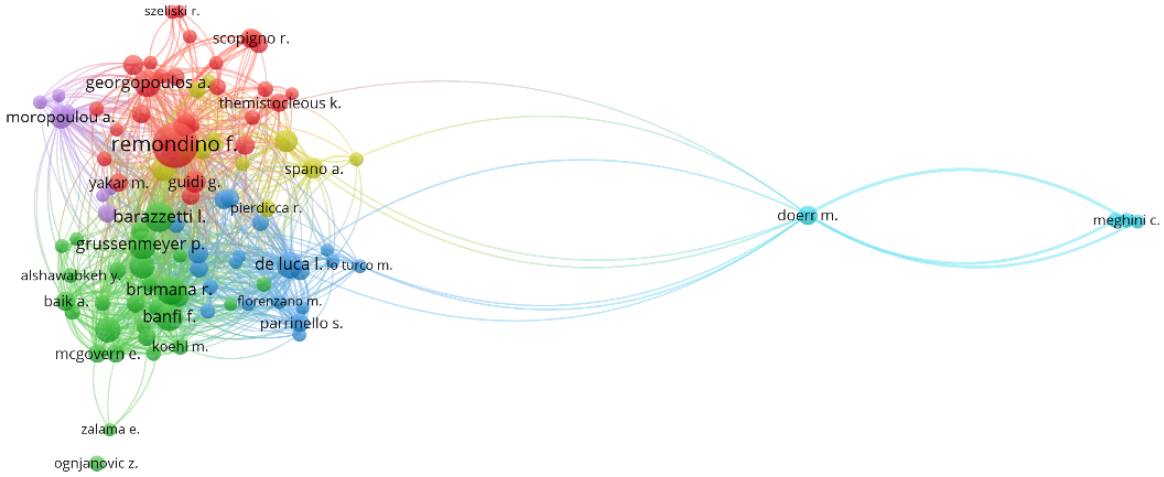

Figure 7: Co-authorship

Source: VOSviewer

The image displays a network visualization created with VOSviewer that appears to represent academic collaboration or citation between researchers. The network is characterized by different clusters of authors as represented by surnames with initials, and "remondino f." is a hub node (as a big red circle) with numerous connections to other researchers. Visualization is performed employing various colors for diverse research groups or clusters: red nodes (Scopigno r., Szelski r.), green nodes (Grussenmeyer p., Brumana r., Banfi f.), blue nodes (De Luca l., Parrinello s.), and purple nodes (Georgopoulos a., Moropoulou a.). On the right, additional isolated nodes for "doerr m." and "meghini c." are connected to the remainder of the network with fewer links, suggesting that they may be standing in for researchers in another area who seldom collaborate with the core group. Correspondingly, the high interconnectedness suggests a tight-knit research community, likely in some specialty academic disciplines.

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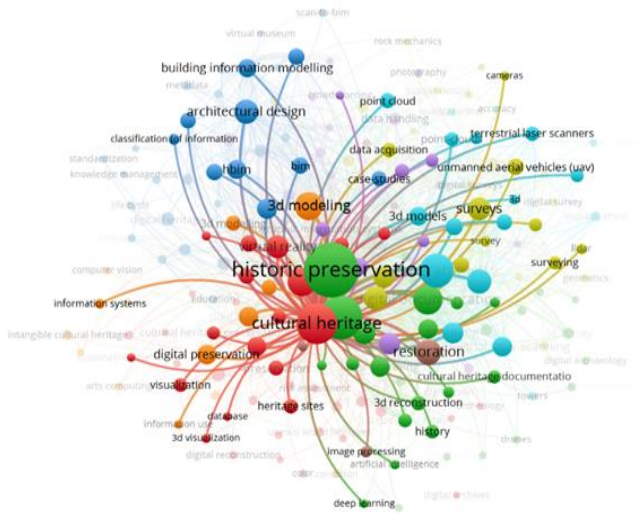
Table 6: Thematic Clusters

	***Cluster 1:*** The bibliometric visualization presents a comprehensive research collection dedicated to the preservation of cultural heritage along with historic buildings. VOSviewer created this network diagram, which presents four fundamental thematic clusters using different color codes: the red group contains digital heritage and conservation elements, and the green group displays preservation with restoration and 3D reconstruction aspects. At the same time, the blue section includes BIM and design and HBIM aspects, and the yellow area deals with surveying via terrestrial laser scanners and drones. The visual scale of the nodes guides us to comprehend their significance which reveals "historic preservation" (green) as well as "cultural heritage" (red) and "3D modeling" (orange) as the most vital research domains. Lines connecting different keywords in scholarly publications represent their co-occurrent relationships, while thicker lines indicate stronger relationships between keywords. The illustration indicates how modern digital tools integrate with conventional heritage preservation practices to transform research through Virtual Reality (VR) applications, point cloud data collection, and deep learning methods. The clustering pattern illustrates the multidisciplinary aspect of this field, which links architecture, computer science, engineering, and cultural studies.

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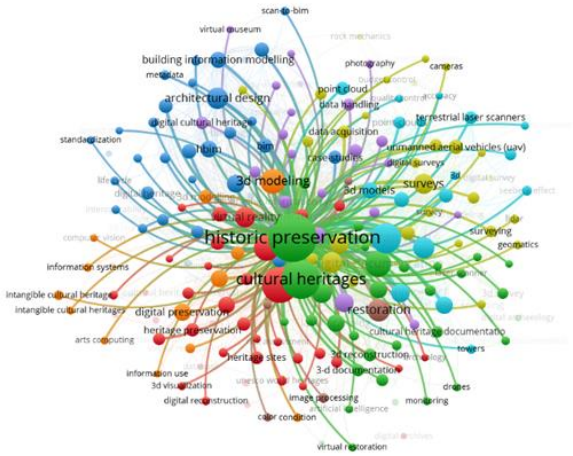

Cluster 2:

The bibliometric visualization demonstrates how keywords in cultural heritage and historic preservation studies relate to each other in co-occurrence networks. The network's center contains two principal research domains connected by strong links: historic preservation (red-green) and cultural heritages (red), representing the network's most frequently occurring and connected terms. Encircling these core ideas are four unique color-coded groups: blue nodes (upper left) symbolizing digital documentation methods such as BIM, architectural design, and standardization. Then, green nodes (right side) emphasize restoration methods, 3D reconstruction, and image processing; red nodes (lower left) address digital preservation, heritage locations, and intangible cultural heritage; and yellow nodes (upper right) illustrate technical surveying techniques like terrestrial laser scanners and unmanned aerial vehicles. Research topics are connected through lines, demonstrating the intensity of relationships between different areas of knowledge within the field. The visualization demonstrates the integration of traditional heritage preservation practices with modern digital methods to demonstrate enhanced cultural research strategies.

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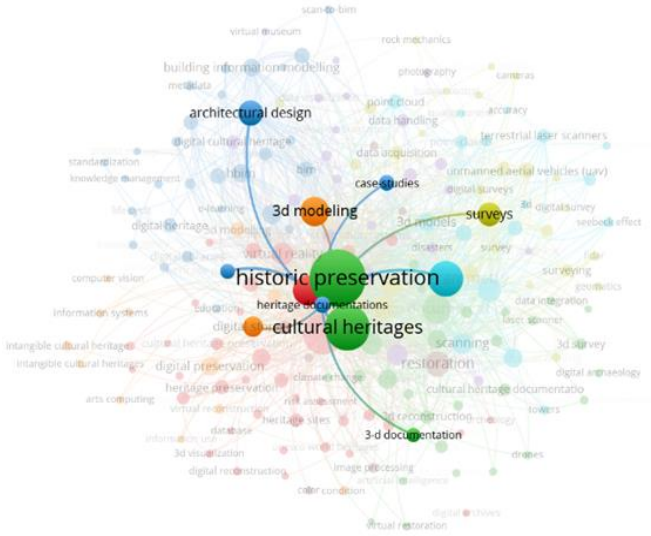

Cluster 3:

The bibliometric visualization networks together research terms that frequently appear alongside cultural heritage and historical preservation topics. The network's center contains two principal research domains connected by strong links, which include historic preservation (red-green) and cultural heritages (red), representing the network's most frequently occurring and connected terms. Encircling these core ideas are four unique color-coded groups. That is, blue nodes (upper left) symbolize digital documentation methods such as BIM, architectural design, and standardization; green nodes (right side) emphasize restoration methods, 3D reconstruction, and image processing; red nodes (lower left) address digital preservation, heritage locations, and intangible cultural heritage; and yellow nodes (upper right) illustrate technical surveying techniques like terrestrial laser scanners and unmanned aerial vehicles. Research topics are connected through lines, demonstrating the intensity of relationships between different areas of knowledge within the field. The graphic display epitomizes the blend between standard preservation approaches and contemporary digital methods, thus highlighting the progress of cultural heritage analytics in sophisticated documentation and preservation methods.

Source: VOSviewer

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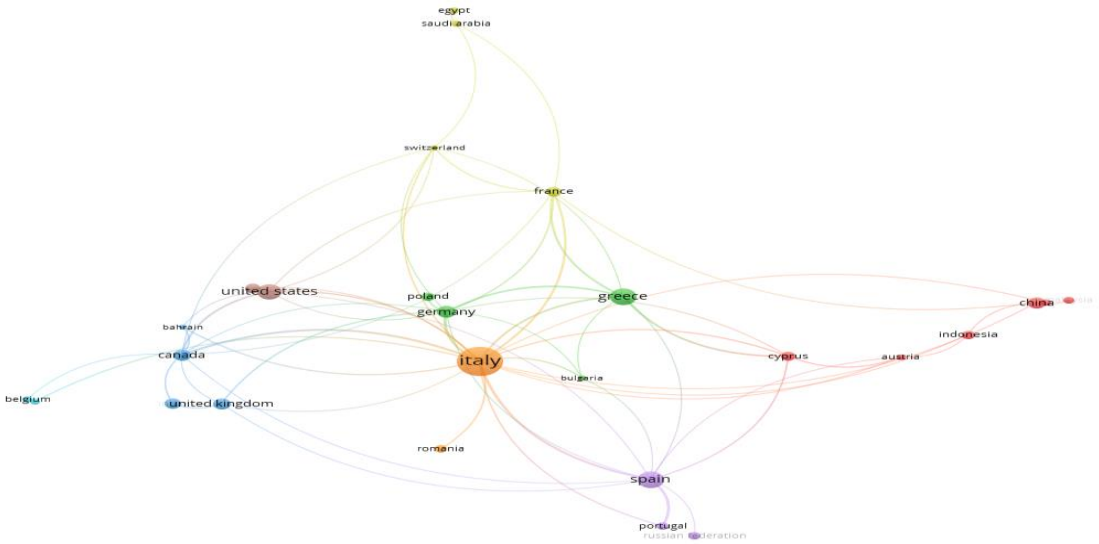

Figure 8: The Country's Co-authorship in Digital Documentation for Heritage Preservation

Source: VOSviewer

This network graph displays global connections focusing on Italy, denoted by the largest orange node in the center and connected to many countries. The map utilizes varied colored nodes and lines connecting them to portray countries and their relationships. All key European countries, such as Germany (green), France (yellow green), Spain (purple), and Greece (green), hold significant positions with various connections. Outside of Europe, the connections reach as far as North America (US, Canada), Asia (China), and the Middle East (Saudi Arabia). Note that each node's size presumably indicates the country's power or visibility in this network, and the colored lines between countries denote various kinds of relationships or connections. Building on this, the map was generated with VOSviewer software and demonstrates the central role of Italy as a hub within this global network of diplomatic, economic, or cultural relations.

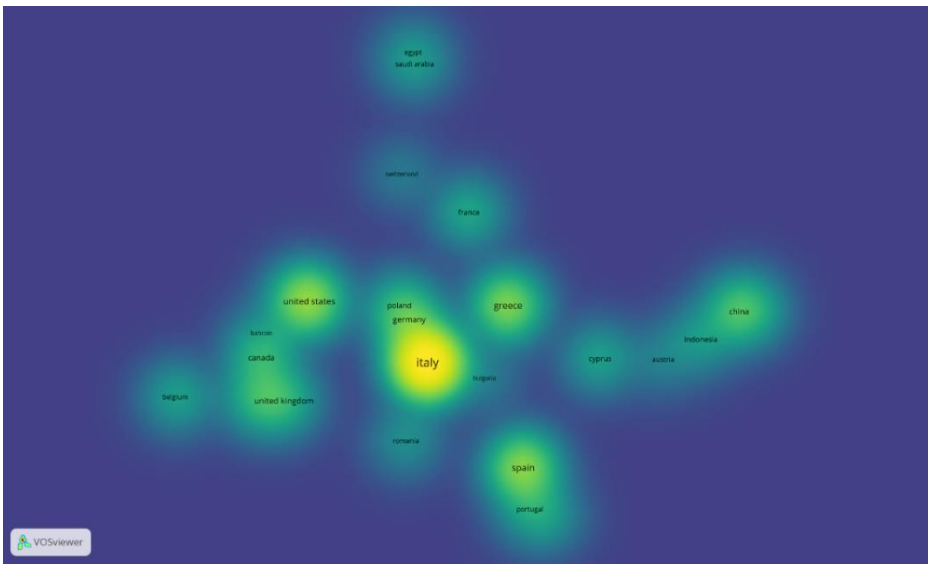

Figure 9: Density Map of Top Contributing Countries

Source: VOSviewer

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Who Is The Most Cited Author In The Field Of Heritage Preservation Technologies?

Table 7: Most Cited Author

Authors	CitesPerYear	CitesPerAuthor
Farrar C.R.	1.4	7
Worden K.	1.4	7
Avila F.	1.3	4.3
Puertas E.	1.3	4.3
Gallego R.	1.3	4.3
Garcia-Macias E.	1.3	4.3
Murphy M.	1.2	4
McGovern E.	1.2	4
Pavia S.	1.2	4
Baik A.	1.1	2.2

Source: Harzing

This table presents the top ten most cited authors across specific fields where Farrar C.R. and Worden K. tie for supremacy regarding their annual 1.4 citations and seven citations per author. The second research group contains four scientists, Avila F., Puertas E., Gallego R., and Garcia-Macias E., who share identical metrics of 4.3 author citations and 1.3 annual citations. The bibliometric table positions Baik A. as the researcher with the most minimal metrics since he receives 1.1 citations each year and 2.2 citations for each work he produces. He trails Murphy M., McGovern E. and Pavia S., who possess similar citation patterns. Academic research participation appears balanced across this field since its citation distribution spans between 1.1 and 1.4 citations per year without any major discrepancies among researchers.

Academic publishers identified in the Table 8 Top Publisher maintain dominance over most-referenced research articles within the entire dataset. Springer Science and Business Media Deutschland GmbH stands out from other publishers through its 135 citations, which proves the substantial influence of its articles on immersive cultural heritage recording. Taylor and Francis Ltd. releases research articles about laser scanning technology applications in historical preservation after Springer Science and Business Media Deutschland GmbH in the reference count. MDPI appears multiple times on the list, representing its role as a scholarly resource that shares research about digital technologies and 3D laser scanning applications. On the other hand, the Association for Computing Machinery (ACM) plays an essential role by fostering research regarding digital methods used to represent socio-historical environments. Hence, top publishers from digital heritage and technical applications domains continue to impact scholarly protection work and research endeavours regarding cultural heritage conservation.

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Which Are The Top Contributing Publications?

Table 8: Top Publisher

Cites	Authors	Title	Publisher
135	Fan Z.; Chen C.; Huang H.	Immersive cultural heritage digital documentation and information service for historical figure metaverse: a case of Zhu Xi, Song Dynasty, China	Springer Science and Business Media Deutschland GmbH
118	Masciotta M.G.; Sanchez-Aparicio L.J.; Oliveira D.V.; Gonzalez-Aguilera D.	Integration of Laser Scanning Technologies and 360Âº Photography for the Digital Documentation and Management of Cultural Heritage Buildings	Taylor and Francis Ltd.
132	Parfenov V.; Igoshin S.; Masaylo D.; Orlov A.; Kuliashou D.	Use of 3D Laser Scanning and Additive Technologies for Reconstruction of Damaged and Destroyed Cultural Heritage Objects	Multidisciplinary Digital Publishing Institute (MDPI)
158	Palcak M.; Kudela P.; Fandakova M.; Kordek J.	Utilization of 3D Digital Technologies in the Documentation of Cultural Heritage: A Case Study of the Kunerad Mansion (Slovakia)	MDPI
144	Partarakis N.N.P.; Doulgeraki P.P.D.; Karuzaki E.E.K.; Adami I.I.A.; Ntoa S.S.N.; Metilli D.D.M.; Bartalesi V.V.B.; Meghini C.C.M.; Marketakis Y.Y.M.; Kaplanidi D.D.M.; Theodoridou M.M.T.; Zabulis X.X.Z.	Representation of Socio-historical Context to Support the Authoring and Presentation of Multimodal Narratives: The Mingei Online Platform	Association for Computing Machinery
196	Stylianidis E.; Evangelidis K.; Vital R.; Dafiotis P.; Sylaiou S.	3D Documentation and Visualization of Cultural Heritage Buildings through the Application of Geospatial Technologies	MDPI
95	Balloni E.; Gorgoglione L.; Paolanti M.; Mancini A.; Pierdicca R.	Few shot photogrametry: A comparison between nerf and mvs-sfm for the documentation of cultural heritage	International Society for Photogrammetry and Remote Sensing
72	Crisan A.; Pepe M.; Costantino D.; Herban S.	From 3D Point Cloud to an Intelligent Model Set for Cultural Heritage Conservation	MDPI

Source: Harzing

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Conclusion

The bibliometric analysis reached all main research goals by identifying the full scholarly territory encompassing digital documentation approaches in heritage preservation. The research productivity and publication trends analysis achieved its first goal through the discovery of substantial output rising from 2015 to reach its peak in 2023, as demonstrated in Figure 1 and Table 2. The escalating scholarly interest in digital preservation techniques manifests through growing publication rates from 2015 to 2023 although the minimal decrease in 2024 seems caused by indexing delays.

Analysis of extensive co-authorship patterns and institutional affiliations enabled researchers to fulfil their second research objective. The research identifies Georgopoulos A., Santana Quintero M. and Ioannides M. as notable figures who significantly contributed to this field of study (see Table 3). Research partnerships revealed European institutions Politecnico di Milano and NTUA as strongest stakeholders which demonstrates the European bias in scholarly collaborations (see Table 4). The visual data collected by (Country Collaboration Network) showed how previous research collaboration patterns demanded more balanced international relationships between regions particularly South America and Africa.

The analysis used co-occurrence mapping to achieve its third objective by displaying research clusters focused on HBIM technology as well as 3D scanning methods and GIS programs and upcoming XR immersive platforms. Cultural safeguarding methods through documentation techniques form a connection with developing AI analytics and VR/AR technologies for heritage engagement. The insufficient representation of intangible cultural heritage needs urgent attention in future studies about safeguarding endangered heritage.

The fourth objective to evaluate research collaboration networks was achieved using co-authorship data visualizations (see Figure 4) and international collaboration network examinations (see Figure 5) that demonstrated strong connections among European researchers but showed low participation from the Global South. Strategic research partnership expansion needs to happen to create an inclusive framework for equal heritage protection across the globe.

The research delivers multiple vital findings that benefit academic experts together with governmental policy makers. Academic researchers can benefit from this study through its presentation of research theme evolution with leading author identification alongside recognition of knowledge gaps that involve insufficient attention to intangible heritage as well as insufficient representation within global research networks. Policymakers must understand digital heritage technologies including HBIM GIS and AI systems as strategic investments which need ethical governance with standards ensuring data compatibility and sustaining preservation goals. This research demonstrates why global partnership initiatives should receive emphasis alongside capacity expansion programs for underdeveloped regions and digital equality promotion efforts to protect cultural heritage assets.

By reflecting on these objectives along with contributions allows this bibliometric analysis to establish fundamental principles that propel sustainable digital heritage preservation strategies toward increased harmony between technological progress, ethical standards and inclusive cultural practices so future generations can benefit from them.

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