Khizanah al-Hikmah : Jurnal Ilmu Perpustakaan, Informasi, & Kearsipan
p-ISSN: 2354-9629
e-ISSN: 2549-1334
Volume 14 Issue 2, June, 2026

Information Security in GLAM: A Bibliometric Mapping of Global Research Output

Margareta Aulia Rachman[1], Tamara Adriani Salim[2], Laksmi[3], & Muhamad Prabu Wibowo[4]

[1,2,3,4]Universitas Indonesia, Indonesia
Correspondence email: margareta.aulia@ui.ac.id

Notes

Submitted: 30-03-2026
Revised: 11-06-2026
Accepted: 18-06-2026

How to cite: Rachman, M. A., Salim, T. A., Laksmi, L., & Wibowo, M. P. (2026). Information Security in GLAM: A Bibliometric Mapping of Global Research Output. Khizanah Al-Hikmah : Jurnal Ilmu Perpustakaan, Informasi, Dan Kearsipan, 14(2). https://doi.org/10.24252/kah.v14i2a1

DOI: 10.24252/v14i2a1

Copyright 2026 © the Author(s)

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

ABSTRACT

Background: Research on information security within Galleries, Libraries, Archives, and Museums (GLAMs) sector remains limited. Despite growing interest in digital transformation and cultural heritage preservation, no systematic effort has been made to map the scientific landscape of this field.
Purpose: The study identifies global research trends, prolific contributors, and thematic patterns in information security within the GLAM context over the past three decades, offering insights into its intellectual structure and directions for further research.
Methods: A bibliometric approach was employed using data from the Scopus database (1990–2024). Quantitative analysis was conducted using VOSviewer to examine publication output, authorship, institutional affiliations, countries, funding agencies, and keyword co-occurrence networks.
Findings: The analysis identified 140 relevant publications. Chern Li Liew from Victoria University of Wellington was the most prolific author, and Australia was the leading contributing country, followed by the United States and the United Kingdom. Information security in GLAM institutions remains an emerging and underdeveloped research area.
Originality/Value: The study highlights the need for broader collaboration and theory development to address the impact of information loss on digital preservation and data security. Its insights can guide future research and strengthen interdisciplinary engagement in this area.

Keywords: Information security; GLAM (Galleries, Libraries, Archives, Museums); Bibliometrics; Publication trends; Cultural heritage

1. INTRODUCTION

Information security has become an urgent concern for knowledge-based organizations of every kind, and GLAM institutions (galleries, libraries, archives, and museums) are no

exception. Verizon's 2025 Data Breach Investigations Report examined over 22,000 security incidents and confirmed more than 12,000 breaches spanning 139 countries. Prior scholarship has consistently shown that strong institutional policy and governance are central to building a secure information environment (Verizon, 2025). Existing research emphasizes that institutional policies and governance play a crucial role in establishing a secure information environment (Farid, 2023; Diesch et al., 2020). Yet despite this broader body of work, studies that specifically examine information security awareness and practice within GLAM institutions remain limited (Rizal, 2024). This study sets out to close that gap by mapping the existing publication landscape and the intellectual structure underlying this niche field.

With the increasing adoption of digital technologies for managing and disseminating collections, information security issues have become a crucial area for further study. GLAM institutions serve the public via cultural heritage, identity, education, experiences, and recreation (Logan and Liew, 2023), while the term information security covers all activities related to protecting organizational assets, modifying data, or disclosing information that is not owned by the organization (Caballero, 2017). In the modern world, digitization has introduced new challenges related to information security, including the risk of data breaches, network attacks, and virus infections (Liu et al., 2023). Encryption and threat detection systems are crucial for protecting data and ensuring user security. There has been a trend towards synergy between cultural heritage institutions in recent years, such as the GLAM collaboration in information resource management (Liu et al., 2023). Many of these institutions actively promote the development of digital humanities projects, with a substantial increase in the number of collaborative projects and partnerships, as well as the frequency of libraries, archives, or museums sharing space or even merging. These collaborations typically follow the trend of digitization, as evidenced by the development of shared digital cultural heritage platforms and content sharing (Rasmussen et al., 2023). They primarily target the construction of digital humanities data resources and services in alignment with the service functions of GLAM institutions. The scale of data has also expanded rapidly with the increasing digitization of cultural heritage and the types of available data have been continuously enriched, from knowledge aggregation to knowledge organization and even knowledge transmission. Effective metadata management is key to ensuring the integrity and security of information among GLAM institutions.

As these institutions use diverse metadata schemas, uniform data rules need to be established to efficiently organize and manage metadata with different standards (Liu et al., 2023). Advikos et al. (2024) propose alternatives for organizing and managing cultural heritage in scenarios where limited public funding is available and there is pressure to develop memory institutions into more inclusive, participatory, and 'entrepreneurial' organizations. Furthermore, although digitizing cultural heritage can improve access and usability for people with very diverse needs, the higher volumes of data also increase the need for effective data models. Digital curation practices and semantic models can help organize and protect data (Liu et al., 2023). Semantic models developed for information security can help optimize search engines and reduce search errors. According to Ahangar et al. (2023), the central nodes and strong links in the conceptual network of information security include: "information security," "security," "information system," "privacy," "telecommunications," "information," "intrusion detection system," "cryptography," "cybersecurity," "authentication," "network," "risk," "threat," and "risk management framework." The extracted semantic model has a goodness of fit (GOF) of 0.710 and confirms 11 semantic relationships. These relationships include: "Requires level," "Reduces,"

"Threatens," "Exploited by," "Has Source," "Uses," "Leads to," "Attacks," "Vulnerability to," "Implemented by," and "Reduces." The study concludes that conceptual networks and semantic models can be inferred in semantic systems and databases, thus providing a new method for creating high-level ontologies to optimize search engines, reduce errors, and recover unwanted information.

The ransomware attack that crippled the British Library's operations in 2023 highlighted the far-reaching consequences of cyberattacks on cultural and educational institutions. Beyond disrupting technological infrastructure, the incident severely impeded access to knowledge, research services, and academic activities that depend on digital collections (Fiscus, 2024). Moreover, Houghton et al. (2025) argued that information security vulnerabilities arise not only from technical deficiencies but also from organizational challenges, including competing institutional priorities, a shortage of personnel with cybersecurity expertise, and inadequate funding for the modernization of information technology infrastructure.

Regarding information security, three key terms are often mentioned: confidentiality, integrity, and availability (Vuorinen and Tetri, 2016). Both confidentiality and integrity are based on the idea that only authorized users can access (view) and edit protected information, while integrity is also related to the consistency of information. Information should not change unless authorized users change it. Availability refers to the accessibility requirement. In other words, information must be available (and changeable) when authorized users need it. Achieving a state of security is never easy because information security is a relative concept in some respects. Its comprehensive nature means that this concept can be approached from various angles: it has been referred to as a process, can be related to consciousness, has been approached from a philosophical perspective, and also has a social side (Vuorinen and Tetri, 2016).

Effective information security in GLAM institutions relies on the implementation of strict security policies and best practices in line with international standards (e.g., ISO/IEC 27002). Information security risk assessments and audits can help identify and address vulnerabilities in the system (Han et al., 2016). The role and challenges of GLAM in information security include the importance of information professionals in collecting, using, and protecting information. They need in-depth knowledge of information security and implement effective policies to protect sensitive data. The convergence of various GLAM institutions creates challenges in terms of information security; while these partnerships can increase efficiency and accessibility, particular attention must be paid to behavioral norms and security.

Education and awareness regarding information security among GLAM staff are also critical. For example, knowledge transfer through online cybersecurity education can improve security practices and risk management in libraries. Unfortunately, no research has directly addressed information security research trends in the GLAM context. Bibliometric analysis is a useful tool here as it uses indicators to measure developments and trends by evaluating a discipline, institution, journal, or other scientific entity, creating new knowledge, and assisting decision-making (Anninos, 2014; Herrera-Calderon et al., 2021).

Against this backdrop, the present study examines the evolution of information security research in GLAM (Galleries, Libraries, Archives, and Museums) institutions through a bibliometric approach. By mapping publication trends, intellectual structures, and patterns of scholarly collaboration, this study provides a comprehensive overview of the development of

the field and identifies emerging research directions. The findings contribute to a deeper understanding of how information security has been conceptualized and investigated within GLAM institutions and offer an evidence-based framework for strengthening the protection of organizational assets and sensitive information from unauthorized access, modification, disclosure, and destruction. Furthermore, the study provides insights into the reliable operation of information systems and services and highlights critical areas that warrant further scholarly and practical attention in the context of GLAM institutions.

2. METHODS

Research using bibliometric analysis is especially popular among researchers because this method can be used to handle large amounts of scholarly data and generate highly impactful research (Donthu et al., 2021). Bibliometric data were retrieved from the Scopus database and were analyzed using VOSviewer for network visualization. This form of analysis was considered a popular and rigorous method for exploring and analyzing large volumes of scientific data and had been employed by academics for various purposes, including uncovering emerging trends in article and journal performance, identifying collaboration patterns and research constituents, and exploring the intellectual structure of a particular domain within the existing literature (Donthu et al., 2021). The analytical design of this study followed the bibliometric procedures proposed by Nigatu (2024), who applied similar techniques to map research trends in museum studies. Bibliometric analysis quantitatively evaluated scientific publications to identify research trends, collaborations, and thematic evolution (Ong et al., 2025). This approach facilitated the identification of citation networks, keyword co-occurrences, and thematic evolution over an extended period.

This study adopts a broader approach by analyzing a wider range of information security literature to provide a more comprehensive understanding of the research landscape in GLAM (Galleries, Libraries, Archives, and Museums) institutions. Specifically, the study examines the evolution of the relevance and publication volume of information security research in GLAM institutions over the past three decades. It further investigates the major research trends and assesses the extent of scholarly collaboration within this field. In addition, the study maps the co-word structure of information security research in GLAM institutions to identify the intellectual and thematic relationships among key topics. Finally, the study discusses the implications of the findings and proposes directions for future research.

This study utilized the Scopus database to develop a comprehensive search strategy for identifying publications related to information security in GLAM (Galleries, Libraries, Archives, and Museums) institutions. The search was conducted on May 28, 2025, without imposing any restrictions on publication year, thereby ensuring the inclusion of literature from different periods and publication types. To retrieve relevant publications, the study employed a structured search strategy that combined synonymous and related keywords using Boolean operators (OR, AND, and NOT). The search terms were carefully formulated to capture concepts associated with both “information security” and “GLAM” institutions, maximizing the breadth and precision of the retrieval process. The complete set of keywords and search strings used in this study is presented in Table 1.

Table 1. Search terms

Topics:	Information security in GLAM institutions	
Concepts:	*Information security*	*GLAM*
Synonyms	*"Information security"*	*Galleries, Libraries, Archives, Museums*
Broader Terms	*"information security," "security," "information system," "privacy," "telecommunication," "information," "intrusion detection system," "cryptography," "cyber security," "authentication," "network," "risk," "threat," and "risk management framework."*	-
Narrower Terms	-	-
Related Terms	*confidentiality, integrity, availability*	
Alternative Spellings	-	*Gallery, Library, Archive, Museum*
Parts of Speech	-	*Galler*, Librar* Archive*, Museum**

(Source: adaptation of Rumsey, S. (2008))

This study adopted a broader approach by analyzing a wider range of information security literature to provide a more comprehensive understanding of the research landscape in GLAM (Galleries, Libraries, Archives, and Museums) institutions. Specifically, the study examined the evolution of the relevance and publication volume of information security research in GLAM institutions over the past three decades. It further investigated the major research trends and assessed the extent of scholarly collaboration within this field. In addition, the study mapped the co-word structure of information security research in GLAM institutions to identify the intellectual and thematic relationships among key topics. Finally, the study discussed the implications of the findings and proposed directions for future research.

This study utilized the Scopus database to develop a comprehensive search strategy for identifying publications related to information security in GLAM institutions. The search was conducted on May 28, 2025, without imposing any restrictions on publication year, thereby ensuring the inclusion of literature from different periods and publication types. To retrieve relevant publications, the study employed a structured search strategy that combined synonymous and related keywords using Boolean operators (OR, AND, and NOT). The search terms were carefully formulated to capture concepts associated with both "information security" and "GLAM" institutions, thereby maximizing the breadth and precision of the retrieval process. The complete set of keywords and search strings used in this study is presented in Table 1.

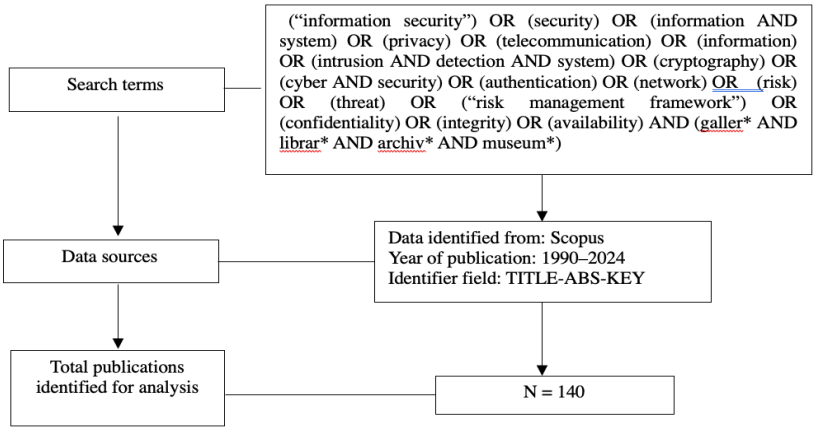


Figure 1. Flowchart of the data collection process

3. RESULTS AND DISCUSSION

Relevance and Publication Output of Information Security Research in GLAM Institutions Over the Past Three Decades

The search process was conducted using the search term "information security" by adding the terms "information security," "security," "information systems," "privacy," "telecommunication," "information," "intrusion detection systems," "cryptography," "cybersecurity," "authentication," "network," "risk," "threat," and "risk management framework," as well as the related terms "confidentiality," "integrity," and "availability" restricted to GLAM institutions in the title, abstract, keywords, and text of the articles. The results showed 140 publications in the Scopus database related to this topic. The analysis of the publication review revealed interesting trends and developments within this field, with clear evidence of a positive growth rate aligned with technological developments. During the first decade (1990–2000), there were only four publications, with a small increase to five in the second decade (2001–2010); the number of publications increased to 72 in the third decade (2011–2020), with a further 49 in the period from 2021 to 2024.

Research Trends in Information Security Within GLAM Institutions

a) Publication Year

The growth in the number of publications in the early 2000s was not significant; substantial growth only began in 2011 before peaking in 2017. Figure 2 shows the number of studies published by year, with the highest number (22) recorded in 2017 and 2022. This is followed by 2019 and 2023, both of which saw the publication of 12 articles.

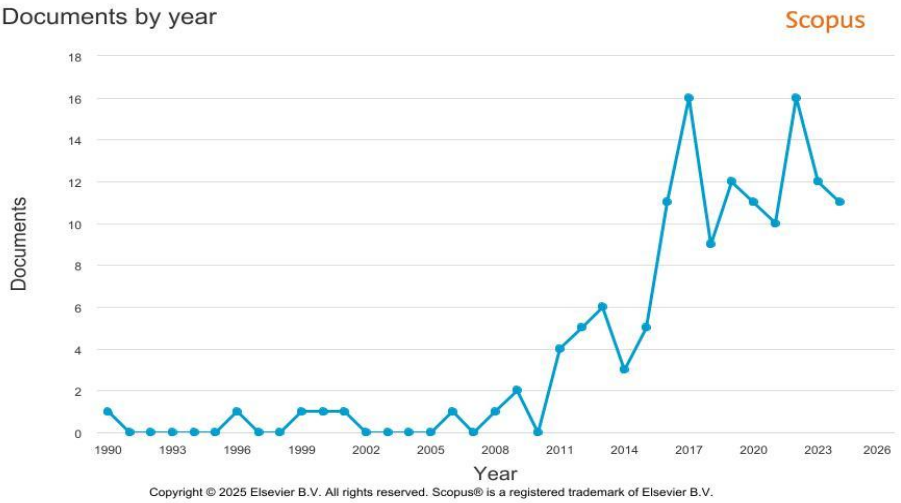


Figure 2. Volume of publications on information security in GLAM institutions (1990–2024)
(Source: Adapted from SCOPUS 2025)

b) Top Authors and Affiliations

Figure 3 shows the 10 authors who have most frequently researched information security in GLAM institutions. The author who has explored this topic most frequently is Chern Li Liew from Victoria University of Wellington, Wellington, New Zealand, with a total of four publications. The second most prolific author is Brian M. Watson of The University of British Columbia, Vancouver, Canada, who has produced three articles on this topic.

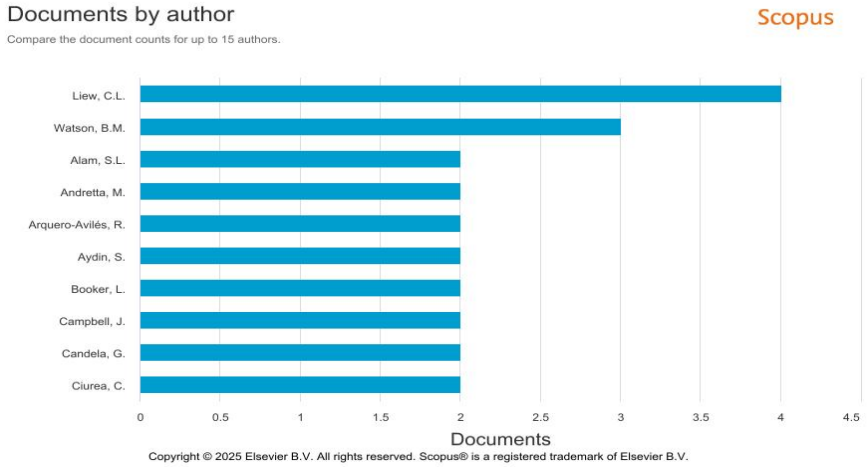


Figure 3. Documents by author name
(Source: Adapted from SCOPUS 2025)

Figure 4 shows the distribution of publications based on author affiliation. This distribution is relatively uneven, with a few institutions dominating publication contributions. The institution with the highest contribution is Victoria University of Wellington, which tops the list with 7 publications. This indicates that this institution is a major center for research production on the topic analyzed. This is followed by Alma Mater Studiorum, Università di Bologna (5 publications), and University College London (UCL) in third place with 4 publications. These three institutions can be considered leading contributors or key actors in the research landscape.

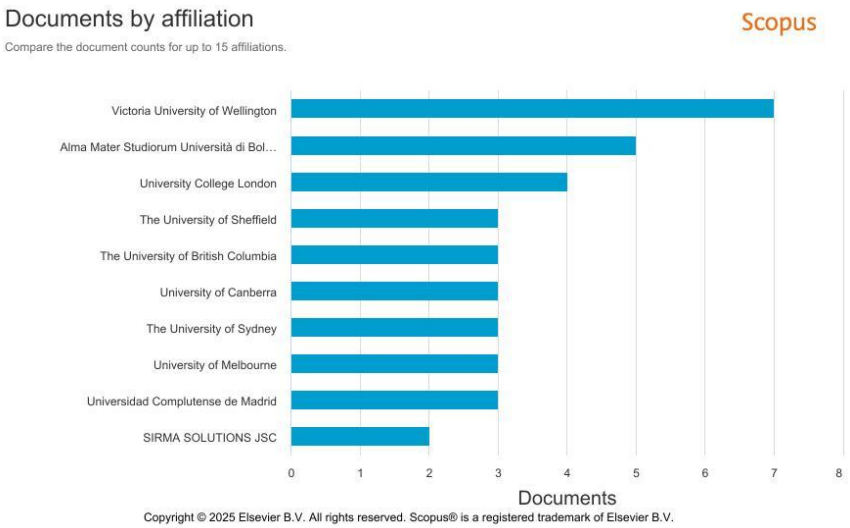


Figure 4. Documents by author affiliation
(Source: Adapted from SCOPUS 2025)

c) Top Countries

Figure 5 shows the top 10 countries contributing to research on information security in GLAM institutions. The leading country is Australia, with 22 publications. This reflects a consistent and significant commitment to information security issues in the GLAM sector. The United States and the United Kingdom published 17 and 16 articles, respectively. They are followed by Spain (10 publications), Italy (nine publications), Canada, India, and New Zealand (eight publications each), China (four publications), and Germany (four publications).

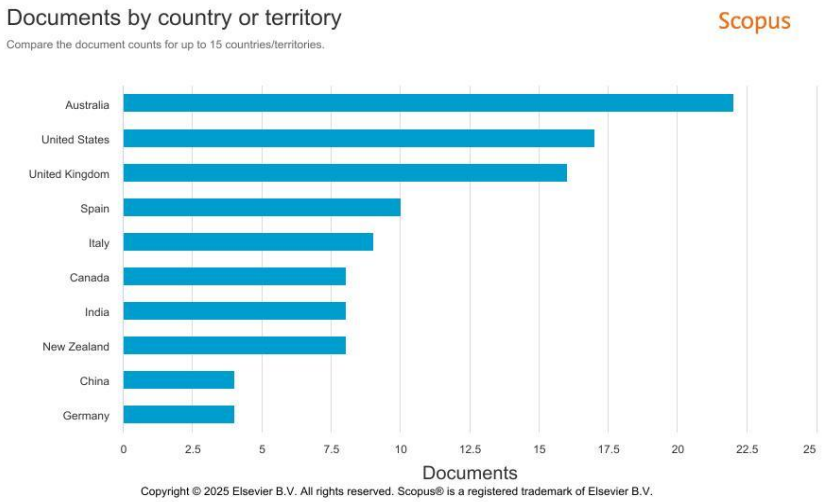


Figure 5. Highest number of publications produced by country
(Source: Adapted from SCOPUS 2025)

d) Top Types of Publication

Analysis of publication type refers to the type of document or form of scientific publication most dominantly produced in research on information security in GLAM institutions. Figure 6 shows that the types of publications in this field consist of articles (60.7%), conference papers (21.4%), book chapters (9.3%), books (4.3%), reviews (3.6%), and notes (0.7%). Journal articles through a strict peer-review process and therefore have a consistent level of quality and credibility. A journal is a form of scientific publication containing research results from students, lecturers, or researchers (Hasanah and Rachman, 2021). In contrast, although proceedings can be published quickly, their quality varies. The disciplines that produce many proceedings include engineering and computer science. This differs from reviews, which are often the primary source of citations because of their high bibliometric value.

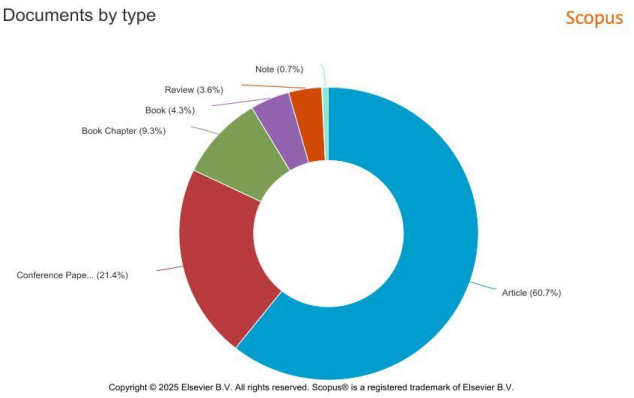


Figure 6. Documents by publication type
(Source: Adapted from SCOPUS 2025)

e) Most Popular Subject Areas

Figure 7 presents the distribution of the most prominent subject areas in the scholarly literature addressing information security within GLAM institutions. The leading domain is social sciences with 83 publications, followed by computer science with 66 publications, and arts and humanities with 44 publications. This distribution highlights the interdisciplinary nature of research in this field, bridging social, technical, and cultural perspectives.

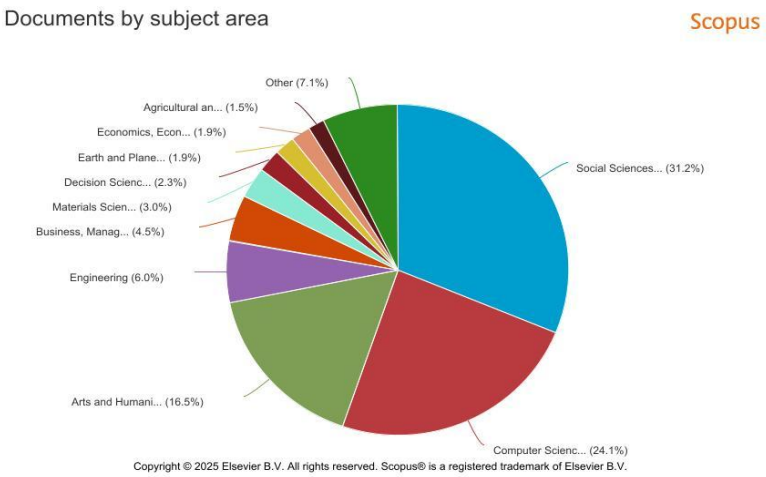


Figure 7. Most popular subject areas
(Source: Adapted from SCOPUS 2025)

f) Top Publishers

Figure 8 shows publishers that have contributed the most publications to the research topic from 1990 to 2024. The highest number of publications is Global Knowledge Memory And Communication, with four publications, followed by Aib Studi (Associazione Italiana Biblioteche), Iop Conference Series Materials Science and Engineering, and the Journal of Documentation, with three publications each. The number of publications produced by Aib Studi decreased from 2017 to 2024, while Global Knowledge Memory and Communication experienced an increase in publications from 2022 to 2024.

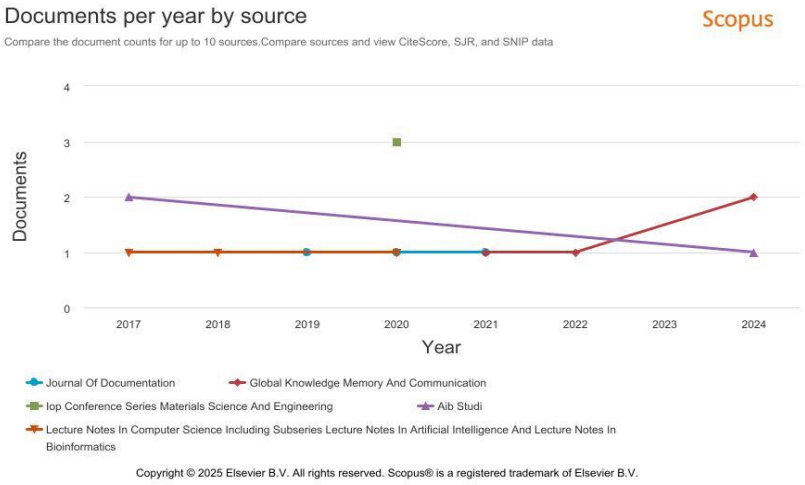


Figure 8 Top publishers in terms of publications on information security within GLAM institutions (1990–2024)
(Source: Adapted from SCOPUS 2025)

f) Most Funding Sponsors

Figure 9 presents the 10 institutions that have funded research on information security in GLAM institutions during the research period. The European Commission has

provided funding for eight publications, followed by the Seventh Framework Programme, which funds three publications.

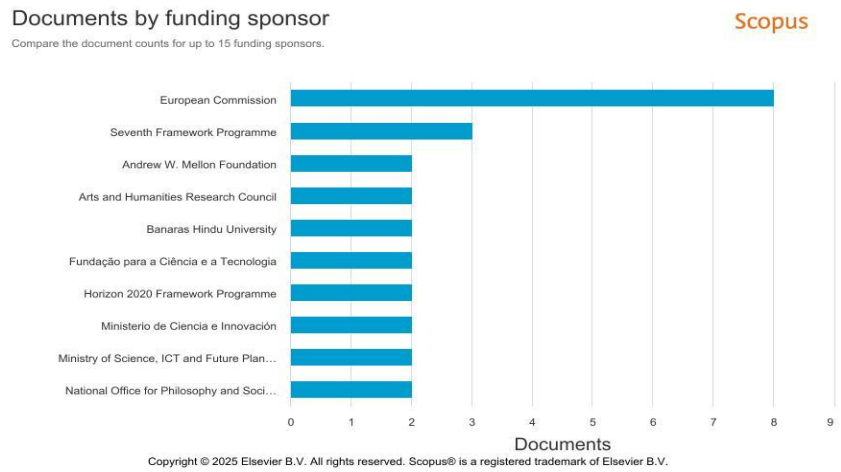


Figure 9. Top sponsors by number of publications
(Source: Adapted from SCOPUS 2025)

Collaboration Research Trends of GLAM Institutions in Information Security

Figure 10 shows the most active authors in terms of collaboration, namely Geovanni Delnevo, Lorenzo Monti, Silvia Mirri, and Paola Salomoni. These four authors produced two collaborative articles. However, the analysis of the collaboration relationship of these authors has just a single color cluster (pink), indicating that there has been a minimal level of collaboration between researchers in this field.

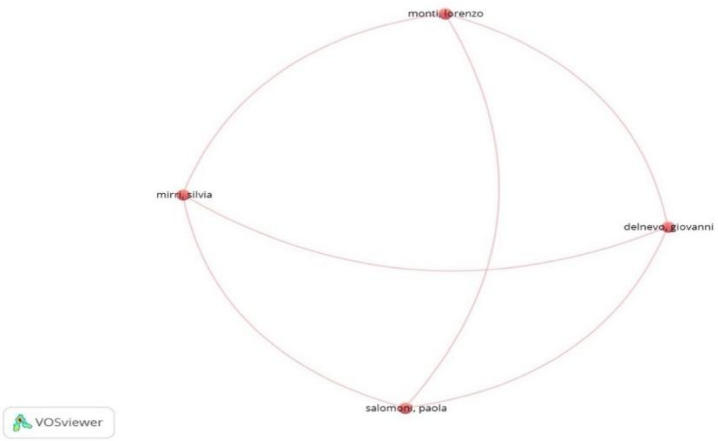


Figure 10. Visualization of the co-authorship network in information security research within GLAM institutions (1990–2024)
(Source: VOSviewer Analysis, 2025)

Co-word Map in Research on Information Security Within GLAM Institutions

This study conducted a co-occurrence analysis to find research topics within the field of interest. Data visualizations used in this analysis are network visualization, overlay, and

density. Only two different research themes were identified through thematic analysis of the authors' keywords. Figure 11 shows the interconnected keywords in the context of GLAM institutions, including digital libraries, galleries, and museums. In addition, "cultural heritage" is the most dominant keyword. This group offers a comprehensive view of the current research area but reveals certain limitations in addressing broader issues. Research on information security in GLAM institutions still focuses on digital libraries, archives, and museums rather than information security itself.

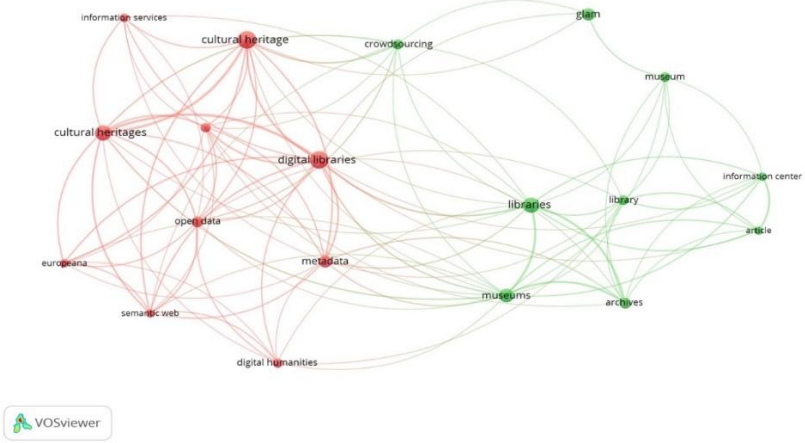


Figure 11. Visualization of the keyword network in information security research within GLAM institutions (1990–2024) (Source: VOSviewer Analysis, 2025)

The overlay visualization in Figure 12 demonstrates that such research focuses on the institutions themselves, with the term "GLAM" becoming more popular in recent years. The latest topics include GLAM, the semantic web, and digital humanities.

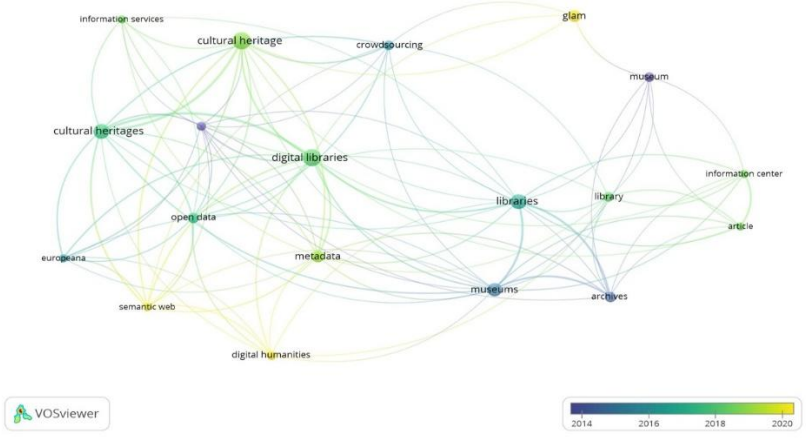


Figure 12. Overlay visualization of information security research within GLAM institutions (1990–2024) (Source: VOSviewer Analysis, 2025)

The analysis in Figure 13 shows the density of the research gap in terms of information security in GLAM institutions. The darker and faded areas mean that keywords are used less frequently, highlighting a research gap where confidentiality, integrity, availability risk, and risk management have never been discussed. These keywords could provide the basis for further researchers to conduct more in-depth research on digital libraries and cultural heritage.

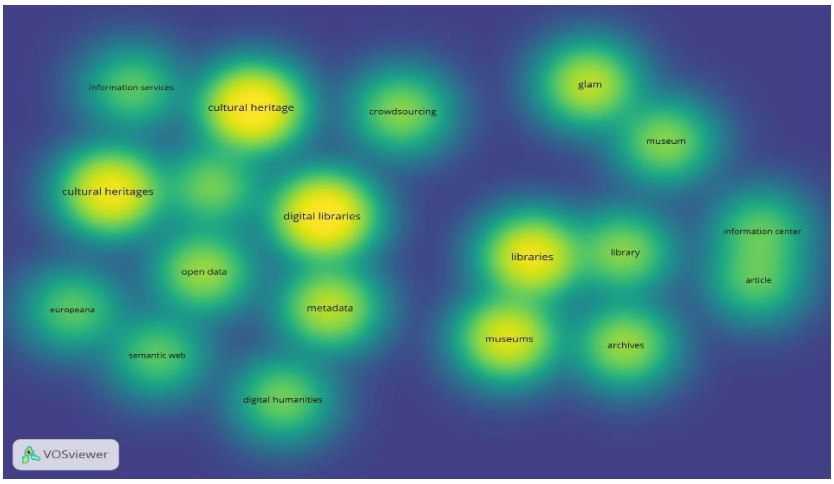


Figure 13. Visualization of keyword density
(Source: VOSviewer Analysis, 2025)

Implications for Future Research

The analysis of frequently cited publications reveals that existing publications have significantly impacted the development of information security within GLAM institutions as a research topic. Chern Li Liew has four publications, but has not been involved in a collaborative relationship with other authors. Likewise, authors with collaborative relationships, such as Geovanni Delnevo, Lorenzo Monti, Silvia Mirri, and Paola Salomoni, have not produced significant and impactful publications. Furthermore, comparing these findings with previous studies on broader topics regarding information security that produce semantic models in information security, it is clear that researchers have not widely worked on this research topic. The keyword network visualization demonstrates that existing studies focus on GLAM institutions themselves rather than their information security. Table 2 provides a comparison of the keywords found in this study with the results of the semantic model for "information security" (Ahangar *et al*., 2023).

Table 2. Comparison of keyword findings with the semantic model of "information security"

Keyword findings in network visualization	**Semantic model of "information security" (Ahangar et al., 2023)**
Digital libraries, cultural heritage, information services, libraries, museums, metadata, open data, digital humanities, archives, semantic web, crowdsourcing, GLAM, article, information center, Europeana	information security, security, information system, privacy, telecommunication, information, intrusion detection system, cryptography, cyber security, authentication, network, risk, threat, and risk management framework

DISCUSSION

This study's analysis demonstrates that there has been minimal development in terms of information security research topics in the context of GLAM institutions, with just 140 publications from 1990 to 2024. These institutions face various threats such as data breaches, network attacks, and virus infections, which can compromise the security of digital collections and sensitive information (Xiong and Wang, 2024). In addition, the bibliometric analysis of information security research trends provides important insights that can guide future research efforts. There is a need to increase international collaboration to address the geographic gap in the existing research, especially involving researchers from low- and middle-income countries. By encouraging global partnerships, researchers can pool resources, share expertise, and ensure that information security can be addressed comprehensively. This finding is supported by Kennan and Lymn (2019), who showed that the knowledge and skills required to work in GLAM institutions extend beyond information management. Information is rarely mentioned as a separate term due to the perception that information management is undervalued in libraries and archives, yet most qualifications for working in libraries and archives contain the word "information" in some form.

Empirical studies have underscored the significance of systematic management. For instance, an investigation of Chinese digital libraries by Han et al. (2016) identified substantial vulnerabilities, highlighting the necessity of continuous monitoring and enhancement of security mechanisms. Moreover, research on GLAM institutions reveals a persistent lack of authoritative cataloging policies addressing diversity, equity, and inclusion (DEI) metadata, indicating a broader need for standardized governance frameworks to ensure both data security and ethical information management (Werling and Radio, 2024). Funding agencies can prioritize support for collaborative research that bridges gaps between locations with varying levels of research infrastructure, thereby increasing the inclusiveness and global applicability of research findings. According to this study's keyword network analysis, cultural heritage was the most frequently occurring word; this further demonstrates that the interconnectedness of GLAM institutions is in cultural heritage information security.

The findings from this bibliometric analysis offer several important implications for information security research. First, the increasing number of studies in this area reflects a strong global commitment to advancing information security knowledge and practice. However, the uneven distribution of research across regions indicates a geographic disparity in research efforts. Second, the dominance of high-income countries, particularly Australia, the United States, and the United Kingdom, suggests that research leadership is concentrated in regions with greater resources and research infrastructure. This concentration impacts the generalizability of research findings, meaning that the specific challenges faced by low- and middle-income information security environments may not be adequately addressed. Furthermore, leading institutions such as Victoria University of Wellington, Alma Mater Studiorum Università di Bologna, and University College London have been identified as key centers of innovation in information security research in the GLAM sector. These institutions not only produce a substantial volume of scholarly work but also play a significant role in shaping the intellectual direction of the field through their contributions. Clustering of frequently occurring keywords reveals emerging themes and evolving trends. The strong emphasis on cultural heritage demonstrates that information security in this context goes beyond technical issues and encompasses contextual and domain-specific dimensions. Finally, the analysis of highly cited publications demonstrates the significant influence of

certain studies that have provided a conceptual foundation for current practices and future research in this area.

Several bibliometric studies in the broader domain of information security, such as cybersecurity, big data and cybersecurity, and social media security, indicate that publication volumes and citation counts have increased significantly in the last decade (Chhtrapati et al., 2024). Furthermore, a study entitled "A comprehensive bibliometric analysis of big data and cybersecurity" highlights a surge in the number of publications and collaborations between countries or institutions between 2016 and 2020 (Koca and Çiftçi, 2025). However, despite the global trend showing improvement, particularly in technical or computational fields and risk management, specialized literature incorporating aspects of "GLAM" remains relatively scarce. These studies often identify several key thematic clusters, such as: (1) technology & technical architecture for threat detection, machine learning, and privacy/cryptography (Koca and Çiftçi, 2025); (2) human behavior and compliance with information security policies, including security awareness and training in academic institutions and libraries (for example, a study entitled "Impact of information security awareness on information security compliance of academic library staff in Turkey" by Kavak (2024) showed that information security awareness significantly influences compliance among library staff); and (3) information security governance in the public sector, including implementation challenges and success factors, highlighting frameworks, policies, risks, and best practices (Magnusson et al., 2024).

The findings reveal several notable gaps in information security research within GLAM (Galleries, Libraries, Archives, and Museums) institutions. First, the field remains limited in both volume and specificity, with relatively few studies focusing explicitly on GLAM contexts and their unique characteristics, such as archives, cultural heritage collections, and digital libraries. Second, existing research is dominated by technical perspectives, while the human and organizational dimensions, including institutional culture, ethical considerations, and the historical value of collections remain underexplored. Third, scholarly output and collaboration are concentrated in resource-rich countries, with limited international collaboration and research capacity in developing-country contexts. Finally, although themes such as privacy, governance, and awareness have gained sustained attention, topics such as digital collection security, archival preservation, and digital cultural risks remain insufficiently developed.

The complexity of information security, especially in today's rapidly evolving technological era, highlights the need for a multidisciplinary approach. This approach should integrate perspectives from fields such as library and information science, archival science, archaeology, anthropology, history, data science, computer science, architecture, and others. Recent research supports this, showing that technological advances and increasing digitization of cultural heritage within the GLAM sector have led to rapid data growth and diversification, from knowledge gathering to organization and transmission (Liu et al., 2025). For example, libraries are experiencing ongoing changes that present challenges and drive the development of new practices, policies, and services (Gaitanou et al., 2022). Consequently, innovation in information security research should be prioritized. Supporting emerging themes and innovative approaches is crucial, and new areas like artificial intelligence (AI), data science, cybersecurity, the semantic web, and digital humanities should be explored. Enhancing the accessibility of research findings for practitioners and policymakers is essential as this allows research to be applied in practice, ultimately improving GLAM management.

The co-occurrence analysis demonstrates that existing research clusters primarily focus on cultural heritage, digital libraries, and museums. This finding aligns with recent studies highlighting the growing importance of cybersecurity in digital museum applications (Bolatov, 2024). However, topics explicitly linking security to cultural heritage preservation remain underexplored. The dominance of publications from the social sciences suggests that human and organizational aspects of information security are increasingly recognized (Rizal, 2024). Nonetheless, as noted by Farid (2023), institutional policy frameworks remain uneven, particularly in non-academic GLAM institutions. From a governance perspective, success in implementing information security relies on organizational culture and management support (Diesch et al., 2020). While technical safeguards have received considerable attention in digital museum studies (Bolatov, 2024), there is still a need for integrative research that connects

Based on the findings of this research, there are several key recommendations for this field of study: encouraging international and multidisciplinary collaboration; increasing research inclusiveness and resource accessibility; prioritizing innovative information security research within emerging technological and cultural contexts; and bridging the gap between research and real-world policy/practice, particularly for global applications.

4. CONCLUSION

This study contributes to the mapping of the scientific publication landscape on information security within GLAM institutions through a bibliometric co-citation analysis. The analysis elucidates the intellectual structure of the field, identifies prolific authors and their influential works, and traces the evolution of research from 1990 to 2024. The findings underscore the limited volume of information security research within the GLAM context and highlight the narrow thematic scope that continues to characterize scholarly inquiry in this area. GLAM institutions play a vital role in preserving and sharing cultural heritage. As more digital collections are produced, the need for robust information security measures to protect sensitive data and ensure the integrity of digital assets becomes increasingly important. The results of this study further demonstrate the dynamic and evolving nature of information security research in the GLAM sector. The increasing volume of publications, contributions from leading countries and institutions, and the emergence of new research themes all demonstrate that the field is expanding in both scope and impact. However, this study highlights gaps in certain areas of research and geographic disparities, indicating opportunities for further exploration and collaboration. Future research should build on these findings by addressing these gaps and exploring new frontiers within this field to ensure the continued preservation of cultural heritage.

AUTHORS' CONTRIBUTIONS

Margareta Aulia Rachman: Conceptualization, research design, data collection, data analysis, and drafting the manuscript. **Tamara Adriani Salim:** Research methodology, supervision, and revision. **Laksmi:** Data validation, analytical framework, and revision. **Muhamad Prabu Wibowo:** Final review, language editing, supervision, and accountability for the integrity of the work.

CONFLICT OF INTERESTS

We state that there are no known conflicts of interest linked with this publication, and that there has been no significant financial assistance for this work that could have influenced its outcome.

REFERENCES

Avdikos, V., Dragouni, M., Michailidou. M., Pettas, D. (2024). Rethinking GLAMs as commons: a Conceptual framework [version 2; peer review: 2 approved]. Open Research Europe, 3:157 https://doi.org/10.12688/openreseurope.16473.2

Ahangar, A., Babalhavaeji, F., Hosseini Beheshti, M. S., Hariri, N., & Khademi, M. (2024). Semantic Model of Information Security: Extracting Conceptual Network with Analysis Approach of Scientific Publications and Delphi. Scientometrics Research Journal, 9(2), Autumn & Winter): 247-268. doi: 10.22070/rsci.2022.14656.1511

Akilotu, B. N., Kadiroglu, Z., Zengur, A. (2019). Information Security and Related Machine Learning Applications. 1st International Informatics and Software Engineering Conference: Innovative Technologies for Digital Transformation, IISEC 2019.

Anninos, L. N. (2014). Research performance evaluation: some critical thoughts on standard bibliometric indicators. Studies in Higher Education, 39 (9): 1542–1561, DOI: 10.1080/03075079.2013.801429

Bolatov, Z. (2024). Cybersecurity of digital museum application. International Journal of Information Security and Privacy, 19(1): 22–37. https://doi.org/10.4018/IJISP.329017

Caballero, A. (2017). Chapter 24 - Information Security Essentials for Information Technology Managers: Protecting Mission-Critical Systems, Editor(s): John R. Vacca, Computer and Information Security Handbook (Third Edition), Morgan Kaufmann

Chhtrapati, D., Trivedi, D., Chaudhari, S.P., Sharma, A., Bhatt, A. (2024). Global research performance on social media security: a bibliometric visualization analysis. Information Discovery and Delivery, 52 (1): 101–113. https://doi.org/10.1108/IDD-04-2022-0029

Diesch, R., Pfaff, M., & Krcmar, H. (2020). A comprehensive model of information security success factors for organizations. Information & Computer Security, 28(1): 96–118. https://doi.org/10.1108/ICS-08-2018-0094

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., Lim, W. M. (2021). How to conduct a Bibliometric analysis: An overview and guidelines. Journal of Business Research, 133: 285-296,

Farid, G. (2023). Digital information security management policy in academic libraries. Journal of Information Science and Technology, 48(2); 115–128. https://doi.org/10.1016/j.jist.2023.04.005

Fiscus, M., (2024). Knowledge Held Hostage: What the British Library Ransomware Attack Can Teach Us. College & Research Libraries, 85(5), pp.628–638. https://doi.org/10.5860/crl.85.5.628

Gaitanou, P., Andreou, I., Sicilia, M.-A., & Garoufallou, E. (2022). Linked data for libraries: Creating A global knowledge space, a systematic literature review. Journal of Information Science, 50(1); 204-244. https://doi.org/10.1177/01655515221084645

Herrera-Calderon, O., Yuli-Posadas, R. Á., Peña-Rojas, G., Andía-Ayme, V., Hañari-Quispe, R. D., & Gregorio-Chaviano, O. (2021). A bibliometric analysis of the scientific production related to zero hunger as a sustainable development goal: trends of the pacific alliance towards 2030. Agriculture and Food Security, 10(1), 1–15. https://doi.org/10.1186/S40066-021-00315-8/FIGURES/6

Han, Z., Huang, S., Li, H. and Ren, N. (2016). Risk assessment of digital library information Security: a case study. The Electronic Library, 34 (3): 471-487. https://doi.org/10.1108/EL-09-2014-0158

Hasanah, N., & Rachman, M.A. (2021). Trend of Library and Information Science Research in Library and Information Science Journals in Indonesia (2013-2019). Webology, 18 (1): 233-246

Houghton, F., Winterburn, M. and Oakley, K., (2025). The 2023 Rhysida Ransomware Attack on the British Library: Prioritisation, Expertise, and Funding Issues. Information Technology and Libraries, 44(1). https://doi.org/10.5860/ital.v44i1.17112

Kavak, A. (2024). Impact of information security awareness on information security compliance of academic library staff in Türkiye, The Journal of Academic Librarianship, 50 (5). https://doi.org/10.1016/j.acalib.2024.102937

Kennan, M.A., & Lymn, J (2019) Where is the I(nformation) in GLAM? Education, Knowledge and Skill Requirements of Professionals Working in GLAM Sector Institutions, Journal of the Australian Library and Information Association, 68 (3): 236-253, DOI: 10.1080/24750158.2019.1613708

Koca, M., Çiftçi, S. (2025). A comprehensive bibliometric analysis of Big Data and Cyber Security: intellectual structure, trends, and global collaborations. Knowl Inf Syst. https://doi.org/10.1007/s10115-025-02531-1

Liu, F., Hindmarch, J., & Hess, M. (2023). A Review Of The Cultural Heritage Linked Open Data Ontologies And Models. Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLVIII-M-2-2023; 943–950, https://doi.org/10.5194/isprs-archives-XLVIII-M-2-2023-943-2023

Loach, K. & Rowley, J (2022). Cultural sustainability: A perspective from independent libraries in the United Kingdom and the United States. Journal of Librarianship and Information Science, 54(1), 80–94

Logan, M.A., & Liew, C. L. (2023). GLAM Convergence Revisited: An Examination of User Perception and Experience, Journal of Library Administration, 63 (8), 1014-1043, DOI: 10.1080/01930826.2023.2281340

Magnusson, L., Iqbal, S., Elm, P. et al. (2025). Information security governance in the public sector: investigations, approaches, measures, and trends. Int. J. Inf. Secur. 24 (177) https://doi.org/10.1007/s10207-025-01097-x

Nigatu, T. F. (2024). A bibliometric analysis of museum visitors' experiences. Heritage, 7(2), 642–660. https://doi.org/10.3390/heritage7020037

Ong, W., Hisham, H., Nordin, A. Z. M., Zanudin, A., Hamzaid, N.A., Mat, S., Azizan A. (2025). Bibliometric Analysis of Research Trends in Spinal Cord Injury Rehabilitation: Mapping the Landscape of Scientific Publication. Journal of Scientometric Research, 14(1):188-200

Rahma, S. K., Siti Khadijah, U. L., & Anwar, R. K. (2025). Global Research Trends and Developments on Intangible Cultural Heritage: A Bibliometric Study. Khizanah Al-Hikmah: Jurnal Ilmu Perpustakaan, Informasi, Dan Kearsipan, 13(1). https://doi.org/10.24252/v13i1a1

Rasmussen, C.H., Rydbeck, K., Larsen, H. (2023). Libraries, archives, and museums in transition. Changes, Challenges, and Convergence in a Scandinavian Perspective. London and New York: Routledge

Rizal, M. A. (2024). Information security awareness: A systematic literature review. Journal of Information and Knowledge Management, 23(3) https://doi.org/10.1142/S0219649224500215

Rumsey, S. (2008). *How to find information: a guide for researchers* (2nd ed.). McGraw-Hill/Open University Press. https://app.kortext.com/borrow/399090

Siddiqui, A. T., Jahangeer, G. B., & Basha, A. F. (2024). Role of Information Security and Protection in the Modern Era. In K. Helge & C. Rookey (Eds.), Creating and Sustaining an Information Governance Program (pp. 24-35). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-0472-3.ch003

Sterbak, M., Segec, P., Jurc, J., (2022). Design of algorithms for automated collection of IT assets. 20th Anniversary of IEEE International Conference on Emerging Elearning Technologies and Applications Iceta 2022 Proceedings.

Stubbs, B. (2024). Augmented Reality [AR] Storytelling For The Galleries, Libraries, Archives, And Museums [Glam] Sector: A Case Study With The South Australian Museum Fire Exhibit And Megafauna Displays. Advances in Librarianship, Volume 54, 251–267

Verizon, (2025). Data Breach Investigations Report (DBIR). New York: Verizon Business. Available at: Verizon DBIR 2025 Report [Accessed 11 June 2026].

Vuorinen, J and Tetri, P (2016). Paradoxes in Information Security. IEEE Potentials, 35 (5): pp. 36-39 doi: 10.1109/MPOT.2016.2569740

Werling, S., & Radio, E., (2024). Comparing Critical Cataloging Procedures and Developing Local Policies in the Context of Digital Library Metadata, Journal of Library Metadata, DOI: 10.1080/19386389.2024.2407710

Xiong, J. and Wang, X. (2024). Library data protection and threat detection system based on network security. International Journal of Information and Computer Security, 24 (1-2): 137 – 153