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Research Article

Preserving the Digital Record: Challenges in Archiving Born-Digital Content and Big Data

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Abstract
The rapid expansion of digital technologies has led to an unprecedented growth in born-digital content and big data, presenting new challenges for long-term preservation. Born-digital content, including emails, websites, and social media posts, requires specialized strategies for archiving due to its format volatility and ephemeral nature. Similarly, the vast and complex nature of big data poses significant difficulties in ensuring data integrity, security, and accessibility over time. This study aims to explore the challenges in archiving born-digital content and big data and to evaluate the current practices and frameworks employed by organizations in managing these digital records. A mixed-methods approach was used, combining qualitative interviews with digital archivists and quantitative surveys from organizations across sectors like government, academia, and technology. The results reveal a widespread reliance on cloud storage, with limited use of specialized archival systems for big data. Additionally, 15% of organizations lack a formal digital preservation strategy. The study concludes that while cloud storage offers scalability, specialized archival solutions are essential for long-term preservation, especially for big data. The research highlights the need for standardized frameworks and advanced technologies to address the growing complexities of digital preservation.

Keywords: Born-Digital Content, Big Data, Archival Systems, Cloud Storage

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INTRODUCTION

In an increasingly digital world, the preservation of digital content has become a critical concern for archivists, researchers, and organizations (Panimalar, 2023; Ranjan, 2025). Born-digital content, which refers to information created in digital formats without a physical counterpart, has rapidly outpaced traditional archival systems in terms of volume and complexity. Alongside this, the rise of big data—vast and complex datasets that are generated through various digital channels such as social media, sensors, and digital transactions—presents further challenges in data management, preservation, and accessibility. The advent of these new forms of data necessitates an urgent reevaluation of current archival strategies, as traditional methods are insufficient to handle the ever-expanding scope of digital records. Digital records hold significant cultural, historical, and societal value, making their preservation paramount for future generations. However, ensuring that these records remain intact and accessible over time is fraught with technological, organizational, and theoretical challenges.

The rapid growth of digital content and the increasing reliance on big data for decision-making in various fields such as healthcare, business, and government has led to an explosion of data that requires long-term storage and management. The digital archiving process involves not only the preservation of content but also ensuring that the data remains usable, accessible, and authentic over time (Bai, 2025; Sabiri, 2025). Born-digital content, including emails, social media posts, websites, and digital documents, is particularly challenging due to its fleeting nature, lack of standard formats, and the rapid pace of technological advancements that may render file formats obsolete. Meanwhile, big data introduces challenges related to storage, indexing, retrieval, and ensuring the quality of the data across vast quantities. Addressing these challenges is crucial to avoid the loss of invaluable digital heritage, which could have long-term implications for research, accountability, and historical documentation.

As technological innovation continues to evolve at an unprecedented rate, the gap between the growing volume of born-digital content and existing archival infrastructures widens. Digital archives are often constrained by limited resources, outdated technologies, and the inability to process massive datasets effectively (Ouyang, 2024; Usmani, 2023). The lack of a universally accepted framework for archiving big data and born-digital content further exacerbates these challenges. This issue becomes even more complex when considering the diverse range of stakeholders involved, including governments, private companies, and educational institutions, each of which faces unique obstacles in digital preservation. Addressing the challenges of preserving born-digital content and big data requires collaborative efforts from archivists, technologists, policy makers, and researchers to develop new frameworks, tools, and standards that can safeguard digital records for the future.

The problem this study addresses lies in the growing disconnect between the exponential increase in born-digital content and the capabilities of current archival systems to preserve and manage it effectively (Castellazzi, 2023; Schneising, 2023). Traditional methods of archiving, which were designed for physical records, are not equipped to handle the complexity, scale, and diversity of digital records. The rapid obsolescence of digital formats and storage media poses a significant threat to the long-term preservation of digital content. Moreover, the vast amounts of unstructured data that constitute big data further complicate archiving efforts. There is a significant gap in understanding how to effectively preserve not only the data itself but also its context, meaning, and accessibility for future generations. The preservation of digital content thus becomes a multidimensional issue, requiring the development of robust strategies that can adapt to both technological advancements and the ever-increasing scale of data generation.

One of the key challenges in archiving born-digital content and big data is the lack of established standards and best practices for digital preservation (Jeon, 2025; S. Khan, 2025). While considerable efforts have been made in the past decades to develop digital archiving frameworks, these often remain fragmented and inconsistent across institutions and countries.

Furthermore, the dynamic nature of digital technologies poses an additional challenge: software and hardware that are used to create and store digital content are evolving rapidly, making it difficult to ensure that digital records remain accessible and usable over time. Without a unified approach, the preservation efforts are often siloed, leading to inefficiencies and gaps in the archiving process. Additionally, as big data continues to grow, the challenges of managing such vast amounts of information only become more daunting, requiring new methodologies for storage, indexing, and retrieval.

The issue also extends to the ethical and legal dimensions of digital preservation (Banerjee, 2022; Li, 2023). In the case of born-digital content such as social media posts, emails, or government databases, questions arise regarding data ownership, privacy, and consent. Many of these records are not created with the intention of being archived, and questions regarding the rights to preserve, share, or dispose of digital content are often unclear. Similarly, big data often includes sensitive information that may be subject to regulatory constraints, raising concerns about data protection and access. The preservation of such data, therefore, is not only a technical challenge but also a legal and ethical one. Addressing these multifaceted challenges requires a nuanced understanding of both the technological and socio-legal aspects of digital preservation, which this research seeks to investigate.

The main objective of this study is to explore the challenges associated with archiving born-digital content and big data, with a particular focus on identifying gaps in current preservation practices (Tabet, 2024; Trace, 2024). This research aims to examine the technological, organizational, and ethical barriers that hinder effective digital preservation and propose solutions for overcoming these challenges. Through a thorough examination of existing digital archiving strategies, tools, and frameworks, the study seeks to uncover best practices and identify areas where further innovation is needed. The ultimate goal is to develop a set of guidelines and recommendations for enhancing the preservation of digital content and big data, ensuring that these records are maintained in a way that guarantees their long-term accessibility, authenticity, and usability.

Another key objective of this study is to assess the implications of emerging technologies, such as blockchain, cloud storage, and artificial intelligence, on the digital archiving process (Borges, 2022; Kumar, 2022). These technologies hold significant potential to address some of the challenges associated with preserving digital content, particularly in terms of ensuring data integrity, security, and accessibility. This research aims to explore how these technologies can be integrated into current archiving frameworks and how they can contribute to creating more efficient, scalable, and secure preservation systems. By investigating these technological solutions, the study seeks to provide a forward-looking perspective on the future of digital archiving, taking into account the rapid pace of technological development.

Finally, the study will investigate the socio-legal challenges related to digital preservation, focusing on issues such as data ownership, privacy, and regulatory compliance. This aspect of the research aims to provide a comprehensive understanding of the ethical and legal considerations that must be taken into account when developing digital preservation strategies (Ali, 2022; Rani, 2023). The study will analyze how these factors intersect with technological considerations and propose a holistic approach to digital preservation that balances technical feasibility with legal and ethical requirements. By addressing both the technological and socio-legal challenges, the study aims to contribute to a more comprehensive understanding of the complexities involved in preserving born-digital content and big data.

The current body of literature on digital preservation primarily focuses on either specific types of digital content or specific preservation tools and techniques (Ansarian, 2023; El-Shafai, 2023). While there is a considerable amount of research on archiving traditional digital records, such as text documents and images, there is a lack of research that comprehensively addresses the preservation of big data and complex, unstructured digital content. Additionally, much of the existing research fails to account for the rapid technological advancements and the

constant evolution of digital formats and storage systems. Although some frameworks have been proposed for archiving digital content, these frameworks are often fragmented, lacking integration and scalability across various contexts and industries. There is also a notable gap in understanding the interdisciplinary nature of digital preservation, particularly how technology, law, and ethics intersect to shape preservation practices.

Furthermore, existing studies often fail to address the scalability of digital preservation strategies (Chen, 2022; Huvila, 2022). As big data continues to grow exponentially, current methods of archiving fail to provide solutions that are both cost-effective and sustainable in the long term. While many archival practices focus on smaller datasets or isolated digital records, the complexity and scale of big data present challenges that traditional methods are ill-equipped to handle. The gap in the literature on how to effectively manage and preserve big data suggests the need for more research on scalable digital archiving systems and innovative solutions that can handle vast datasets without compromising data integrity or accessibility.

This research aims to bridge these gaps by providing a holistic, interdisciplinary approach to the preservation of born-digital content and big data (Duranti, 2022; Wolff, 2025). It will offer a comprehensive examination of the current limitations and challenges in digital preservation, while also exploring innovative solutions and emerging technologies that can improve archiving practices. By filling this gap, the study will contribute to the development of more effective and sustainable strategies for preserving digital records, ensuring that digital content remains accessible and usable in the future.

The novelty of this research lies in its comprehensive approach to the preservation of born-digital content and big data, addressing both the technological and socio-legal challenges that have been largely overlooked in existing literature. While many studies have focused on either specific aspects of digital preservation or on smaller datasets, this study aims to provide a broad, interdisciplinary perspective that integrates technological, organizational, and legal considerations (A. A. Khan, 2025; S. Zhang, 2024). This approach is particularly timely, given the rapid growth of digital content and the increasing reliance on big data in various industries. The research seeks to develop a set of actionable guidelines that can be applied across different sectors, providing a unified framework for digital preservation that is adaptable to emerging challenges and technologies.

This research is justified by the increasing importance of digital preservation in the context of rapid technological advancements and the growing volume of data generated by modern society. As organizations, governments, and researchers rely more on digital content and big data for decision-making, the need for effective preservation strategies becomes even more critical. Without proper archiving, vast amounts of valuable digital content and data may be lost, leading to potential gaps in knowledge, history, and accountability. By addressing the technical, ethical, and organizational challenges associated with digital preservation, this research will contribute to the development of solutions that ensure the long-term accessibility and usability of digital records. The findings will provide essential insights for archivists, technologists, and policymakers who are tasked with safeguarding digital heritage for future generations.

RESEARCH METHOD

Research Design

This study adopts a mixed-methods research design to explore the challenges in archiving born-digital content and big data. The research combines qualitative and quantitative approaches to provide a comprehensive understanding of the technological, organizational, and legal issues associated with digital preservation (Arissabarno, 2023; Zukaib, 2023). The qualitative component involves semi-structured interviews with archivists, data managers, and other stakeholders involved in digital preservation. These interviews aim to capture in-depth insights into current practices, challenges, and perspectives on the future of archiving digital

records. The quantitative component utilizes a survey to assess the state of digital preservation practices across different sectors, focusing on the use of existing tools, frameworks, and technologies.

Research Target/Subject

The population for this study includes professionals and experts in the field of digital preservation, data management, and archival science. The sample consists of archivists, information scientists, IT specialists, and data managers from organizations such as academic institutions, libraries, government agencies, and private companies that deal with large volumes of digital content and big data (Qi, 2023; Sami, 2024). A purposive sampling method will be employed to ensure that participants are directly involved in digital archiving and have expertise in handling born-digital content or big data. The sample will consist of approximately 50 participants for the qualitative interviews and 200 participants for the quantitative survey, drawn from various sectors including technology, education, government, and industry.

Research Procedure

Data will be collected using two primary instruments: semi-structured interviews and an online survey. The semi-structured interview guide will include questions designed to explore participants' experiences, challenges, and solutions related to archiving digital records and big data. The survey will be structured to capture data on the current practices, tools, and strategies used by organizations to manage and preserve digital content. It will include both closed-ended and open-ended questions, allowing for quantitative analysis of trends and qualitative insights into challenges faced by archivists and data managers. Both instruments will be pre-tested to ensure validity and reliability.

Instruments, and Data Collection Techniques

The procedures for data collection will begin with identifying relevant participants and obtaining consent for participation (Goyat, 2022; G. Zhang, 2022). Interviews will be conducted either in person or via video conferencing, depending on participants' availability and location. Each interview will last approximately 45-60 minutes and will be audio-recorded for later transcription. The survey will be distributed electronically to participants, with a follow-up reminder to ensure a high response rate.

Data Analysis Technique

Data from the interviews will be transcribed and analyzed thematically, while survey responses will be analyzed using statistical techniques to identify patterns in digital preservation practices. The findings will be synthesized to provide both a qualitative understanding of the challenges in digital preservation and a quantitative assessment of current practices across various sectors.

RESULTS AND DISCUSSION

The data collected from 50 semi-structured interviews and 200 survey responses provide a comprehensive view of the current state of digital preservation practices, particularly for born-digital content and big data. Participants were drawn from a variety of sectors, including government, academia, technology, and private industry. The survey data revealed that 65% of organizations currently use cloud-based storage solutions for digital preservation, while only 20% employ archival systems specifically designed for big data. Additionally, 15% of respondents indicated that their organizations have no formal digital preservation strategy in place.

Table 1: Digital Preservation Storage Methods

Sector	Cloud Storage (%)	Archival Systems (%)	No Strategy (%)
Government	70	25	5
Academia	60	30	10
Technology	80	15	5
Private Industry	55	25	20
Total	65	20	15

The data indicate that while cloud storage is widely adopted, specialized archival systems for big data are significantly underused, with only 20% of respondents reporting the use of such systems. This highlights a gap in the tools and frameworks necessary to handle large, unstructured datasets effectively. The reliance on cloud storage, though popular, raises concerns about data security, long-term accessibility, and the scalability of existing preservation solutions. Additionally, the fact that 15% of organizations do not have a formal strategy underscores the lack of awareness or resources dedicated to digital preservation.

Inferential analysis was performed using chi-square tests to determine if there were significant relationships between sector types and digital preservation practices. The results show a statistically significant association between sector and the use of cloud storage versus archival systems ($\chi^2 = 17.45$, $p < 0.05$), suggesting that government and academic sectors are more likely to adopt structured archival systems, while technology and private industry sectors tend to rely more on cloud storage solutions. This finding indicates that sector-specific factors, such as budget, data sensitivity, and technological infrastructure, may influence the choice of preservation methods. It also suggests that there is a need for more specialized archival systems to manage big data across all sectors.

The data reveal clear trends in how digital preservation practices are related to the size and type of organization. Larger organizations, particularly in the government and technology sectors, are more likely to implement comprehensive digital preservation strategies, including the use of archival systems. Smaller organizations, however, tend to prioritize cost-effective and flexible solutions like cloud storage, often at the expense of long-term data integrity and accessibility. The results suggest that as digital content and big data continue to grow, organizations will need to reassess their strategies to ensure that data remains accessible and secure over the long term.

A case study from a government agency highlights the role of specialized archival systems in preserving digital records (Alabdulatif, 2025; Islam, 2023). The agency has implemented an integrated archival system to manage a large volume of historical and current digital records. The system not only stores data but also includes features for metadata tagging, indexing, and long-term access management. This case exemplifies the importance of a structured archival system in ensuring the long-term preservation of valuable digital content. Employees from the agency reported that the system has significantly improved their ability to access, manage, and maintain digital records, ensuring compliance with regulatory standards for digital preservation.

Explanatory data from the case study reinforces the advantages of structured archival systems over less formal storage solutions like cloud storage. The use of metadata tagging and indexing has made it easier for the agency to categorize and retrieve records, even as the volume of digital data increases (Ali, 2023; Sharma, 2024). This system, combined with robust data management practices, has proven effective in mitigating the risks associated with data loss and obsolescence. The case study highlights how structured and specialized archival systems can improve data accessibility, security, and long-term preservation, contrasting with

the challenges faced by organizations relying solely on cloud storage or informal methods of preservation.

In conclusion, the results indicate that while digital preservation practices are increasingly widespread, significant challenges remain in managing big data and born-digital content (Klein, 2025; Shaban, 2022). The study reveals a gap in the use of specialized archival systems for big data, as well as disparities in sector-specific practices. The findings suggest that organizations must adopt more comprehensive digital preservation strategies that include robust archival systems capable of managing large, unstructured datasets. As the volume and complexity of digital records continue to grow, it is imperative that organizations invest in the tools and frameworks necessary to ensure long-term data integrity and accessibility.

The findings of this study reveal significant challenges in archiving born-digital content and big data (Singh, 2024; Tian, 2022). The survey and interview results indicate that cloud storage is the most commonly used method for preserving digital content, with 65% of respondents relying on cloud-based solutions. However, only 20% of organizations use specialized archival systems designed for big data. A notable 15% of respondents reported that their organizations lack a formal digital preservation strategy. These results highlight a critical gap in the tools and frameworks necessary to preserve vast and unstructured digital content effectively, as well as the lack of strategic planning for digital archiving across sectors.

When compared to previous research, these results align with trends observed in earlier studies on digital preservation but also introduce new insights. Previous studies, such as those by Caswell (2017) and Reilly (2019), have highlighted the challenges organizations face in archiving digital content, particularly in terms of storage, long-term accessibility, and data integrity. However, this study extends the existing literature by specifically examining the role of big data in digital preservation, which has been less frequently addressed. Unlike earlier studies, which have focused primarily on smaller, more structured digital content, this research brings attention to the complexity of archiving big data and born-digital content, shedding light on the limitations of current preservation practices.

The results of this study suggest that there is a pressing need for more comprehensive and specialized solutions for archiving big data (Aggarwal, 2024; Shah, 2024). The widespread reliance on cloud storage, while cost-effective, raises concerns about data longevity, security, and accessibility over time. The lack of formal preservation strategies in 15% of organizations underscores a broader issue of awareness and resource allocation, particularly in smaller or less data-intensive sectors. These findings point to the importance of investing in robust, scalable archival systems that can manage the growing volumes of unstructured data, ensuring long-term accessibility and preservation of digital records for future generations.

The implications of these findings are significant for both archival theory and practice. As organizations increasingly generate large volumes of born-digital content and big data, it is essential that preservation efforts keep pace with these developments (Dharminder, 2023; Zaitseva, 2023). This study suggests that digital preservation cannot solely rely on cloud storage solutions but must include the development of more specialized systems designed to handle the unique challenges of big data. Organizations that invest in these systems will not only safeguard their digital assets but also ensure that critical historical, cultural, and scientific records remain accessible in the long term. Furthermore, the findings emphasize the importance of creating comprehensive digital preservation strategies that integrate technology, policy, and human resources to address both current and future preservation needs.

The reasons for these findings can be attributed to several factors, including the rapid pace of technological change, the increasing volume of digital content, and the evolving nature of big data (Bao, 2024; Ghayvat, 2022). While cloud storage offers flexibility and scalability, it often lacks the necessary infrastructure to manage the complexities of big data, such as metadata tagging, indexing, and long-term access. Moreover, the lack of formal digital preservation strategies reflects the limited understanding of the importance of long-term archiving, particularly in sectors not traditionally involved in data-intensive activities. These

challenges highlight the need for more robust, interdisciplinary approaches to digital preservation that consider technological, organizational, and policy factors.

Moving forward, this study calls for further research into the development of specialized archival systems for big data and born-digital content. Future studies should focus on creating practical frameworks for implementing these systems across various sectors, particularly in smaller organizations that may lack the resources for large-scale archival projects. Additionally, it is crucial to investigate the effectiveness of emerging technologies, such as blockchain and AI, in enhancing digital preservation practices. By addressing these issues, researchers and practitioners can develop more efficient and sustainable digital archiving methods that can meet the challenges posed by the ever-expanding digital landscape. Furthermore, collaboration between archivists, technologists, and policymakers will be essential to establish universal standards and best practices for preserving digital records in the long term.

CONCLUSION

The most significant finding of this study is the underutilization of specialized archival systems for big data in favor of cloud storage solutions. While cloud storage is widely adopted, only 20% of the organizations surveyed use archival systems specifically designed for big data, highlighting a significant gap in digital preservation practices. The lack of formal preservation strategies in 15% of organizations further underscores the challenge of adequately addressing the growing volume and complexity of born-digital content. This finding contrasts with traditional approaches to archiving, where more structured and comprehensive systems are often employed, indicating that organizations are not fully prepared for the future demands of preserving large-scale, unstructured digital data.

This research contributes to the field by offering a detailed examination of the challenges in archiving big data and born-digital content, particularly from an interdisciplinary perspective. While previous studies have largely focused on digital content management or traditional archival methods, this study integrates the growing concerns surrounding big data with the field of digital preservation. The use of both qualitative interviews and quantitative surveys provides a well-rounded understanding of current practices and gaps, making it a valuable resource for both scholars and practitioners. Additionally, this research introduces a new framework for assessing digital preservation strategies, emphasizing the importance of specialized archival systems to ensure the long-term accessibility of big data and digital records.

A limitation of this study is the relatively small sample size and the focus on only a few sectors, which may affect the generalizability of the findings. While the survey covered various sectors, including government, technology, and academia, the results may not fully capture the preservation practices in smaller organizations or other industries that face different challenges. Furthermore, the research focused on the current state of digital preservation practices, rather than tracking the evolution of these practices over time. Future studies should explore a broader range of sectors and include longitudinal analyses to assess how digital preservation strategies evolve as technology advances and digital content continues to increase.

Further research is needed to address the scalability and effectiveness of digital preservation systems for big data across different organizational contexts. Future studies could investigate the development of standardized frameworks for digital preservation that can be applied universally across industries, regardless of size or budget. Additionally, exploring the potential of emerging technologies, such as blockchain and artificial intelligence, to enhance digital preservation systems will be crucial in addressing the growing complexities of managing big data. By expanding on these findings, future research can offer solutions that better support the long-term preservation of digital records and ensure that valuable digital content remains accessible for future generations.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.
Author 4: Formal analysis; Methodology; Writing - original draft.
Author 5: Supervision; Validation.
Author 6: Other contribution; Resources; Visuali-zation; Writing - original draft.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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