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# Digital Curation of the Kartini Nuclear Reactor Archives within the National Archival Information Network (JIKN)

**Dwi Ridho Aulianto**[1)*]
[1)]*National Research and Innovation Agency, Jakarta, Indonesia*
[1)]dwiridhoaulianto@gmail.com

**Abstract**
**Background:** Scientific archives play a crucial role in preserving a nation's intellectual heritage and collective memory. However, many scientific records—particularly in developing countries—remain fragmented, vulnerable to deterioration, and poorly accessible due to limited digital integration and archival interoperability. Digital curation has emerged as a strategic approach to address these challenges by ensuring long-term accessibility, authenticity, and meaningful public engagement with scientific heritage.
**Objective:** This study examines how digital curation practices contribute to the preservation and communication of scientific memory through the case of the Kartini Nuclear Reactor Archives integrated into Indonesia's National Archival Information Network (JIKN).
**Methods:** A qualitative descriptive approach was employed to analyze the digital curation process collaboratively implemented by the National Research and Innovation Agency (BRIN) and the National Archives of Indonesia (ANRI). The dataset consists of thirty-six digitized archival photographs produced between 1974 and 1979 and presented in a virtual exhibition on the JIKN platform. The analysis was guided by four evaluative dimensions: accessibility, authenticity, engagement, and sustainability.
**Results:** The findings show that integration into JIKN enhances accessibility through structured metadata consistently applied across 36 archival records and supported by visual representation. Provenance and contextual integrity are maintained through identifiable metadata fields, including creator attribution and archival classification. Public engagement is evidenced through the virtual exhibition format, which recorded 320 user accesses during its display period.
**Conclusion:** The study demonstrates that digital curation within a national archival network can transform scientific archives into dynamic infrastructures of collective memory. By integrating metadata standardization, visual access, and institutional collaboration, this approach provides a replicable model for preserving scientific heritage in developing contexts.

***Keywords:*** Collective *memory; digital curation; JIKN, national archival network; scientific archives*

## INTRODUCTION

Scientific archives constitute a fundamental resource for understanding a nation's intellectual development, technological capacity, and collective identity. Beyond their administrative or technical value, scientific archives document how knowledge is produced, institutionalized, and legitimized over time. They preserve not only research outputs but also the epistemic processes, organizational structures, and socio-political contexts that shape scientific practice. As Gilliland (2020) and Yakel (2019) argue, archives should be understood

* Corresponding Author

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as dynamic infrastructures of knowledge rather than passive repositories, mediating relationships between evidence, culture, and public accountability.

The rapid expansion of digital technologies has significantly altered the ways scientific archives are created, preserved, and accessed. Digital curation has emerged as a strategic response to challenges such as media fragility, technological obsolescence, and the increasing volume and heterogeneity of digital records (Higgins, 2008; Niu, 2014). Within archival and information science, digital curation is conceptualized as a lifecycle-based process encompassing appraisal, metadata creation, contextualization, preservation, and re-use (Faniel & Yakel, 2017). Recent scholarship further emphasizes that digital curation is not merely a technical activity but a form of memory work, in which curatorial decisions actively shape how scientific knowledge is remembered, interpreted, and communicated to society (Brien, 2023; Brien & Yakel, 2022).

In developing-country contexts, the preservation of scientific archives presents both acute challenges and strategic opportunities. Scientific records are frequently dispersed across institutions, stored in analogue formats, or embedded within fragmented information systems, rendering them vulnerable to loss and inaccessibility (Borglund & Öberg, 2017; Niu, 2014). At the same time, the Global South has increasingly developed alternative models of digital preservation that priorities inclusivity, interoperability, and policy-driven collaboration rather than resource-intensive technological solutions (Ocón, 2021; García & Wolski, 2022). These approaches highlight the importance of aligning digital preservation with institutional governance, cultural context, and long-term sustainability (Duff & Harris, 2021; Haux, 2020).

Indonesia offers a particularly relevant case for examining the role of digital curation in preserving scientific memory. The establishment of the National Research and Innovation Agency (BRIN) in 2021 marked a major reconfiguration of the national research ecosystem, consolidating research institutions and their associated records under a single organizational framework. Parallel to this transformation, the National Archives of Indonesia (ANRI) has developed the National Archival Information Network (Jaringan Informasi Kearsipan Nasional—JIKN) as a federated digital infrastructure designed to integrate archival holdings across government bodies, research institutions, and other public organizations. JIKN facilitates archival interoperability through standardized metadata, provenance control, and open-access mechanisms, enabling broader public engagement with national documentary heritage (Noor & Grataridarga, 2019; Zahara & Salim, 2022).

Within this national archival ecosystem, the Kartini Nuclear Reactor Archives constitute a significant body of scientific heritage. Constructed between 1974 and 1979, the Kartini Reactor—an acronym for Karya Teknisi Indonesia—symbolized Indonesia's early efforts to develop indigenous scientific and technological expertise in nuclear research (Soentono & Arbie, 1994). The records documenting its design, construction, and inauguration include photographs, technical reports, and official correspondence that reflect both scientific practice and broader national aspirations for technological self-reliance. Over time, however, these records became dispersed across institutional boundaries and physical storage environments, limiting their accessibility and interpretive potential.

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The digital curation of the Kartini Nuclear Reactor Archives through JIKN represents a concerted effort to preserve, contextualize, and publicly communicate this scientific legacy. Through digitization, structured metadata, and narrative contextualization, the project seeks to reconstruct archival provenance while enabling broader access and interpretive engagement. This process aligns with contemporary understandings of archival representation as a performative act that simultaneously preserves evidential integrity and reinterprets records within new socio-technical contexts (Ketelaar, 2017; Pacheco, 2023). By embedding scientific archives within a national digital network, the initiative transforms static documentation into a communicative and participatory form of heritage (Gilliland & McKemmish, 2016; Russo & Watkins, 2019).

From the perspective of collective memory, the Kartini Reactor initiative illustrates how archives function as active agents in shaping shared understandings of the past. Collective memory is not a fixed repository of facts, but a socially mediated process sustained through institutions, technologies, and narrative practices (Assmann, 2011). Digital archives and virtual exhibitions amplify this process by enabling users to interact with historical materials in new ways, fostering public engagement and educational use (Velhinho, 2023). In this sense, digital curation operates at the intersection of scientific preservation and cultural remembrance, reinforcing the role of archives in constructing national identity and scientific heritage (Duff & Harris, 2021).

Accordingly, this study aims to analyze how digital curation practices contribute to the preservation and communication of scientific memory through the case of the Kartini Nuclear Reactor Archives within the National Archival Information Network. This study draws on an empirical analysis of a curated dataset of digitised archival photographs presented through a virtual exhibition on the JIKN platform. Using a qualitative descriptive approach, the study examines the curatorial workflow collaboratively implemented by BRIN and ANRI and evaluates its outcomes in terms of accessibility, authenticity, engagement, and sustainability. By situating this case within broader debates on digital curation, archival representation, and collective memory, the article contributes to an understanding of how national archival infrastructures in developing contexts can sustain scientific heritage while expanding public access and long-term stewardship.

## LITERATURE REVIEW

### Digital Curation in Archival and Information Science

Digital curation has become a central concept in archival and information science as institutions confront the challenges of preserving digital and digitized materials over extended timeframes. Early conceptualization's framed digital curation as a lifecycle-based process encompassing selection, preservation, and access (Higgins, 2008; Niu, 2014). Within this framework, curation extends beyond technical preservation to include appraisal, metadata creation, and ongoing management to ensure that digital objects remain usable and meaningful despite technological change.

Subsequent research has emphasized the socio-technical nature of digital curation, highlighting the interplay between technological infrastructures, institutional policy, and

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professional judgement. Faniel and Yakel (2017) demonstrate that effective digital curation requires close alignment between data practices and archival principles, particularly in research-intensive environments. Similarly, Post, Hedges, and Green (2021) argue that digital curation is inherently collaborative, involving negotiations among archivists, information professionals, system designers, and users. These studies underscore that digital curation is not a static technical solution, but an ongoing institutional practice shaped by organizational contexts and social expectations.

More recent scholarship reframes digital curation as a form of memory work, foregrounding its role in mediating how knowledge is remembered and communicated (Brien, 2023). Brien and Yakel (2022) extend this perspective by conceptualizing digital archives as memory infrastructures, in which curatorial decisions actively influence interpretation, visibility, and reuse. This shift moves digital curation beyond preservation-oriented discourse toward a broader cultural and epistemological understanding of archives as agents in shaping collective remembrance.

**Archival Representation, Metadata, and Authenticity**

Archival representation plays a critical role in ensuring the authenticity and interpretive reliability of digital archives. Representation encompasses the descriptive, structural, and contextual elements through which records are organized and made intelligible to users (Yakel, 2019). In digital environments, this process relies heavily on metadata standards, controlled vocabularies, and descriptive frameworks that reconstruct provenance and contextual relationships.

Gilliland (2020) emphasizes that archival representation is foundational to maintaining trust in digital archives, particularly as records are transformed into digital surrogates. The loss of physical cues associated with original records heightens the importance of metadata in conveying evidential integrity. Pacheco (2023) further argues that digital authenticity depends on the ability of metadata to document both provenance and curatorial intervention, enabling users to understand how records have been selected, transformed, and contextualized.

The concept of archival description as a performative act has gained traction in recent literature. Ketelaar (2017) contends that description does not merely reflect archival reality but actively constructs meaning by framing how records are encountered and interpreted. Sköld (2022) extends this argument through the notion of paradata, emphasizing the ethical importance of documenting decision-making processes in digital transformation. Together, these perspectives position archival representation as both an epistemological and ethical practice, central to sustaining authenticity in digital curation initiatives.

**Digital Archives and Collective Memory**

The relationship between archives and collective memory has been extensively explored within memory studies and archival theory. Assmann (2011) conceptualizes collective memory as a socially mediated process sustained through institutions, cultural practices, and material infrastructures. Within this framework, archives function as memory institutions that both preserve traces of the past and shape how societies remember them.

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In the digital age, this relationship has become increasingly dynamic. Digital archives, virtual exhibitions, and participatory platforms enable new forms of interaction with archival materials, transforming users from passive recipients into active participants in memory construction (Russo & Watkins, 2019; Velhinho, 2023). Duff and Harris (2021) argue that digital environments amplify the social life of archives, allowing records to circulate beyond institutional boundaries and acquire new meanings through reuse and reinterpretation.

Gilliland and McKemmish (2016) introduce the concept of participatory archives to describe models that invite broader community engagement in archival processes. Such approaches challenge traditional custodial paradigms by emphasizing shared authority, inclusivity, and transparency. Within scientific and research archives, participatory practices also contribute to science communication and public understanding, enabling technical documentation to be reframed as cultural and educational heritage (Brien, 2023).

**Digital Curation in the Global South and National Archival Infrastructures**

Scholarly attention to digital curation in the Global South highlights distinctive challenges related to resource constraints, institutional fragmentation, and uneven technological capacity. Borglund and Öberg (2017) note that many digital preservation models developed in Western contexts are difficult to implement in developing countries without significant adaptation. However, recent studies emphasize that Global South contexts also foster innovative, policy-driven approaches grounded in collaboration and sustainability (Ocón, 2021; García & Wolski, 2022).

National archival infrastructures play a crucial role in addressing these challenges. Haux (2020) argues that sustainable digital preservation depends on governance frameworks that integrate technology, policy, and institutional accountability. In Southeast Asia, initiatives such as Malaysia's electronic heritage programmes and regional scientific digital archives demonstrate how state coordination can support long-term preservation and access (Esmaeili et al., 2015; Kong & Phoothong, 2018). Indonesian studies similarly highlight the role of national platforms in harmonizing metadata practices and expanding archival accessibility (Noor & Grataridarga, 2019; Zahara & Salim, 2022).

Despite these advances, gaps remain in the literature regarding how national archival networks operationalize digital curation as a mechanism for preserving scientific memory. While existing research addresses technical infrastructure and policy alignment, fewer studies examine how curatorial workflows, metadata practices, and narrative contextualization collectively contribute to authenticity, engagement, and sustainability within scientific archives.

**Research Gap and Analytical Positioning**

Building on the above literature, this study addresses a critical gap at the intersection of digital curation, archival representation, and collective memory within a national archival infrastructure. Existing scholarship provides strong theoretical foundations for understanding digital curation and memory, yet empirical analyses of scientific archives curated within integrated national networks—particularly in developing-country contexts—remain limited.

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By examining the digital curation of the Kartini Nuclear Reactor Archives within the National Archival Information Network, this research contributes empirical insight into how digital curation practices can transform scientific records into sustainable infrastructures of collective memory.

## METHODS

This study adopts a qualitative descriptive approach to examine how digital curation practices contribute to the preservation and communication of scientific memory within a national archival infrastructure. A qualitative design is appropriate because the research seeks to interpret curatorial processes, archival representation, and institutional practices rather than to measure variables or test causal relationships. Within archival and information science, qualitative methods are commonly employed to analyze socio-technical systems, curatorial decision-making, and the cultural dimensions of digital preservation (Yakel, 2019; Post, Hedges, & Green, 2021).

The study focuses on the Kartini Nuclear Reactor Archives as a purposively selected case due to their historical, scientific, and symbolic significance within Indonesia's research heritage. Constructed between 1974 and 1979, the Kartini Nuclear Reactor represents one of Indonesia's earliest efforts to develop domestic expertise in nuclear science and technology (Soentono & Arbie, 1994). The archives documenting its design, construction, and inauguration consist of photographs, technical reports, and official correspondence that reflect both scientific practice and institutional decision-making. These records have been digitized and curated through collaboration between the National Research and Innovation Agency (BRIN) and the National Archives of Indonesia (ANRI) and subsequently integrated into the National Archival Information Network (Jaringan Informasi Kearsipan Nasional—JIKN).

The primary data set comprises thirty-six digitized archival photographs curated as part of the Kartini Nuclear Reactor virtual exhibition on the JIKN platform. These materials were originally created by the former National Atomic Energy Agency (BATAN) during the operational phase of the reactor between 1974 and 1979 and are now publicly accessible through the national archival system. Secondary data include institutional policy documents, metadata guidelines, and scholarly literature on digital curation, archival representation, and collective memory (Higgins, 2008; Gilliland, 2020; Pacheco, 2023; Pasqui, 2024), which provide conceptual and contextual grounding for the analysis.

The analytical framework integrates principles of archival representation with the Digital Curation Centre (DCC) Lifecycle Model (Higgins, 2008). This framework conceptualizes digital curation as a continuous process encompassing appraisal, metadata creation, preservation, access, and reuse, while emphasizing the role of representation in maintaining provenance and authenticity (Yakel, 2019; Gilliland, 2020). To operationalize this framework, the analysis applies four evaluative dimensions synthesized from contemporary digital heritage scholarship: accessibility, authenticity, engagement, and sustainability (Brien, 2023; Pasqui, 2024; Gucer & Janowiecki, 2023).

The digital curation process analysed in this study follows an operational archival workflow implemented within the JIKN system. This workflow consists of several stages: (1)

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archival identification and retrieval, (2) archival description through structured metadata assignment, (3) compilation of archival records into a structured dataset, (4) data entry into the SIKN–JIKN system, and (5) dissemination through a virtual exhibition format. These stages reflect the practical implementation of digital curation within a national archival infrastructure and provide the empirical basis for analysing how archival materials are transformed into accessible and interpretable digital resources.

The operational workflow of digital curation applied in this study is summarized in Table 1.

TABLE 1
Digital Curation Workflow of the Kartini Reactor Archives

| Phase | Core Activities | Empirical Basis | Outputs | Reference |
|---|---|---|---|---|
| Archival Identification | Identification and retrieval of archival materials related to the Kartini Nuclear Reactor construction | Archival records produced by BATAN (1974–1979) | 36 digitized archival photographs selected for curation | Brien (2023) |
| Metadata Description | Assignment of structured metadata fields (unique code, title, date, level of description, extent and media, creator, managing institution) following hierarchical archival levels (fonds–item) | SIKN–JIKN metadata schema applied across all records | Standardized metadata ensuring provenance, classification, and interoperability | Pacheco (2023) |
| Archival Listing | Compilation of archival records into a structured dataset based on descriptive metadata | Metadata records derived from 36 archival items | Organized archival dataset supporting analysis and retrieval | Gilliland (2020) |
| System Entry | Entry of archival data into the SIKN–JIKN system and integration within the national archival platform | JIKN digital platform interface and archival system | Digitally accessible archival records within an integrated system | Noor & Grataridarga (2019) |
| Exhibition and Dissemination | Development of virtual exhibition including narrative contextualization, thematic grouping, and public presentation | JIKN virtual exhibition "Menyingkap Jejak Reaktor Nuklir Kartini" | Public-facing digital exhibition with recorded user interaction | Ketelaar (2017) |

Archival description constitutes a central stage in this workflow and involves assigning standardized metadata fields aligned with the SIKN–JIKN schema. These include unique archival codes reflecting hierarchical levels of description (fonds, subfonds, series, file, and item), title, date of creation, level of description, extent and media, descriptive notes, creator (Badan Tenaga Nuklir Nasional/BATAN), and managing institution (Badan Riset dan Inovasi Nasional/BRIN). The resulting metadata structures enable the reconstruction of provenance, contextual relationships, and classification systems within the digital archival environment (Pacheco, 2023).

Data analysis was conducted through a qualitative interpretive process combining metadata assessment, content and narrative analysis, and comparative reflection. Each archival photograph, together with its associated metadata and exhibition caption, was treated as a unit of analysis. Metadata assessment involved examining the presence and consistency of key descriptive elements (e.g., creator, date, classification code, and institutional attribution) across all 36 records in accordance with the SIKN–JIKN schema, focusing on how these elements support provenance reconstruction and archival authenticity (Pacheco, 2023).

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Content and narrative analysis were conducted through iterative thematic coding applied across the entire dataset. This process identified recurring themes related to construction processes, labour practices, and technological infrastructure, as well as broader narratives of scientific development, national identity, and technological self-reliance. These themes were derived inductively from the visual and textual materials and subsequently interpreted in relation to the four evaluative dimensions applied in this study.

The results of these analyses were then analytically mapped onto the dimensions of accessibility, authenticity, engagement, and sustainability, enabling a systematic interpretation of how digital curation practices operate in practice within the JIKN platform. Comparative reflection was used to situate the findings within broader Global South digital curation practices, drawing on insights from comparable initiatives to contextualize the Indonesian case (Ocón, 2021; Wong & Chiu, 2024).

All materials analyzed in this study are publicly accessible and do not contain confidential or sensitive information. Proper attribution to custodial institutions—BRIN and ANRI—was maintained, and original metadata and archival narratives were not altered, ensuring respect for provenance integrity and professional archival ethics (Gilliland & McKemmish, 2016).

## FINDINGS

This section presents the empirical findings derived from the analysis of the digital curation of the Kartini Nuclear Reactor Archives within the National Archival Information Network (JIKN). The findings are organized according to the four evaluative dimensions applied in this study: accessibility, authenticity, engagement, and sustainability. These dimensions reflect how digital curation practices operate in practice and how scientific archives are transformed into accessible, interpretable, and sustainable digital resources.

TABLE 2
Four-Dimensional Evaluation of Digital Curation Outcomes

| Dimension | Evaluation Focus | Key Findings | Supporting Evidence |
|---|---|---|---|
| Accessibility | Discoverability and public access | Accessibility is enhanced through the consistent application of structured metadata and visual archival materials | All 36 records are retrievable via standardized metadata fields (title, date, creator, classification); visual documentation supports intuitive access |
| Authenticity | Provenance integrity | Metadata structures systematically preserve provenance and contextual relationships | Each record includes unique code, creator (BATAN), managing institution (BRIN), date, and level of description |
| Engagement | Public interaction | The virtual exhibition enables measurable and interpretive user engagement | 320 user accesses recorded (Aug–Sep 2025); narrative captions and thematic grouping support interpretation |
| Sustainability | Institutional continuity | Sustainability is supported through standardized metadata and integration within national archival infrastructure | Integration within JIKN platform and use of SIKN metadata schema ensure interoperability and continuity |

### Accessibility

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The integration of the Kartini Nuclear Reactor Archives into the National Archival Information Network (JIKN) has significantly expanded access to Indonesia's scientific heritage. Prior to digitization, archival records related to the reactor were dispersed across institutional repositories and were predominantly accessible only through on-site consultation. Such conditions limited public visibility and constrained the use of scientific archives for research, education, and broader societal engagement.

Based on the analysis of 36 digitized archival photographs, accessibility is enhanced through the application of structured metadata aligned with the SIKN–JIKN schema. Each record includes descriptive elements such as title, date, creator, institutional provenance, and classification, which enable users to locate and retrieve records efficiently via keyword searches and thematic navigation. For example, archival records consistently identify *Badan Tenaga Nuklir Nasional (BATAN)* as the creator and include structured identification codes, allowing users to understand the institutional origin and context of each item. Accessibility in this context extends beyond technical availability to include semantic clarity, enabling users to interpret the historical and scientific significance of the records within their original institutional framework.

The use of digitized visual archives further enhances accessibility by providing immediate and intuitive entry points to complex scientific histories. All items in the dataset consist of photographic records documenting stages of the reactor's construction. As illustrated in Figure 1, the archival photograph depicting manual excavation during the foundation-laying phase shows workers using simple tools and manual labor techniques. This image illustrates the technological conditions and labor practices involved in the early construction process, providing concrete visual evidence that complements and enriches textual interpretation. Such visual representation enables non-specialist users to understand scientific and technical processes more easily.

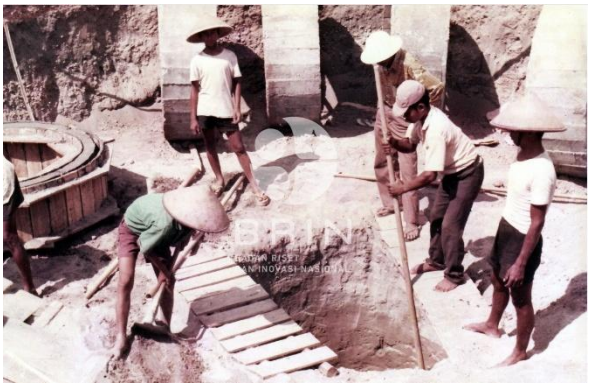

Figure 1. Digitized archival photograph showing manual excavation during the foundation-laying phase of the Kartini Nuclear Reactor construction (source: National Archival Information Network – JIKN, https://jikn.anri.go.id/deskripsi-arsip/1-penggalian-tanah-peletakan-pondasi-paku-bumi-dilakukan-pekerja-secara-manual)

By presenting these images within JIKN's digital interface, scientific archives become more approachable while remaining valuable sources of evidence for research. The findings suggest that accessibility achieved through JIKN is both technical and interpretive in nature. By combining open digital access with structured metadata and visual documentation, the

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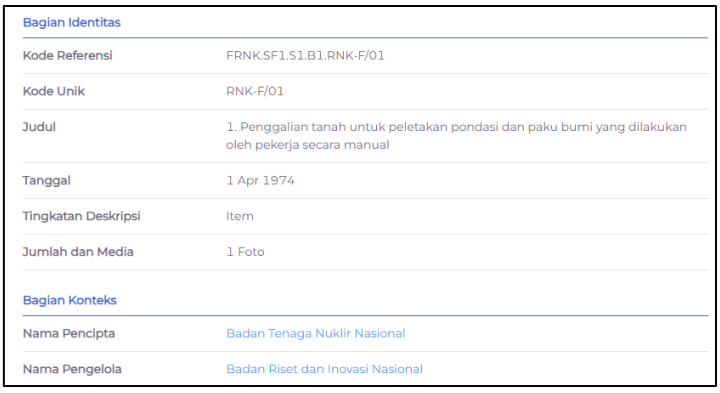
digital curation of the Kartini Nuclear Reactor Archives enables users to engage with scientific records as part of a coherent national archival system. This approach supports broader public understanding of Indonesia's scientific development while reinforcing the role of national archival infrastructure in mediating access to scientific memory.

**Authenticity**

Authenticity constitutes a core outcome of the digital curation process applied to the Kartini Nuclear Reactor Archives. The findings indicate that the integration of these archives into the National Archival Information Network (JIKN) effectively preserves provenance, contextual integrity, and evidential reliability throughout the digitization and dissemination process.

Based on the analysis of 36 digitized archival photographs, each item is explicitly linked to its originating institution and archival series through structured metadata aligned with the SIKN–JIKN schema. Key descriptive elements—including creator, date of creation, institutional unit, and classification code—enable the reconstruction of provenance relationships that might otherwise be obscured during digital transformation. This metadata structure ensures that digital surrogates retain a clear connection to their original context of creation and use, reinforcing trust in the authenticity of the records.

As illustrated in Figure 2, a representative metadata record includes a unique archival code (RNK-F/01), a descriptive title, date of creation (1 April 1974), level of description (item), media type (photograph), and explicit attribution to the creator (*Badan Tenaga Nuklir Nasional/BATAN*) and managing institution (*Badan Riset dan Inovasi Nasional/BRIN*). The presence of these elements demonstrates how provenance and custodial responsibility are preserved within the digital environment. The distinction between creator and managing institution further enables users to understand both the origin and current stewardship of the archival record.



| Bagian Identitas | |
|---|---|
| Kode Referensi | FRNK.SF1.S1.B1.RNK-F/01 |
| Kode Unik | RNK-F/01 |
| Judul | 1. Penggalian tanah untuk peletakan pondasi dan paku bumi yang dilakukan oleh pekerja secara manual |
| Tanggal | 1 Apr 1974 |
| Tingkatan Deskripsi | Item |
| Jumlah dan Media | 1 Foto |
| **Bagian Konteks** | |
| Nama Pencipta | Badan Tenaga Nuklir Nasional |
| Nama Pengelola | Badan Riset dan Inovasi Nasional |

Figure 2. Example of a metadata record from the Kartini Nuclear Reactor Archives on the JIKN platform, displaying unique archival code, title, date, level of description, creator (BATAN), and managing institution (BRIN).

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The findings further show that authenticity is supported not only through technical metadata but also through contextual descriptions that explain the function and historical background of the records. Such descriptive practices allow users to distinguish between original records and their digital representations, while also understanding the institutional and operational circumstances under which the records were produced.

Visual and descriptive transparency also plays a role in sustaining authenticity. The presentation of archival images alongside explanatory captions enables users to interpret visual evidence within its proper historical and organizational context. Rather than isolating images as illustrative artefacts, JIKN situates them within an archival framework that foregrounds provenance and custodial responsibility.

Overall, the findings demonstrate that authenticity within JIKN is achieved through the combined application of metadata standardization, provenance documentation, and contextual description. These mechanisms ensure that the Kartini Nuclear Reactor Archives remain trustworthy sources of scientific evidence while being transformed into accessible digital resources. Authenticity, in this sense, is not diminished by digitization but is actively reinforced through systematic digital curation practices embedded within a national archival infrastructure.

**Engagement**

The findings indicate that digital curation through the National Archival Information Network (JIKN) enables meaningful public engagement with the Kartini Nuclear Reactor Archives. Through the virtual exhibition format, scientific records that were previously accessible only to specialized audiences are re-presented in a narrative and interpretive structure that supports broader understanding and interaction. During its exhibition period from 1 August to 30 September 2025, the virtual exhibition *"Menyingkap Jejak Reaktor Nuklir Kartini di Yogyakarta"* recorded 320 user accesses, indicating measurable public interaction with the curated archival materials.

Engagement is facilitated through thematic organization and descriptive captions that contextualize technical and historical information. Rather than presenting archival records as isolated documents, the exhibition arranges the 36 photographic records into coherent storylines related to the construction process, institutional collaboration, and technological development of the Kartini Nuclear Reactor. This narrative structure allows users to navigate the archival materials intuitively and to connect individual records with broader scientific and national contexts.

As illustrated in Figure 3, the virtual exhibition interface presents a clearly structured layout, including the exhibition title, institutional attribution, and visual preview of selected archival materials. This design functions as an entry point that frames user interaction with the archival content. The integration of visual elements, thematic grouping, and interface design supports interpretive engagement by guiding users through the archival narrative.

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Figure 3. Interface of the Kartini Nuclear Reactor virtual exhibition on the JIKN platform, showing the exhibition title, institutional attribution, and visual layout of digitized archival materials (source: JIKN platform).

The findings further show that visual materials play a central role in enhancing engagement. Digitized photographs documenting construction activities, technical processes, and working conditions provide concrete entry points for users to explore scientific history. These visual records support interpretive engagement by translating abstract or technical concepts into accessible visual evidence, thereby reducing barriers to understanding for non-specialist audiences.

The JIKN platform also supports engagement through its digital interface, which allows users to browse and explore archival materials within an integrated environment. The combination of visual presentation, narrative context, and open access transforms scientific archives into interactive learning resources rather than static repositories. As a result, engagement is not limited to passive viewing but extends to interpretive exploration and educational use.

Overall, the findings suggest that engagement achieved through JIKN is closely linked to the communicative design of the digital curation process. By integrating visual archives, thematic narratives, and user-oriented interface design, the Kartini Nuclear Reactor Archives function as accessible and engaging representations of Indonesia's scientific heritage within a national archival network.

**Sustainability**

The findings indicate that sustainability in the digital curation of the Kartini Nuclear Reactor Archives is supported through institutional integration and standardized archival practices within a national framework. The collaboration between the National Research and Innovation Agency (BRIN) and the National Archives of Indonesia (ANRI) enables the management and dissemination of archival materials through the JIKN platform, ensuring continuity of access within an integrated archival system.

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The use of structured metadata aligned with the SIKN–JIKN schema plays a key role in supporting sustainability. As observed across the dataset of 36 archival items, each record is consistently described using standardized fields such as unique archival codes, titles, dates, creator attribution (BATAN), and managing institution (BRIN). This standardization enables interoperability across archival systems and ensures that digital records remain interpretable and reusable over time.

Institutional sustainability is further reflected in the integration of the virtual exhibition within the broader SIKN–JIKN ecosystem. Although the exhibition period has ended, system records maintained by BRIN indicate that the exhibition *"Menyingkap Jejak Reaktor Nuklir Kartini di Yogyakarta"* reached 320 user accesses during its active period (August–September 2025). The preservation of these records within the system demonstrates that user interaction data and archival content are retained as part of the institutional digital infrastructure.

As illustrated by the JIKN platform interface, the integration of multiple exhibitions within a single system further indicates an ongoing institutional commitment to digital curation and public access. The presence of comparable exhibitions within the same platform suggests that the Kartini Reactor Archives are part of a broader, sustained digital archival programme rather than an isolated initiative.

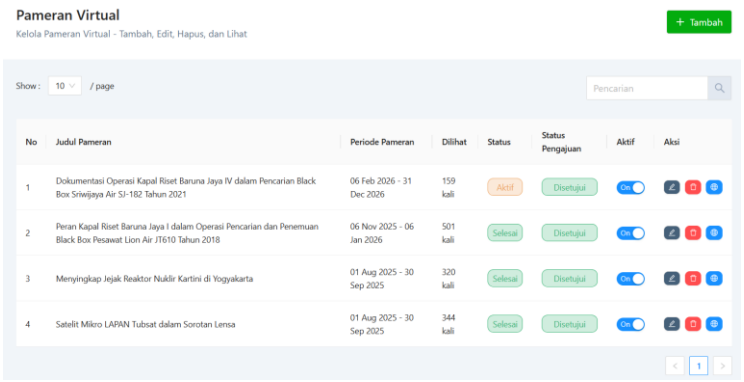


Figure 4. List of virtual exhibitions within the JIKN platform, showing the Kartini Nuclear Reactor exhibition alongside other curated digital archival programmes (source: SIKN–BRIN system interface).

Overall, the findings suggest that sustainability in this case is achieved through the combination of metadata standardizations, institutional collaboration, and integration within a national archival infrastructure. While this study does not evaluate long-term preservation outcomes beyond the platform level, the observed alignment between metadata practices, institutional roles, and system integration indicates a structured and policy-driven approach to sustaining digital scientific archives.

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## DISCUSSION

The findings of this study demonstrate that digital curation within a national archival network can effectively transform scientific archives into accessible, trustworthy, and engaging infrastructures of collective memory. By examining the Kartini Nuclear Reactor Archives curated through the National Archival Information Network (JIKN), this study provides empirical support for theoretical arguments that position digital curation as both a technical and cultural practice embedded within institutional governance (Higgins, 2008; Gilliland, 2020; Brien, 2023). The analysis of 36 digitized archival photographs, associated metadata, and exhibition narratives shows how these processes operate in practice within a specific national archival context.

### Accessibility as Mediated Access to Scientific Memory

The enhanced accessibility observed in the Kartini Reactor case confirms that digital curation extends beyond the provision of online access. As demonstrated in the findings, structured metadata aligned with the SIKN–JIKN schema enables not only discoverability but also semantic clarity, allowing users to understand scientific records within their institutional and historical contexts. The consistent use of metadata elements such as creator attribution (BATAN), archival codes, and classification fields across the dataset illustrates how accessibility is supported through structured representation rather than mere digitization. This aligns with Yakel's (2019) argument that archival representation in digital systems plays a decisive role in shaping how users encounter and interpret records. This suggests that accessibility in digital archival systems is not merely a function of availability, but is actively constructed through representational practices that shape how users interpret scientific records.

The use of digitized visual archives further supports Pasqui's (2024) preservation-by-design principle, in which access and sustainability are embedded at the point of curation rather than treated as post-hoc considerations. In this case, the exclusive use of photographic records enables intuitive interpretation of scientific processes, particularly for non-specialist audiences. Accessibility therefore functions as a mediated process rather than a purely technical feature, reinforcing Faniel and Yakel's (2017) observation that meaningful access depends on the integration of metadata, context, and user-oriented design.

### Authenticity, Provenance, and Trust in Digital Archives

The findings related to authenticity underscore the continuing relevance of archival principles of provenance and original context in digital environments. Through structured metadata, classification codes, and custodial attribution, the Kartini Reactor Archives retain clear evidential links to their originating institution. The example of records containing unique identifiers (e.g., RNK-F/01), creator attribution (BATAN), and managing institution (BRIN) demonstrates how provenance is reconstructed within the digital environment, supporting what Pacheco (2023) describes as metadata-based reconstruction of authenticity. This demonstrates that digitization, when guided by archival representation, does not erode authenticity but can actively reinforce it. This finding highlights that authenticity in digital environments is not

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passively preserved but actively produced through structured metadata and curatorial intervention.

Ketelaar's (2017) notion of archival description as a performative act is particularly relevant here. By documenting curatorial decisions and contextualizing records within JIKN, the digital archive performs authenticity as an ongoing practice rather than a fixed attribute. This perspective is further strengthened by Sköld's (2022) emphasis on paradata and ethical transparency in digital transformation, highlighting the importance of documenting not only records but also the processes that shape their representation.

**Engagement and Digital Curation as Memory Work**

Engagement emerges as a defining dimension of digital curation in this study. The findings show that narrative contextualization and virtual exhibition design enable scientific archives to function as communicative heritage rather than static documentation. This is evidenced by the organization of 36 photographic records into thematic narratives and the recorded 320 user accesses during the exhibition period, indicating measurable interaction with the archival content. This supports Brien's (2023) conceptualization of digital curation as memory work, in which curatorial practices actively mediate between archival evidence and public understanding. This indicates that digital curation transforms scientific archives into communicative resources, where engagement is shaped by narrative design rather than mere availability of records.

The Kartini Reactor virtual exhibition exemplifies what Gilliland and McKemmish (2016) describe as participatory archival environments, where users engage with records through interpretation and exploration rather than passive consumption. Visual materials play a crucial role in this process, translating technical and institutional histories into accessible representations that support learning and reflection. As Russo and Watkins (2019) argue, such communicative strategies enhance the cultural and educational value of digital heritage initiatives.

From a collective memory perspective, these findings resonate with Assmann's (2011) view of memory as a socially mediated process sustained through institutions and technologies. By situating scientific records within a narrative and visual framework, digital curation contributes to the construction of shared understandings of Indonesia's scientific past, reinforcing the symbolic significance of the Kartini Reactor as a milestone in national technological development.

**Sustainability and National Archival Governance**

Sustainability in this study is achieved through the alignment of digital curation practices with institutional collaboration and national governance structures. The integration of scientific archives into JIKN illustrates Haux's (2020) argument that sustainable digital preservation depends on policy ecosystems rather than isolated technical solutions. The consistent application of SIKN–JIKN metadata standards across the dataset demonstrates how standardization supports long-term interpretability and reuse of digital records. This suggests

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that sustainability in digital curation is less dependent on technological sophistication and more on institutional coordination and standardized practices.

This finding aligns with studies from the Global South that emphasize the importance of coordinated, policy-driven infrastructures in resource-constrained contexts (Ocón, 2021; García & Wolski, 2022). Rather than replicating preservation models developed in Western institutional settings, Indonesia's approach demonstrates how national archival networks can support sustainability through standardization, institutional accountability, and open access. Similar patterns have been observed in other Southeast Asian contexts, suggesting the emergence of regionally distinctive models of digital archival governance (Noor & Grataridarga, 2019; Zahara & Salim, 2022).

**Integrative Implications**

Taken together, the discussion confirms that the four evaluative dimensions—accessibility, authenticity, engagement, and sustainability—are deeply interrelated rather than independent outcomes. Digital curation operates as an integrative practice that simultaneously addresses technical preservation, evidential trust, public communication, and institutional continuity. This multidimensional character supports Gilliland's (2020) argument that digital archives should be understood as socio-technical infrastructures embedded within cultural and political contexts. This study demonstrates that these dimensions are co-produced through the same curatorial processes. In particular, metadata standardization simultaneously supports accessibility, authenticity, and sustainability, while narrative design bridges accessibility and engagement.

By empirically examining the Kartini Nuclear Reactor Archives, this study extends existing literature on digital curation and collective memory by demonstrating how scientific archives can be mobilized within a national archival network to sustain long-term access and meaning. The findings contribute to ongoing debates on the role of archives in shaping scientific heritage and national memory, particularly within developing-country contexts where institutional coordination and policy alignment play a central role. It further shows that operational archival workflows within national infrastructures shape not only access to scientific archives, but also their interpretation and public significance.

## CONCLUSIONS

This study has examined how digital curation within a national archival network contributes to the preservation and communication of scientific memory through the case of the Kartini Nuclear Reactor Archives integrated into the National Archival Information Network (JIKN). By applying a qualitative descriptive approach and a four-dimensional evaluative framework—accessibility, authenticity, engagement, and sustainability—the study demonstrates that digital curation can transform scientific archives into accessible, trustworthy, and meaningful resources for both research and public engagement.

The findings indicate that accessibility is enhanced not merely through digitization, but through the integration of structured metadata, visual archives, and narrative contextualization that support interpretive understanding. Authenticity is sustained through provenance

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documentation, standardized description, and custodial transparency, ensuring that digital surrogates retain their evidential value within a networked archival environment. Engagement is facilitated through narrative-driven virtual exhibition design, while sustainability is supported through institutional collaboration and alignment with national archival governance frameworks.

Taken together, these results highlight that digital curation functions as an integrative practice rather than a series of isolated technical interventions. The Kartini Reactor case demonstrates that national archival infrastructures can simultaneously support access, trust, engagement, and long-term preservation, positioning scientific archives as active components of collective memory.

This study contributes to the digital curation literature by showing how operational archival workflows within a national infrastructure shape not only access to scientific records, but also their interpretation and public significance.

While this study is limited to a single case, it offers insights that are transferable to other scientific archival initiatives seeking to balance preservation, accessibility, and public engagement within national or federated archival systems. Future research could extend this analysis through comparative studies across institutions or countries, as well as through empirical assessment of user interaction and educational impact within digital archival platforms.

Overall, the findings underscore the importance of aligning metadata practices, institutional governance, and interpretive design in sustaining scientific heritage in digital environments.

## AUTHOR CONTRIBUTIONS

The author solely conceived the study, conducted the analysis, interpreted the findings, and wrote the manuscript. The author also reviewed and approved the final version of the manuscript.

## CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest that could have influenced the outcomes of this research. No financial interests or personal relationships relevant to this article have been reported. The authors are committed to upholding the integrity of the research and ensuring that the findings presented are objective and free from external influence.

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