

Unlocking Southeast Asia's digital heritage

discovery, partnerships, and engagement

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ABSTRACT

National University of Singapore (NUS) Libraries' digitisation and digital stewardship programme expands open access to rare and unique Southeast Asian materials while ensuring long-term usability, trustworthiness, and preservation. This paper traces the shift from ad-hoc digitisation to a coordinated, standards-based programme anchored by Digital Gems, NUS Libraries' public gateway to digitised special collections. It argues that metadata is the operational backbone linking workflows, multilingual description and authority control, rights and ethics review, interoperability (stable identifiers, APIs, OAI-PMH harvesting), user experience, aggregation, and preservation actions. The paper also examines partnership models – loan-and-return digitisation with rights holders and co-creation with NUS units and regional collaborators – that responsibly expand collections and enrich context. Finally, it shows how engagement through teaching, research, exhibitions, and outreach moves collections from "available" to "used," generating educational and scholarly impact and encouraging further donations. It concludes with practical lessons: align discovery with preservation, adopt community standards, design for interoperability, foreground rights and ethics, and invest in partnerships and outreach to sustain living digital heritage.

KEYWORDS digitisation; metadata; preservation

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1. Introduction: why a Southeast Asia resource hub

NUS Libraries aims to be a leading Southeast Asia resource hub by expanding discovery and access to primary sources that support teaching, research, and public understanding of the region. Southeast Asia's documentary heritage is widely dispersed and often fragile, under-described, and difficult to consult – challenges compounded by multilingual materials, diverse scripts, and shifting historical geographies. Digitisation therefore functions not only as conversion, but as an institutional strategy for access, stewardship, and scholarly enablement.

Two anchor collections shape this work: the Singapore/Malaysia Collection (SMC), a long-developed research collection on Singapore, Malaysia, and ASEAN ([Lee, 2025](#)), and the Chinese Southeast Asia Collection, which includes extensive runs of Chinese-language newspapers and periodicals, commemorative publications, school records, genealogies, and community histories ([Sim, 2025](#)). Together with NUS Libraries' broader holdings – manuscripts, rare books, private papers, maps, photographs, ephemera, and audiovisual materials – these resources support research ranging from colonial administration and socio-political change to migration networks and cultural life.

Digitisation reduces physical handling and widens access, but it also introduces long-term responsibilities: rights and ethics review, durable identifiers, reliable metadata, interoperable delivery, and preservation. This paper presents NUS Libraries' programme through three reinforcing pillars – discovery, partnerships, and engagement – anchored by Digital Gems, the Libraries' public gateway to digitised special collections. It argues that standards-based metadata is the operational backbone that connects workflows, multilingual description, integrations, user experience, aggregation, and preservation, and that partnerships and outreach are essential to keep digital heritage not only available, but actively used.

2. From ad-hoc to programmatic digitisation

Digitisation programmes often begin with opportunistic projects driven by available funding, equipment, or immediate demand. NUS Libraries' trajectory has similarly included early projects that were valuable but not yet integrated into a coordinated pipeline. Over time, the Libraries' approach has shifted from isolated digitisation efforts to a programme with clearer governance, selection criteria, metadata practices, and preservation alignment.

2.1. Early groundwork and the shift to coordination

Earlier digitisation initiatives demonstrated the research value of providing remote access to rare sources. Examples include *Lat Pau* (founded in 1881), recognised as the earliest Chinese-language newspaper in Singapore, and *Journal of Three Voyages* ([Lee, 2025](#)), which captures travel and observation during a period when China was largely closed to foreigners. These projects established proof of concept: digitised collections could be used by scholars beyond campus, could support teaching, and could preserve access to sources otherwise constrained by fragility and reading-room logistics.

The key transition occurred in 2016, when NUS Libraries established the Special Collections Unit to move digitisation from ad-hoc selection to a coordinated programme. The intent was not only to increase the volume of digitisation, but also to improve consistency in imaging practices, metadata creation, rights review, and publication workflows, and to situate digitisation within longer-term preservation planning.

2.2. Capacity building and workflow maturation

Digitisation at scale depends on throughput, quality control, and repeatable processes. In 2018, upgraded scanning infrastructure supported higher output and better image quality, raising throughput to an average of about 12,000 pages per month. Scaling required the library to clarify selection criteria (significance, rarity, condition, demand, rights feasibility, language/script representation) and to strengthen internal coordination between curatorial decision-making, imaging, metadata creation, systems, and user-facing publication.

This shift from ad-hoc to programmatic digitisation also reframed how success is measured. Rather than viewing digitisation as a completed deliverable ("we scanned X pages"), the programme increasingly evaluated outcomes such as discoverability in multiple channels; quality of descriptive metadata; inclusion of rights statements; usability for reading, citation, and teaching; and durability through preservation workflows that support fixity, replication, and future migration.

2.3. Digital Gems as a programme anchor

In 2019, NUS Libraries launched Digital Gems¹, an open gateway to rare and unique materials spanning the humanities, social sciences, and natural sciences ([NUS Libraries, 2020](#)). Digital Gems represents the public interface of the programme and a unifying publication platform for multi-format digitised content. By providing a central access point, Digital Gems also operationalises consistent workflows: items are digitised, described, rights-reviewed, quality-checked, published, and then integrated for discovery via harvesting and other pathways.

3. Metadata as the backbone: discovery, integration, and preservation

Digitisation without metadata produces visibility without findability. For rare and multilingual collections, metadata is not peripheral: it is the backbone that enables discovery, contextual understanding, interoperability, and preservation.

3.1. Metadata for discovery: consistency, authority, multilingual description

Digital collections become useful when users can locate what they need and understand what they find. Discovery depends on consistent application of core descriptive elements such as titles, creators, dates, subjects, and places. Consistency supports meaningful faceting and helps users refine large result sets. It also enables computational use: digital humanities workflows, linked data approaches, and large-scale text analysis require structured and predictable fields.

¹ <https://digitalgems.nus.edu.sg/>

Authority control makes search more accurate by standardising names and places, even when spellings, scripts, or boundaries change. It links different name forms to the same person or place and avoids mixing up different entities with similar names.

Multilingual description matters for Southeast Asian collections. It keeps original scripts while also supporting discovery across languages through translated or transliterated fields and shared vocabularies.

It is also important to record how items relate to each other – such as which collection or series they belong to, and whether they are versions or translations – so users can understand provenance and context.

3.2. Metadata for integration: crosswalks, URIs, APIs, and harvesting

NUS Libraries designs metadata with interoperability in mind. Interoperability requires more than choosing schemas; it requires mapping fields across systems, aligning definitions, and preserving relationships during transformation. The programme uses crosswalks to map elements between schemas while maintaining semantic integrity.

To connect metadata across systems, the Libraries emphasises the use of URIs and stable identifiers so that records can be linked reliably in discovery layers, external portals, and scholarly citations. Stable identifiers also support course links, references in publications, and integrations with external research databases – for example, databases documenting postwar Chinese popular culture in Singapore and Malaya, as reported in *Lianhe Zaobao* ([An, 2025](#)).

Standardised protocols enable machine-to-machine exchange. OAI-PMH supports metadata harvesting so that portals and aggregators can ingest records at scale and keep them updated. This reduces the need for bespoke integrations. A key outcome is that viewers and external discovery services can incorporate NUS Libraries content without custom development, lowering barriers to collaboration and expanding reach.

3.3. Preservation alignment: structure and evidence

Preservation is not only storage; it is the ability to demonstrate authenticity and sustain usability over time. NUS Libraries frames preservation as structure and evidence. Structural metadata keeps complex digital objects intelligible by recording how components relate. Preservation metadata records fixity checks and actions, providing an audit trail that supports trust and accountability. By aligning with established long-term archiving practices, the Libraries aims to ensure that packages can move across systems with minimal effort, reducing vendor lock-in and future migration risk.

4. Digital Gems: the public gateway for open access

Digital Gems is the primary public platform through which NUS Libraries shares digitised special collections. It provides access to rare and unique materials across multiple disciplines and formats, supporting both close reading and broader exploration.

4.1. Scope and highlights

Digital Gems is open to all and includes rare books, manuscripts, private papers, journals, newspapers, drawings, pamphlets, photographs, and maps. It hosts over 30 collections and more than 210,000 items.

Key highlights include

- the *Biodiversity Library of Southeast Asia* (BLSEA)², an open access library of rare and unique biodiversity literature on Southeast Asia drawn from the Lee Kong Chian Natural History Museum (LKCNC) and NUS Libraries ([NUS Libraries, 2017](#)); and
- the *Bugis–Makassar Repository*³, developed with Universitas Muslim Indonesia and NUS Southeast Asian Studies, featuring rare manuscripts, journal-logs, correspondence, and oral histories from South Sulawesi, including the 19th-century Daeng Paduppa journal-log written primarily in Lontara ([NUS Libraries, 2024](#)).

Digital Gems also features major private papers collections, such as

- the Bai Yan collection⁴ – Bai Yan (1920–2019) was a Singapore performing-arts figure – documenting local stage culture through scripts, clippings, and correspondence ([Cai, 2023](#)),
- the Wang Sha private papers⁵ – Wang Sha (1925–1998) was a well-known Singapore comedy and entertainment personality – comprising scripts, costumes/props, recordings, and memorabilia related to popular entertainment ([Sim, Toh & Lin, 2025](#)), and
- the Yeap Chor Ee private papers⁶ – Yeap Chor Ee (1867–1952) was a Penang businessman and philanthropist – containing family and business records that shed light on diasporic enterprise and philanthropy ([Sim et al., 2024](#)).

Digital Gems further includes Guy Charles Madoc's 1943 wartime manuscript *An Introduction to Malayan Birds*⁷; Madoc (1911–1999) is associated with ornithological

² Biodiversity Library of Southeast Asia: <https://digitalgems.nus.edu.sg/browse/collection/50224>

³ Bugis–Makassar Repository: <https://digitalgems.nus.edu.sg/browse/collection/484179>

⁴ Bai Yan collection: <https://digitalgems.nus.edu.sg/browse/collection/67695>

⁵ Wang Sha private papers: <https://digitalgems.nus.edu.sg/browse/collection/508505>

⁶ Yeap Chor Ee private papers: <https://digitalgems.nus.edu.sg/browse/collection/82544>

⁷ *An Introduction to Malayan Birds*: <https://digitalgems.nus.edu.sg/view/466393>

work in Malaya, and the manuscript contributes to the documentation of Malayan birdlife during the wartime period ([NUS Lee Kong Chian Natural History Museum, 2025](#)). More than 100 historical newspapers in Chinese, Malay, and English further strengthen the platform as a source base for research on society, culture, and everyday life in Southeast Asia.

4.2. User experience and discovery features

Digital Gems supports discovery through faceted search by date, creator, subject, place, and language; thumbnails and structural navigation for complex items; deep-zoom viewing; full text search for OCR-enabled newspapers; collection pages that add context; and stable identifiers that support citation and course linking.

4.3. Aggregation and external discovery pathways

Digital Gems is designed to be harvested and integrated. A key example is metadata integration with the National Library Board (Singapore) OneSearch platform ([National Library Board Singapore, n.d.](#)), enabling national-level discovery. Digital Gems metadata is also exposed for harvesting by other aggregators, reducing duplicated effort and widening reach by placing materials where users already search.

5. Governance and workflow: from selection to publication

Sustaining a digitisation programme requires governance that protects materials, ensures ethical and legal compliance, and maintains quality at scale.

Selection balances scholarly value, institutional priorities, and feasibility: significance and rarity; condition and handling; rights status; language and script representation; anticipated use; and partnership potential (e.g., translation and contextualisation). Digitisation follows careful handling protocols, calibrated imaging, and quality control. Metadata creation includes descriptive, administrative, technical, and preservation components. Rights and sensitivity reviews occur prior to publication. After publication, usage and feedback inform iterative improvement.

6. Partnerships: rights holders, departments, and regional collaboration

Partnerships expand access, bring subject expertise into description, and strengthen legitimacy through co-creation and trust.

6.1. Rights holders and loan-and-return

Important heritage sources often remain in private custody. NUS Libraries therefore uses a loan-and-return model where appropriate: materials are loaned for digitisation and returned, while digital surrogates (with agreed rights statements) are made available.

Examples include the Riau Lingga Sultanate Family Papers⁸ – historical documents, manuscripts, and correspondence of the royal family of the Riau–Lingga Sultanate (1824–1911), based on Penyengat Island, which shed light on the administration, culture, literary production, and Islamic intellectual traditions of a Malay polity that later came under Dutch control ([Diyana, 2025a](#)) – and Guy Charles Madoc’s wartime manuscript *An Introduction to Malayan Birds* ([NUS Lee Kong Chian Natural History Museum, 2025](#)). Both were digitised and returned to their owners. These collaborations depend on trust, clear permissions, careful handling, and transparent documentation.

6.2. Internal partnerships within NUS

With the Lee Kong Chian Natural History Museum, BLSEA selects, digitises, and shares biodiversity resources, supporting research, conservation, and teaching. With NUS Geography, historical maps have been scanned and georeferenced under relevant permissions to support spatial analysis⁹ ([NUS Libraries, 2018](#)). With Architecture partners, collections such as Singapore Pioneer Architects¹⁰ preserve early studio materials and student projects that illuminate Singapore’s architectural heritage.

6.3. Flagship external partnership: Bugis–Makassar and Daeng Paduppa

The Bugis–Makassar Repository is a flagship partnership with Universitas Muslim Indonesia (UMI) and NUS Southeast Asian Studies. In October 2023, UMI donated the original Daeng Paduppa manuscript¹¹ to NUS Libraries ([NUS Department of Southeast Asian Studies, 2023](#)). The programme is preserving, digitising, and translating the journal into Indonesian and English for open access via Digital Gems.

Fieldwork in Sulawesi has broadened the initiative to include oral histories with nakhoda and master shipbuilders, documentation of keris craftsmanship, identification of additional manuscripts (including a possible 1600s keris text), and on-site digitisation of a ship captain’s diary. These sources illuminate maritime networks and their ties to Singapore, grounding regional history in local voices ([Diyana, 2025b](#)).

6.4. Subject expertise and co-description

Librarians rely on researchers and cultural custodians to guide selection and contextual description for complex sets such as private papers and photographs. Expert inventories and identification accelerate metadata creation and improve quality, shortening time to publication while deepening interpretive context.

⁸ Riau Lingga Sultanate Family Papers: <https://digitalgems.nus.edu.sg/browse/collection/486746>

⁹ Historical maps of Singapore: <https://libmaps.nus.edu.sg/>

¹⁰ Singapore Pioneer Architects: <https://digitalgems.nus.edu.sg/browse/collection/12377>

¹¹ Daeng Paduppa manuscript: <https://digitalgems.nus.edu.sg/view/520515>

7. Digital preservation infrastructure

Long-term access requires continuous preservation as technologies change. In 2023, NUS Libraries adopted Libnova as a Digital Preservation System to manage the long-term preservation of born-digital and digitised assets, including NUS Archives and photo databases. Preservation work includes scheduled fixity checks, storage replication across locations, format identification, and detailed logging of preservation actions. Governance includes multiple checksums, multiple copies across varied storage media and locations, adequate documentation and descriptive metadata, and security controls such as encryption and access restrictions.

A core objective is to preserve integrity and portability so that preservation packages can move across systems with minimal effort, supporting future migration and reducing dependency on any single vendor.

8. Engagement, teaching, research, and public value

Digitisation creates value when materials are used. NUS Libraries supports engagement through social media highlights, donor presentations, seminars, talks, exhibitions, and online showcases.

Collections such as Bai Yan's papers, the Bugis–Makassar programme, Yeap Chor Ee, Wang Sha, and Madoc's wartime manuscript have been activated through public programmes and outreach ([Cai, 2023](#), [NUS Libraries, 2024](#); [Sim et al., 2024](#); [Zhang & Xin, 2025](#); [NUS Lee Kong Chian Natural History Museum, 2025](#)). Engagement can also generate donations. After the Wang Sha programme, Chin Whai, an 87-year-old veteran of Singapore's Chinese performing arts scene, announced a donation of private papers and artefacts ([Zhong, 2025](#)), and the family of the late Tang Hu – Wang Sha's stage partner – indicated plans to organise and donate materials. Together, the private collections of Wang Sha, Chin Whai, and Tang Hu will help reconstruct post-war popular entertainment and expand primary sources for study.

9. Evidence of impact and usage

Digital Gems shows sustained growth in usage, with page views and downloads increasing over time. The platform's importance for teaching and research is also visible in spikes in user queries and helpdesk tickets during maintenance downtime, suggesting reliance by learners and researchers.

BLSEA appears in coursework and theses across ecology, conservation, geography, and environmental history. Bugis–Makassar materials and private papers feature in assignments, seminars, and exhibitions. Partnerships further broaden reach, while preservation infrastructure provides technical assurance of integrity, supporting continued use.

10. Lessons learned and reflections

Discovery and preservation must advance together. Consistency and authority control, combined with multilingual description, improve search quality and reach. Rights and ethics underpin trust through clear item-level rights, sensitivity review, transparent documentation, loan-and-return models, and preservation records. Collaboration multiplies value by bringing in content and expertise; fieldwork anchors collections in local voices and practices. Workflow discipline – selection, handling, imaging, description, rights review, quality control, publication, and preservation – raises standards and reduces rework.

11. Conclusion

Digital heritage is a shared endeavour. Technology enables it; standards stabilise it; rights and ethics guide it; partnerships and engagement bring it to life. NUS Libraries' approach – programmatic digitisation, metadata-driven discovery, interoperable integrations, partnership-based expansion, active engagement, and preservation-aligned governance – aims to connect Southeast Asian heritage to learners, researchers, and the public, accessible today and safeguarded for the long term.

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