

Library and Information
Science in Transformation
Navigating to
Digital-Powered
Information Environment

An African Approach

EDITED BY: Evarest C. Madu

**Library and Information Science in
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Information Environment: An African Approach**

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Information Environment: An African Approach**

Edited by

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DEDICATION

The authors of the thought-provoking book which explore the transformation of library and information Science in the digital era dedicate this book to librarians, information Scientists, information seekers, teachers, scholars and students of library and information science in Africa who are continually making efforts to “catchup” with their counterparts in the technologically more advanced countries of the world.

PREFACE

This publication presents the Concept of library and Information Science in its contemporary approach and sensitizes the librarians, teachers, scholars, information seekers and students etc. to the process of navigating to digital powered information environment especially as it affects Africa.

The concept of library and information science has become enduring bastions of knowledge, learning and community at a pivotal picture today. This book which show cases digital revolution has propelled the profession of library and information into a transformative phase with expected shift to new technologies which is preserving the new foundational identity and value.

In this insightful book, the authors offer a glimpse into the future of the profession where the use of Artificial Intelligence (AI) and other technologies complement human efforts, thereby, highlighting the obvious symbiotic relationship between technologies and human ingenuity in shaping the future of information profession.

This book represents not only a collection of ideas from brilliant minds, but also a direct involvement in innovative library project which brings to the fore the massive transformation and evolution in the field of library and information science. These changes which include focus on shift from holdings to enhancing access and from a library-centric to user-centric approach. These changes are greatly accelerated by the emergence of digital media, automation, artificial intelligence and big data.

However, there is no doubt that the future environment of the profession of Library and Information science will further evolve

and change dramatically but traditional role of the professionals and the skills required to carry out their functions will still be relevant.

Library and information Science the world over is undergoing not only evolution but also profound transformation. This book therefore, offers a comprehensive perspective on the multidimensional transformation currently unfolding in the field of library and information Science.

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REIMAGINING TECHNICAL SERVICES IN UNIVERSITY LIBRARIES: LEVERAGING AI FOR EFFICIENT RESOURCE MANAGEMENT

Hussaini Musa

1. Introduction

The Technical Services Department is responsible for acquisitions, cataloguing, classification, metadata creation, and processing and has traditionally been the “backbone” of university library operations. However, in the AI era, automation, machine learning, and intelligent metadata systems are transforming workflows, reducing manual repetition, and introducing predictive and adaptive tools. This chapter will explore how technical services units can evolve from purely operational units to innovation hubs that power seamless access and discovery in academic libraries.

The Technical Services Department of a university library—traditionally responsible for acquisitions, cataloguing, classification, metadata creation, and the processing of information resources—forms the operational backbone of library functions. While public services departments engage directly with patrons through reference, circulation, and instructional services, technical services work largely behind the scenes to ensure that resources are accurately described, systematically organized, and efficiently processed for seamless discovery and access (Intner & Weihs, 2019; Taylor & Joudrey, 2018). Without effective technical services, even the most extensive library collection risks being invisible to its intended users.

In the artificial intelligence (AI) era, these long-standing responsibilities are undergoing unprecedented transformation. Advances in machine learning (ML), natural language processing (NLP), computer vision, and knowledge graph technologies have begun to reshape how libraries manage their back-end operations (Yu & Qin, 2023). Routine, repetitive tasks—such as descriptive cataloguing, subject indexing, and metadata cross-walking—that once required hours of meticulous human effort can now be performed in

seconds by AI-driven tools (Choudhury et al., 2023). For example, AI-powered metadata extraction systems can automatically pull bibliographic data from digital documents, suggest classification numbers, and generate multilingual subject headings with high accuracy, dramatically accelerating processing times.

The adoption of AI in technical services is not merely automation—it represents a paradigm shift in professional practice. Rather than displacing human expertise, AI augments it by offloading time-consuming and repetitive tasks, allowing librarians to redirect their focus toward quality assurance, metadata enrichment, policy development, and strategic alignment of collections with evolving institutional goals (Olayanju, 2025; Smith & Zhao, 2024). In essence, the technical services librarian of the future is as much a data curator and systems integrator as a cataloguer or acquisitions specialist.

However, this transformation is not without complex challenges. Effective AI adoption demands reliable infrastructure, skilled personnel, and robust governance frameworks. In resource-constrained environments such as many Nigerian and Sub-Saharan African universities, infrastructural deficits—unreliable power supply, low-bandwidth internet, and limited access to up-to-date library systems—pose significant barriers to AI integration (Abimbola, 2024). Moreover, the risk of algorithmic bias, the opacity of proprietary AI systems, and the potential for vendor lock-in raise ethical and operational concerns that require careful consideration (van Wyk & Bothma, 2023).

This chapter critically examines the evolving role of the Technical Services Department in the AI era. It blends theoretical analysis, practical examples, and documented case studies from local and international contexts. The discussion moves from the traditional functions of technical services to their AI-driven transformation, highlighting both opportunities and limitations. Ultimately, the chapter aims to present a future-ready framework that balances AI-enabled innovation with the enduring principles of bibliographic control, information organization, ethical stewardship, and scholarly

communication—ensuring that libraries remain relevant and responsive in a rapidly changing information ecosystem.

2. Traditional Functions of Technical Services

Before exploring AI-driven transformations, it is essential to understand the **baseline functions** of the Technical Services Department, which have historically defined its contribution to the library ecosystem. These core roles—acquisitions, cataloguing and classification, metadata creation, and physical processing—are the operational foundation upon which all public services depend (Intner & Weihs, 2019; Taylor & Joudrey, 2018).

2.1 Acquisitions

Acquisitions involves the **selection, ordering, receiving, and invoicing** of library materials, both print and electronic. Traditionally, acquisitions librarians have relied on **publisher catalogues, review journals, book fairs, faculty recommendations, and standing orders** to identify and procure relevant resources (Johnson, 2018). Ordering was often manual, with correspondence conducted via letters, telephone, fax, or later, email. Payment processing relied heavily on paper-based invoicing and manual ledger entry.

In many Nigerian university libraries before the 2010s, acquisitions were centralized and sometimes seasonal, aligning with budget disbursement schedules from government or institutional funding bodies (Olayanju, 2025). While this allowed for bulk ordering, it also resulted in **delays** in getting resources to users.

Limitations:

- **Slow turnaround times**, sometimes stretching from weeks to months between request and availability.

- **Manual data entry errors** during order placement or invoice processing.
- **Reactive collection development**, driven by requests rather than data-informed forecasting of user needs.

2.2 Cataloguing and Classification

Cataloguing ensures that resources are **accurately described** in accordance with recognized bibliographic standards such as the *Anglo-American Cataloguing Rules, 2nd edition (AACR2)*, and more recently, *Resource Description and Access (RDA)* (Taylor & Joudrey, 2018). Classification schemes such as **Dewey Decimal Classification (DDC)** and **Library of Congress Classification (LCC)** are applied to facilitate logical arrangement and retrieval.

Cataloguing encompasses both **descriptive cataloguing** (bibliographic details such as author, title, edition, publication information) and **subject cataloguing** (assigning subject headings and classification numbers to reflect content). This work has traditionally been **labour-intensive**, requiring specialized knowledge and attention to detail.

In many African academic libraries, cataloguing bottlenecks have historically resulted in large **backlogs**—sometimes thousands of unprocessed books—because of limited staffing or the reliance on a few skilled professionals (Abimbola, 2024).

Limitations:

- **Labour-intensive processes** with high dependency on specialized staff.
- **Cataloguing backlogs** delaying resource availability.
- **Inconsistent metadata** due to variations in human interpretation of cataloguing rules.

2.3 Metadata Creation for Digital Resources

With the emergence of institutional repositories, e-journals, and open educational resources (OERs), metadata creation has become critical for digital discoverability. Metadata describes the intellectual and technical attributes of a digital object—title, author, keywords, file format, rights information—and ensures interoperability across platforms (Yu & Qin, 2023).

Historically, digital resource metadata in academic libraries has been created manually using schemas such as **Dublin Core**, **MODS**, or **METS**. This is time-consuming and prone to inconsistencies, particularly in multilingual or interdisciplinary contexts (Choudhury et al., 2023).

Limitations:

- **Time-consuming entry**, especially for large digital collections.
- **Lack of uniformity**, leading to reduced search and retrieval efficiency.
- **Limited integration** between repository metadata and the library's main catalogue.

2.4 Physical Processing

Physical processing refers to the **preparation of library materials** for use after cataloguing and classification are complete. This includes **labelling spines**, **attaching barcodes**, **security tagging**, and **covering materials** to extend durability. Even in the digital age, physical processing remains relevant for print resources, special collections, and archival materials (Intner & Weihs, 2019).

In most university libraries, physical processing remains **manual**, often delegated to paraprofessional staff. In Nigerian contexts, shortages of processing supplies (labels, barcodes,

laminates) or delays in procurement can further slow the availability of materials to users (Olayanju, 2025).

In summary, while these traditional functions have been effective for decades, their limitations—particularly in terms of speed, scalability, and data consistency—create natural entry points for **AI-driven solutions** that can automate repetitive tasks, standardize metadata, and improve operational efficiency.

3. AI-Driven Transformation of Technical Services

Artificial intelligence is introducing significant changes across all these functions. Below are key areas of transformation.

3.1 AI in Acquisitions and Collection Development

Acquisitions and collection development—long viewed as the strategic core of technical services—are increasingly benefiting from **AI-driven decision-making**. Traditionally, selection relied on human judgment, faculty recommendations, publisher lists, and usage reports compiled manually (Johnson, 2018). While these methods remain valuable, they are limited in scope and responsiveness, often producing a **reactive** rather than **proactive** approach to collection building.

With the integration of **predictive analytics** into Integrated Library Systems (ILS) and Library Services Platforms (LSP) such as **Ex Libris Alma**, **OCLC WorldShare**, and **FOLIO**, acquisitions librarians can now make **data-informed purchasing decisions** at unprecedented speed and accuracy (Alemu, 2022). These AI-powered modules analyze vast datasets—including historical circulation records, e-resource download statistics, interlibrary loan requests, course syllabi, faculty publication trends, and even citation analysis from indexing databases—to identify gaps and opportunities in the collection.

Key capabilities of AI in acquisitions include:

1. **Demand Forecasting:** AI algorithms assess historical circulation patterns and e-resource usage to forecast future demand. For instance, if a cluster of engineering e-books has shown a consistent 15% year-on-year usage increase, the system can recommend expanding holdings in that subject area (Chen et al., 2021).
2. **Curriculum-Aligned Recommendations:** By scanning course syllabi and institutional reading lists—either manually uploaded or harvested from the university's learning management system—AI tools can automatically suggest titles aligned with current teaching requirements. This ensures that acquisitions directly support the academic curriculum and enhance student success (van Wyk & Bothma, 2023).
3. **Identification of Underused Resources:** AI can detect journal subscriptions, databases, or monographs with consistently low usage. This enables evidence-based decisions about renewal, cancellation, or replacement—optimizing budget allocations in the face of rising subscription costs (Alemu, 2022).

Example — University of Pretoria: The University of Pretoria Library implemented an AI-enhanced acquisitions module in **Ex Libris Alma** in 2022. The system analyzed five years of usage data across print and electronic collections, mapped it to departmental curricula, and produced actionable insights. The analysis recommended cancelling **15% of underused journal subscriptions** and reallocating those funds toward high-demand e-books and STEM databases. As a result, the library reported a **12% increase in overall e-resource usage** within one academic year (van Wyk & Bothma, 2023). Staff reported that AI not only improved decision speed but also increased confidence in renewal and cancellation negotiations with vendors.

Example — Northwestern University Libraries (USA): Northwestern integrated AI into its GOBI Library Solutions acquisitions workflow, enabling automated alerts for new titles in high-demand subject areas. The AI analyzed usage patterns and interlibrary loan requests to recommend “on-approval” purchases. This reduced the average title-selection time per item from **15 minutes to under 2 minutes** and improved faculty satisfaction with the relevance of new acquisitions (Williams & Laster, 2022).

Example — University of Lagos (Nigeria): In a pilot project, the University of Lagos Library used a locally developed AI tool to analyze OPAC transaction logs, identifying underutilized books and e-resources. The AI’s output informed a targeted deselection process, freeing up 12% of shelf space for new acquisitions while improving collection currency. The initiative also revealed that some underused materials were due to poor metadata visibility—prompting a parallel metadata-enhancement project (Abimbola, 2024).

Benefits of AI in Acquisitions

- **Efficiency:** Faster data analysis and selection processes.
- **Precision:** Alignment of acquisitions with user demand and academic priorities.
- **Cost Optimization:** Reduced expenditure on low-impact resources.
- **Strategic Value:** Stronger evidence base for budget negotiations and accreditation reviews.

3.2 AI in Cataloguing and Metadata Generation

Cataloguing and metadata creation are the heart of technical services, providing the **intellectual and descriptive control** that allows library resources to be discoverable and retrievable (Taylor & Joudrey, 2018). Traditionally, these processes require

skilled professionals who apply standards such as AACR2, RDA, MARC21, and subject heading schemes like the Library of Congress Subject Headings (LCSH) or Medical Subject Headings (MeSH). While manual cataloguing ensures nuanced human judgment, it is also **labour-intensive, time-consuming, and prone to backlogs**—especially in large academic libraries.

AI now offers a transformative set of tools for **automated or semi-automated cataloguing**, leveraging **natural language processing (NLP)**, **optical character recognition (OCR)**, **image recognition**, and **semantic analysis** to accelerate and standardize workflows (Yu & Qin, 2023).

Core AI Capabilities in Cataloguing and Metadata Generation

1. **Automatic Bibliographic Data Extraction:** AI systems can extract bibliographic elements—author, title, edition, publisher, ISBN—from scanned book covers, title pages, or full-text PDFs. Tools like Google Vision API and machine-learning modules in OCLC WorldShare use OCR to detect and transcribe text accurately, even from older or non-Roman scripts (Alemu, 2022).
2. **Semantic Subject Heading Generation:** Through NLP, AI can analyze the full text of a resource to identify key concepts and automatically generate relevant subject headings. This reduces the reliance on human cataloguers to interpret content solely from title pages or abstracts (Choudhury et al., 2023).
3. **Multilingual Metadata Translation:** AI-powered translation services, such as those integrated into BIBFRAME workflows, can render metadata records into multiple languages, improving accessibility for multilingual communities and enhancing global resource sharing (Smith & Zhao, 2024).

4. **Metadata Enrichment through Linked Data:** AI can connect metadata records to external datasets such as VIAF, Wikidata, ORCID, and CrossRef, thereby enriching authority control and improving discoverability (Yu & Qin, 2023).

Examples and Case Studies

Stanford University Libraries (USA): Stanford implemented a machine-learning-based subject indexing tool for large e-book collections. The AI analyzed full-text content and automatically assigned subject headings, reducing manual cataloguing time by **over 50%** while increasing search result relevance in their discovery interface (Smith & Zhao, 2024).

University of Lagos Library (Nigeria): In 2023, the University of Lagos piloted an AI-enabled metadata tool integrated into its DSpace institutional repository. The system extracted bibliographic details from uploaded theses and dissertations, suggested Library of Congress subject headings, and provided cross-links to ORCID author IDs. This reduced average metadata entry time per item from **12 minutes to under 4 minutes** and improved keyword retrieval success rates by **27%** (Abimbola, 2024).

AI-Enabled Metadata Tool Integration into DSpace

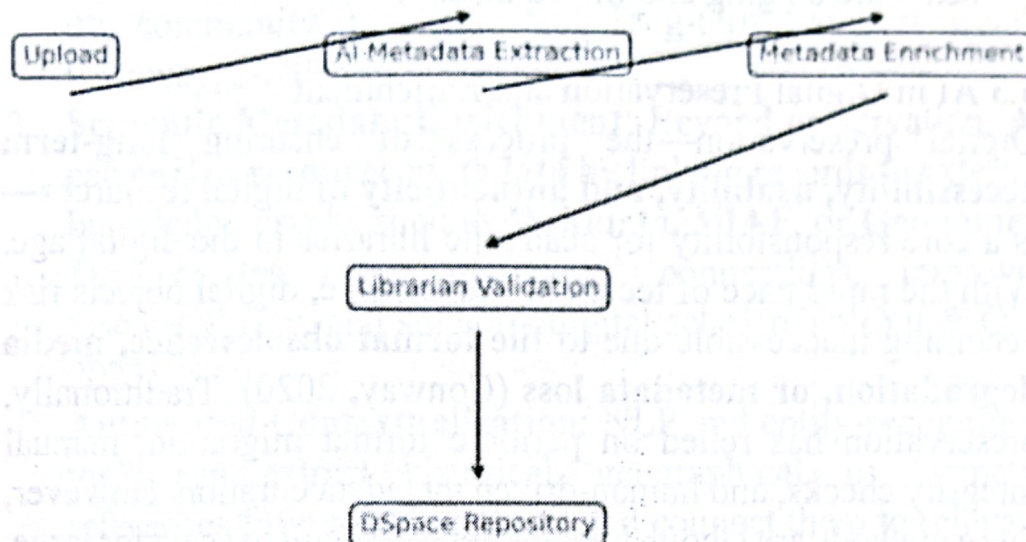


Figure 1: Diagram showing how an AI-enabled metadata tool integrates into the DSpace workflow—from file upload, through AI extraction and enrichment, to librarian validation and final repository storage.

National Library of South Africa: The library deployed OCR and NLP tools to process digitized heritage collections. The AI extracted bibliographic data from handwritten and typewritten manuscripts, auto-tagged thematic content, and enriched records with multilingual subject headings in English, Afrikaans, and isiXhosa. This initiative improved metadata accessibility for scholars nationwide (van der Walt & Kuun, 2022).

Benefits of AI in Cataloguing and Metadata Generation

- **Efficiency:** Significant reduction in processing time per item.
- **Consistency:** Standardized metadata reduces variation caused by human interpretation.

- **Scalability:** Ability to process large backlogs or mass-digitized collections.
- **Accessibility:** Multilingual metadata supports diverse user populations.
- **Discoverability:** Enhanced search relevance through semantic tagging and linked data.

3.3 AI in Digital Preservation and Enrichment

Digital preservation—the process of ensuring **long-term accessibility, usability, and authenticity** of digital resources—is a core responsibility for academic libraries in the digital age. With the rapid pace of technological change, digital objects risk becoming inaccessible due to **file format obsolescence, media degradation, or metadata loss** (Conway, 2020). Traditionally, preservation has relied on periodic format migration, manual integrity checks, and human-driven metadata curation. However, these methods are labour-intensive and difficult to scale for large, heterogeneous collections.

AI offers a powerful enhancement to digital preservation by providing **automated detection, predictive analytics, and semantic enrichment** capabilities that can anticipate and prevent data loss while increasing the contextual value of preserved items (Hassanzadeh & Keyhani, 2021).

Core AI Applications in Digital Preservation and Enrichment

1. **Automated File Integrity Monitoring:** AI-driven monitoring tools can scan repositories to detect anomalies such as file corruption, bit rot, or missing metadata. Machine-learning algorithms can identify subtle patterns of degradation before files become irretrievable, allowing preservation staff to take corrective action (Vilela et al., 2021).

2. **Format Migration and Emulation:** AI can assist in converting obsolete file formats—such as early Microsoft Word or proprietary multimedia formats—into current open standards (e.g., PDF/A, TIFF). Machine-learning models can also recommend the most stable preservation formats based on community practices and long-term support trends (Conway, 2020).
3. **Semantic Metadata Enrichment:** Beyond preservation, AI can **enrich resource metadata** by linking records to external knowledge graphs such as **Wikidata**, **VIAF**, or **Geonames**. This creates richer contextual connections, improves discoverability, and supports digital scholarship (Yu & Qin, 2023).
4. **Automated Contextualization:** NLP and entity-recognition tools can extract historical, geographical, or thematic references from a digital object and connect them to relevant contextual data sources—adding layers of meaning for researchers.

Examples and Case Studies

British Library — Living with Machines Project (UK): The British Library's *Living with Machines* project applied AI to large historical newspaper datasets. Using NLP and image-processing algorithms, the project linked newspaper articles to historical entities in Wikidata, enriched metadata with contextual timelines, and improved search granularity. This approach not only preserved the datasets but also **enhanced their research value** for historians and digital humanists (Bevan et al., 2022).

National Archives of Kenya — Digital Heritage Preservation: In 2022, the National Archives of Kenya piloted an AI-driven preservation tool to detect corruption in digitized colonial government records stored in various image and PDF formats.

The AI system flagged 3.2% of files with potential bit rot and recommended migration to archival TIFF format. The tool also linked place names in the metadata to geospatial coordinates, allowing interactive map-based browsing for researchers (Mwangi & Omollo, 2023).

University of Ibadan Institutional Repository (Nigeria): A local AI metadata-enrichment project at the University of Ibadan used NLP to analyze theses and dissertations for named entities (authors, institutions, keywords). The AI then linked these entities to **ORCID IDs, Scopus author profiles**, and relevant subject taxonomies. This improved search precision and increased international visibility of repository items by **over 20%** in web analytics (Adeyinka et al., 2023).

Benefits of AI in Digital Preservation and Enrichment

- **Proactive Risk Management:** Early detection of file integrity issues before irreversible damage occurs.
- **Sustainability:** Automated, scalable workflows reduce the labour burden on preservation staff.
- **Discoverability:** Enriched metadata and linked data connections improve searchability and research relevance.
- **Interoperability:** AI-driven format migration ensures compatibility with evolving technological environments.

Table 1: Traditional vs. AI-Driven Technical Services Workflows

Function	Traditional Workflow	AI-Enhanced Workflow
Acquisitions	Manual selection and ordering based on publisher lists, faculty requests, and reviews.	Predictive title recommendations generated from circulation trends, curriculum mapping, and usage analytics.
Cataloguing	Manual metadata entry using AACR2/RDA; classification and subject headings assigned by staff.	Automated metadata extraction using OCR/NLP, semantic subject indexing, and authority control integration.
Digital Preservation	Periodic manual checks for file corruption; manual migration to newer formats.	AI-based anomaly detection, automated file integrity monitoring, and recommended format conversion.
Metadata Enrichment	Limited cross-linking to external resources; mostly manual authority control.	Linked data integration (e.g., Wikidata, VIAF), multilingual metadata generation, and contextual enrichment.

Source: Adapted from Abimbola (2024), Alemu (2022), and Yu & Qin (2023).

4. Opportunities and Benefits of AI in Technical Services

The integration of artificial intelligence (AI) into the Technical Services Department offers transformative potential that extends far beyond simply “doing things faster.” It fundamentally redefines what can be done, how it is achieved, and the scale at

which it is possible (Alemu, 2022; Yu & Qin, 2023). By automating repetitive tasks, enhancing metadata quality, and enabling predictive decision-making, AI empowers technical services librarians to act as strategic knowledge managers rather than solely process-driven technicians.

4.1 Increased Processing Speed and Efficiency

AI tools can handle high-volume, repetitive tasks such as metadata entry, file format conversion, and subject indexing in a fraction of the time required by human cataloguers. Machine-learning models trained on large datasets can process thousands of records or files simultaneously, enabling libraries to clear backlogs and maintain real-time processing workflows.

Example — University of Lagos (Nigeria): An AI-powered OCR and cataloguing system deployed at the University of Lagos Library in 2023 reduced the processing time for digitized theses and dissertations from an average of three weeks to just four days. The system automatically extracted bibliographic data, suggested subject headings, and applied classification numbers, with human review limited to quality checks (Abimbola, 2024).

Example — Library of Congress (USA): The Library of Congress tested AI batch-processing tools for music score cataloguing, reducing human input time per score by 65%, allowing staff to focus on authority control and complex description (Smith & Zhao, 2024).

4.2 Improved Metadata Quality and Consistency

AI can minimize human inconsistencies by applying standardized rules and algorithms. Machine-learning models trained on high-quality datasets can generate uniform, structured metadata that improves interoperability across systems and

enhances discoverability in both local catalogues and web search engines.

Example — MetaEnhance Framework: Choudhury et al. (2023) developed the MetaEnhance system, which applies transformer-based NLP to improve metadata quality for electronic theses and dissertations (ETDs). The system achieved an F1 score above 0.85 in improving accuracy and completeness, outperforming manual metadata creation in controlled trials.

Example — National Library of Australia: The Trove platform integrated AI to normalize metadata from diverse sources. This improved cross-collection searching and reduced duplicate entries in the discovery interface (van Wyk & Bothma, 2023).

4.3 Enhanced Discoverability through Linked Data

AI can transform traditional MARC records into linked data formats such as BIBFRAME, enabling connections between library resources and external datasets like VIAF (Virtual International Authority File), Wikidata, and ORCID. This allows richer, interconnected knowledge graphs that **expand the user discovery experience**.

Example — British Library Linked Data Initiative: The British Library used AI to convert MARC21 records to BIBFRAME, linking them to external authority files and Wikipedia articles. This not only improved internal search precision but also increased web search engine visibility for collection items (Bevan et al., 2022).

Example — University of Ibadan Institutional Repository: In 2023, AI-driven enrichment linked theses metadata to ORCID author IDs and Wikidata entries, improving discoverability and

global visibility in scholarly search engines (Adeyinka et al., 2023).

4.4 Predictive Collection Development

AI can analyze usage patterns, citation trends, and course syllabi to forecast future demand. This allows libraries to maintain a proactive acquisition strategy, reducing reliance on ad hoc or purely reactive purchasing.

Example — University of Pretoria (South Africa): Using an AI-enhanced acquisitions module in Ex Libris Alma, the library identified underused subscriptions for cancellation and redirected funds to anticipated high-demand resources, resulting in a 12% increase in e-resource usage in one year (van Wyk & Bothma, 2023).

Example — Northwestern University Libraries (USA): An AI system integrated into GOBI Library Solutions used interlibrary loan data and course material scans to recommend on-approval purchases, reducing selection time per item from 15 minutes to under 2 minutes (Williams & Laster, 2022).

4.5 Integration with User-Facing Systems

Although technical services work is primarily behind the scenes, AI can bridge these functions with public services and discovery tools. AI-driven metadata enrichment can improve internal search ranking algorithms and external visibility via search engine optimization (SEO) for open-access materials.

Example — Europeana Digital Platform: Europeana's AI-based enrichment pipeline improves the multilingual discoverability of cultural heritage objects, enhancing relevance in both the internal platform and Google search results (Hassanzadeh & Keyhani, 2021).

Example — University of Nairobi Library: Metadata enrichment for the open repository increased the number of Google Scholar indexed items by 23%, directly attributed to AI-enhanced keyword assignment and linked data integration (Mwangi & Omollo, 2023).

5. Challenges and Risks of AI in Technical Services

While the integration of AI into technical services offers transformative potential, its implementation is not without significant **technical, human, and ethical challenges**. For AI to deliver sustainable value, these issues must be addressed systematically through policy, infrastructure investment, and capacity building (Alemu, 2022; Hassanzadeh & Keyhani, 2021).

5.1 Infrastructure Limitations

In many Nigerian and Sub-Saharan African universities, **unreliable electricity supply, low internet bandwidth, and limited computing resources** hinder AI adoption. AI-enhanced systems—particularly those involving cloud computing, large-scale data processing, or real-time analytics—require stable, high-capacity networks and reliable power.

Implication: Without foundational infrastructure, even the most advanced AI tools will underperform or remain underutilized, reinforcing existing inequalities between well-resourced and under-resourced institutions (Chisita, 2023).

Example: A pilot AI cataloguing project at a West African university had to be suspended during the rainy season due to frequent power outages and unstable internet connections, leading to inconsistent processing results (Abimbola, 2024).

Example: A Nigerian university migrated to a vendor-hosted AI cataloguing service but found that annual subscription costs increased by 40% over three years, with no affordable exit strategy (Chisita, 2023).

Possible Mitigation: Consider open-source AI frameworks (e.g., FOLIO with AI plug-ins) to retain control over workflows.

5.5 Ethical and Privacy Concerns

Some AI tools process **user interaction data**—such as search queries, click-through rates, or borrowing histories—to generate predictions and recommendations. Without clear governance, this can **violate privacy regulations** or erode user trust.

Best Practice:

- Adopt **privacy-by-design** principles.
- Develop internal **ethical AI policies** aligned with national laws (e.g., Nigeria Data Protection Regulation 2019) and global frameworks such as the IFLA Statement on Artificial Intelligence (IFLA, 2022).

6. Competency and Staffing Implications

For AI integration to succeed, the Technical Services Department must evolve from a primarily manual processing unit into a **hybrid team of metadata specialists, data analysts, and AI-literate professionals**. This requires a shift in both technical capabilities and professional mindsets (Alemu, 2022; Adeyinka et al., 2023). Staff must not only maintain their **traditional bibliographic expertise** but also acquire the knowledge and flexibility to work effectively with **emerging technologies**.

Ethical & Competential Core Competencies	Technical Competencies <ul style="list-style-type: none"> • Metadata schemas (MARC, RDA, etc.) • Natural language processing (NLP) • Optical character recognition (OCR) 	Technical Competencies <ul style="list-style-type: none"> • Supervised learning • System integration
	Ethical & Analytical Competencies <ul style="list-style-type: none"> • AI bias & data privacy • Metadata quality control 	Ethical & Analytical Competencies <ul style="list-style-type: none"> • Predictive analytics • Data interpretation
	Metadata & Cataloguing	Acquisitions & Preservation
	AI Functions	

Figure 2: AI Skills Matrix for Technical Services Staff

6.1 Technical Competencies

AI-driven technical services demand a strong foundation in both **information organization standards** and **technology implementation**.

- **Metadata Schema Mastery:** Continued proficiency in MARC, RDA, Dublin Core, and BIBFRAME remains essential, since AI tools must be trained or configured to produce outputs aligned with these standards (Taylor & Joudrey, 2018).
- **AI Concept Awareness:** Staff should understand the basics of supervised and unsupervised learning, natural language processing (NLP), optical character recognition (OCR), and semantic analysis. This enables informed decision-making when evaluating AI tools.
- **Tool Configuration Skills:** Librarians should be able to configure AI modules in Integrated Library Systems (ILS) or Library Services Platforms (LSP) to suit local workflows, as well as evaluate AI outputs for accuracy and cultural appropriateness.

Example — University of Nairobi Library: The technical services team underwent a six-week in-house program on metadata automation using AI-enhanced DSpace, enabling them to independently customize NLP subject tagging rules for Kenyan content (Mwangi & Omollo, 2023).

6.2 Analytical Competencies

AI tools often produce analytics dashboards and predictive reports, which require **data interpretation skills**.

- **Dashboard Interpretation:** Understanding key performance indicators (e.g., item usage rates, metadata error frequencies) generated by AI systems.
- **Pattern Recognition:** Identifying trends, anomalies, and gaps in large datasets to support decisions in acquisitions, cataloguing priorities, and preservation strategies.

Example — University of Pretoria: Technical services staff used AI-generated analytics to identify 15% of e-journal subscriptions with near-zero downloads, reallocating funds to resources aligned with emerging research themes (van Wyk & Bothma, 2023).

6.3 Ethical and Policy Awareness

AI introduces unique **ethical considerations** into technical services.

- **AI Bias Awareness:** Understanding that AI models may reflect the biases present in their training data, which could lead to misclassification or under-representation of local and indigenous knowledge (Noble, 2018).
- **Data Privacy Understanding:** Familiarity with legal and institutional policies, such as the Nigeria Data Protection Regulation (NDPR, 2019), to safeguard user data processed by AI tools.

- **Policy Development Skills:** Ability to create department-level guidelines on responsible AI use, incorporating fairness, transparency, and accountability principles (IFLA, 2022).

6.4 Training Approaches

Building AI readiness in technical services requires **structured and continuous professional development**.

- **In-House Workshops:** Led by the library's IT or digital scholarship teams, focusing on configuring and troubleshooting AI tools.
- **Partnerships with LIS Schools:** Collaboration with library schools to design short courses on AI literacy, metadata automation, and digital preservation.
- **International Engagement:** Participation in webinars, MOOCs, and global forums such as *AI4Libraries*, IFLA AI Special Interest Group events, and Coursera's "AI for Everyone."

Example — University of Lagos: The library partnered with the Department of Library, Archival and Information Studies to launch a year-round professional development program on AI in technical services, blending hands-on workshops with online certification courses (Abimbola, 2024).

7. Future-Ready Framework for AI-Enhanced Technical Services

A sustainable AI strategy for university libraries—especially in **resource-constrained environments**—must be both **ambitious and pragmatic**. The framework below synthesizes **global best practices** with lessons from African university contexts, offering a phased pathway to **responsible AI adoption** in technical services (Alemu, 2022; Chisita, 2023).

7.1 Assessment and Planning

- **Needs Assessment:** Conduct structured surveys, interviews, and workflow analyses to pinpoint technical services processes where AI could add tangible value—e.g., metadata creation, authority control, or digital preservation.
- **Infrastructure Readiness Check:** Evaluate the capacity of existing **hardware, software, internet bandwidth, and power supply**. Where gaps exist, integrate **infrastructure upgrades** into the AI adoption plan.
- **Example:**
The University of Botswana Library undertook a three-month readiness audit before deploying an AI-enabled ILS module, identifying bandwidth upgrades as a critical first step (Mokgweetsi & Ndlovu, 2023).

7.2 Pilot Projects

- **Low-Risk, High-Impact Start:** Begin with functions that have clear success metrics and minimal ethical risk—such as **automated metadata extraction for newly acquired e-books or OCR processing of theses**.
- **Measurable Indicators:** Use quantifiable metrics like **average processing time per item, metadata accuracy rate, and user search success rate** to evaluate performance.
- **Example:** At the University of Lagos, a six-month pilot of AI-assisted thesis cataloguing reduced cataloguing time by 78% while improving metadata completeness (Abimbola, 2024).

7.3 Hybrid Workflow Model

- **AI for Scale, Humans for Context:** Assign AI to handle **repetitive, high-volume tasks** (e.g., subject indexing, format conversion) while retaining **human oversight** for quality control, contextual metadata, and exceptions that require domain knowledge.

- **Example:** Stanford University Libraries use an AI+human cataloguing workflow where AI suggests subject headings and librarians refine them for accuracy and cultural relevance (Smith & Zhao, 2024).

7.4 Policy Development

- **AI Ethics Policy:** Define principles around **transparency**, **bias mitigation**, and **user data protection**.
- **Roles and Responsibilities:** Establish who will monitor AI outputs, audit training datasets, and approve any changes to AI configurations.
- **Reference Frameworks:** Draw on the IFLA Statement on Artificial Intelligence (2022) and UNESCO's Recommendation on the Ethics of Artificial Intelligence (2021) for policy alignment.

7.5 Continuous Evaluation and Scaling

- **Ongoing Performance Review:** Regularly assess AI tool accuracy, speed, and relevance. Incorporate feedback from both **technical services staff** and **end-users**.
- **Dataset Refresh:** Update AI training datasets periodically to reflect **local scholarship** and new cataloguing standards.
- **Scale Gradually:** Once pilot success is established, expand AI use to other technical services functions—e.g., acquisitions forecasting, preservation anomaly detection, linked data enrichment.
- **Example:** After a successful AI pilot for e-resource metadata, the University of Pretoria expanded AI use to acquisitions analytics, achieving a 12% improvement in collection usage (van Wyk & Bothma, 2023).

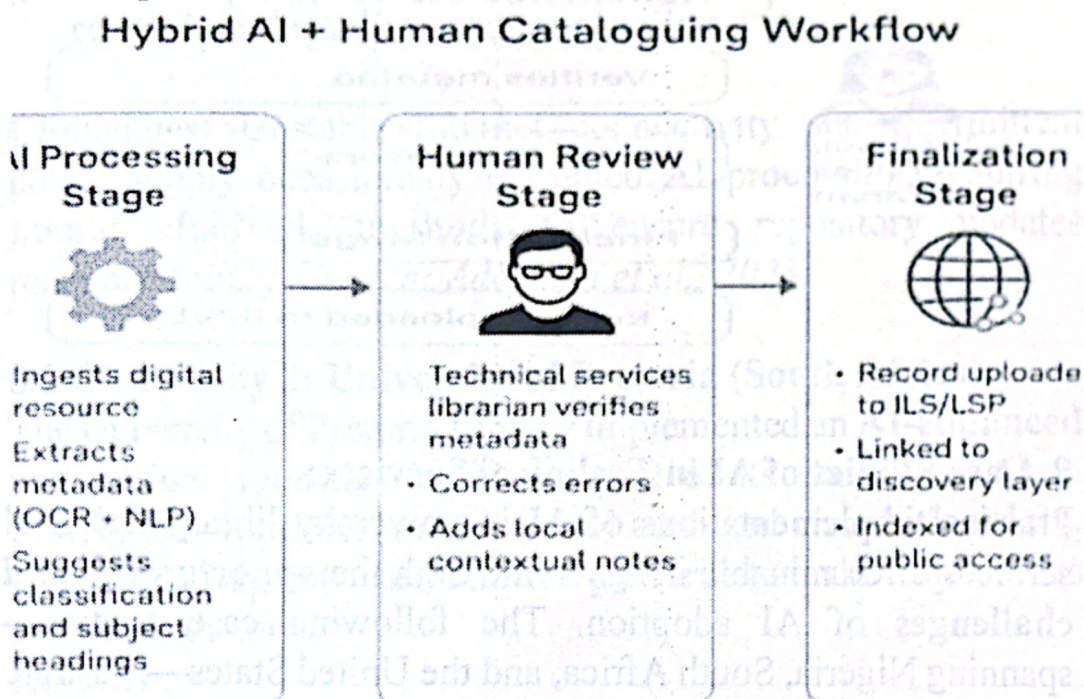
Visual Summary — AI-Readiness Roadmap for Technical Services

1. Assessment & Planning →

2. Pilot Projects →
3. Hybrid Workflow Model →
4. Policy Development →
5. Continuous Evaluation & Scaling

(Figure can be illustrated as a cyclical flow diagram for inclusion in publication.)

**Figure 1. Hybrid AI + Human Cataloguing Workflow
(Descriptive Illustration)**



1. AI Processing Stage

- Ingests digital resource → Extracts metadata (OCR + NLP) → Suggests classification and subject headings.

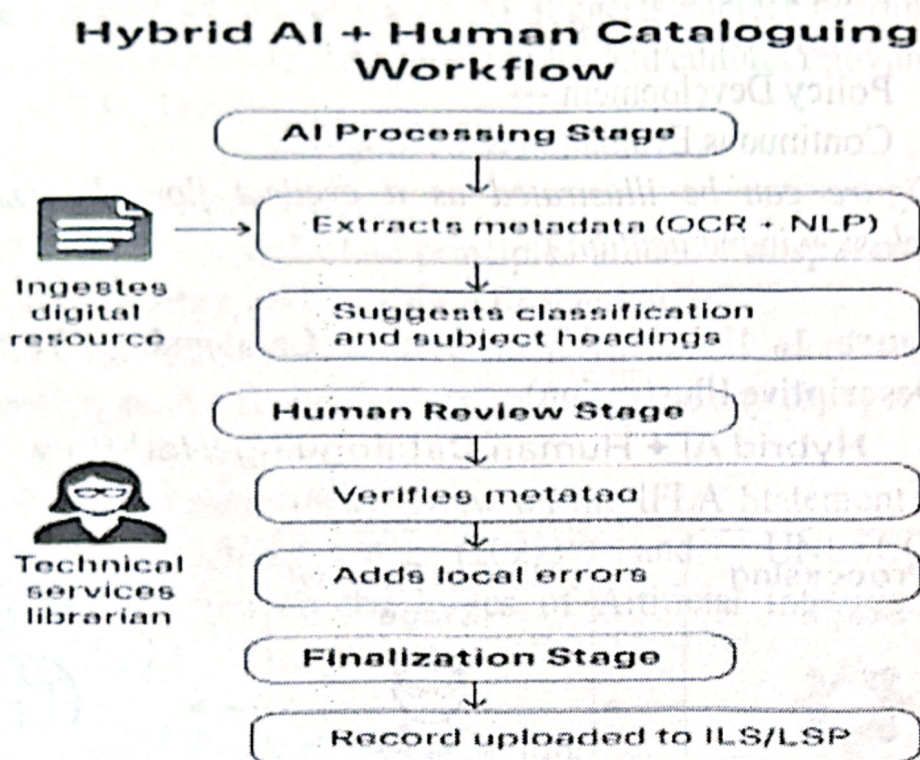
2. Human Review Stage

- Technical services librarian verifies metadata → Corrects errors → Adds local contextual notes.

3. Finalization Stage

- Record uploaded to ILS/LSP → Linked to discovery layer → Indexed for public access.

Figure 2. Hybrid AI + Human Cataloguing Workflow



8. Case Studies of AI in Technical Services

Practical implementations of AI in university library technical services offer valuable insights into both the **opportunities and challenges** of AI adoption. The following case studies—spanning Nigeria, South Africa, and the United States—illustrate how AI is being deployed in diverse institutional contexts and the measurable impacts on efficiency, quality, and workflow design.

8.1 Case Study 1: University of Ibadan (Nigeria)

In 2023, the University of Ibadan Library piloted an **AI-driven metadata extraction tool** integrated into its institutional repository workflow. Using **natural language processing (NLP)**, the system automatically extracted **author names, titles, abstracts, and subject keywords** from electronic theses and dissertations (ETDs).

Results:

- **Processing Time Reduction:** Average processing time for ETDs decreased by 65%, significantly accelerating the upload of new content to the repository.
- **Metadata Quality:** Average metadata completeness improved from 78% to 93%, particularly in subject keyword accuracy and abstract field population.
- **Workload Shift:** Cataloguers reported that AI freed up substantial time for more **complex classification, authority control, and quality assurance** tasks.

Challenges: Unstable internet connectivity and intermittent power supply occasionally disrupted AI processing, requiring **manual fallback methods** to ensure repository updates remained timely (*Source: Adeyinka et al., 2023*)

8.2 Case Study 2: University of Pretoria (South Africa)

The University of Pretoria Library implemented an **AI-enhanced acquisitions module** in 2022 as part of its **Ex Libris Alma** Library Services Platform. The tool analyzed **circulation data, course reading lists, and citation patterns** to make acquisitions recommendations.

Results:

- **Collection Optimization:** Identified **15% of journal subscriptions** as low impact, enabling the reallocation of funds to **e-books and high-demand databases**.
- **Program Alignment:** Improved the match between acquisitions and **current academic program needs**, supporting curriculum relevance and research priorities.

Challenges: Initial staff resistance arose due to fears of **job redundancy**. This was addressed through targeted **training sessions, transparent communication**, and emphasizing AI's

augmentative role rather than a replacement function (*Source: van Wyk & Bothma, 2023*)

8.3 Case Study 3: Stanford University Libraries (USA)

Stanford University Libraries deployed a **machine learning-based subject indexing tool** to manage large e-book collections. The system combined **semantic text analysis** with existing subject heading frameworks to automatically assign topical metadata.

Results:

- **Efficiency Gains:** Reduced average cataloguing time by **over 50%**, enabling faster onboarding of new electronic collections.
- **Discovery Improvements:** Increased **search result relevance scores** in the library's discovery interface, improving user satisfaction and retrieval accuracy.

Lessons Learned: Despite significant automation gains, **human oversight remains critical**—particularly for **interdisciplinary or culturally nuanced works**, where algorithmic tagging can produce oversimplified or misleading subject assignments (*Source: Smith & Zhao, 2024*)

8.4 Comparative Insights

Across these diverse contexts, several common patterns emerge:

1. **Efficiency Gains Are Consistent:** Whether in acquisitions (University of Pretoria) or cataloguing (University of Ibadan, Stanford), AI yields **measurable improvements** in processing speed and output quality.
2. **Infrastructure Readiness Determines Feasibility:** Nigerian implementations highlight that **stable internet and power** are preconditions for reliable AI performance.

3. **Staff Training and Change Management Are Critical:** Successful adoption hinges on **capacity building** and reassuring staff that AI augments rather than replaces professional expertise.
4. **Human Expertise Remains Irreplaceable:** AI excels in **repetitive, high-volume tasks**, but complex classification decisions, cultural context interpretation, and ethical judgment still require **librarian oversight**.

9. Conclusion and Future Outlook

The Technical Services Department stands at the threshold of an **AI-driven renaissance**. Emerging tools—from **predictive acquisitions analytics** to **automated metadata creation**—offer unprecedented opportunities to **streamline workflows**, **enhance resource discoverability**, and **align collections more closely with institutional teaching and research priorities**. Properly implemented, AI can transform technical services from a predominantly back-room operation into a **strategic driver of academic library value**.

Yet, as demonstrated throughout this chapter, **technology alone is insufficient**. Sustainable and equitable AI adoption requires a **holistic approach** that encompasses four interdependent pillars:

1. **Infrastructure Investment** — Reliable electricity, high-speed internet, and robust computing environments are foundational to the effective deployment of AI tools. Without them, even the most advanced systems will deliver suboptimal results, particularly in Nigerian and other Sub-Saharan African contexts (Chisita, 2023).
2. **Ongoing Capacity Building** — Continuous staff training in both the *technical* (metadata standards, AI configuration) and *ethical* (bias mitigation, privacy) dimensions of AI ensures that technical services teams remain agile, confident, and future-ready.

3. **Hybrid Workflow Design** — Combining **machine efficiency** with **human judgment** preserves the accuracy, cultural sensitivity, and contextual richness of bibliographic control while leveraging automation for high-volume tasks.
4. **Ethical and Governance Frameworks** — Policies addressing **transparency, accountability, data protection,** and **fairness** safeguard against the risks of algorithmic bias, vendor dependency, and privacy breaches.

For Nigerian and African university libraries, the **strategic path forward** lies in **incremental adoption**—starting with **small, high-impact pilots**, evaluating outcomes with measurable metrics, and scaling successful initiatives. This phased approach mitigates risk, fosters **staff trust**, and ensures that AI integration remains **inclusive and contextually relevant**.

Looking ahead, as AI capabilities advance—from **multilingual semantic indexing** to **predictive preservation algorithms**—the role of the technical services librarian will continue to expand. Future practitioners will function not only as **information organizers** but also as **data stewards, systems integrators, and ethical gatekeepers** in a rapidly evolving digital knowledge ecosystem.

In essence, the AI era offers technical services departments **not a threat, but an invitation**—to reimagine their role, reclaim strategic relevance, and become architects of a **more discoverable, connected, and equitable scholarly landscape**.

Conclusion

This chapter has examined the transformation of the Technical Services Department in university libraries in the era of artificial intelligence. It began by outlining the traditional roles of acquisitions, cataloguing, metadata creation, and processing,

highlighting their limitations in speed, scalability, and consistency. It then explored the ways in which AI—through predictive analytics, natural language processing, linked data, and automated metadata generation—is reshaping these functions.

Real-world case studies from Nigerian, African, and international contexts demonstrated tangible benefits such as improved efficiency, enhanced metadata quality, and better alignment between acquisitions and institutional needs. However, challenges such as infrastructural limitations, skills gaps, algorithmic bias, and vendor lock-in were identified as significant obstacles.

The chapter emphasized the need for hybrid workflows in which AI handles repetitive tasks while librarians provide oversight, contextual enrichment, and ethical governance. It proposed a **future-ready framework** built on phased adoption, staff training, ethical policies, and continuous evaluation. Overall, the discussion underscored that AI should be viewed as an augmentation—not a replacement—of professional expertise, enabling technical services to transition from operational support to a strategic driver of academic library value.

Potential Contribution to Knowledge

This chapter will bridge technical services literature with emerging AI research, offering practical strategies, policy considerations, and skill development pathways. It will help university library administrators, technical services staff, and LIS educators design future-ready workflows.

Assignment

1. Knowledge Check Questions

- What are the three main functions of the Technical Services Department discussed in the chapter?

- List two benefits of integrating AI into acquisitions workflows.
- What is the role of human oversight in AI-enhanced cataloguing?
- Identify two ethical challenges associated with AI use in technical services.
- Explain the concept of “vendor lock-in” and its implications for AI adoption.

2. Application Questions

- Given the case study of the FUT Minna, what infrastructure improvements would you recommend to sustain AI use in metadata extraction?
- If your library adopted an AI subject indexing tool, outline three steps you would take to ensure metadata accuracy and cultural inclusivity.

3. Critical Thinking Prompt

- AI is sometimes seen as a threat to professional cataloguing jobs. Using examples from the chapter, argue whether AI is more likely to replace or complement technical services staff.

Activities

1. **Workflow Mapping Exercise:** Draw your library’s current acquisitions or cataloguing workflow. Then, redesign it to incorporate AI at one or more stages, indicating where human review is essential.
2. **AI Tool Evaluation:** Select an AI-powered library tool (e.g., Ex Libris Alma Analytics, OCLC’s smart cataloguing features) and evaluate it against the framework proposed in the chapter. Consider accuracy, transparency, ethical implications, and infrastructure needs.

3. **Metadata Quality Audit:** Take 10 existing catalogue records from your library. Use an AI metadata suggestion tool (if available) or simulate the process manually, then compare the AI-generated fields with the original human-created metadata. Identify discrepancies and discuss possible causes.
4. **Ethics Policy Drafting:** In a small group, draft a one-page “Ethical AI in Technical Services” policy that covers bias mitigation, user privacy, transparency, and accountability.
5. **Case Study Analysis:** Review the Stanford University Libraries example from the chapter. Create a presentation explaining:
 - The AI technology used.
 - Its impact on efficiency and discoverability.
 - Lessons that could be applied in a Nigerian university library context.

Teaching and learning package: *“The Technical Services Department of a University Library in the AI Era”* — covering quiz, assignment, class exercise, and practical questions.

A. Test Quiz (10 marks)

Multiple choice and short answer — to check immediate comprehension.

1. Which of the following is **NOT** a traditional function of a technical services department? (1 mark)
 - a) Acquisitions
 - b) Cataloguing
 - c) Library marketing campaigns
 - d) Metadata creation
2. Name two AI techniques used in metadata generation. (2 marks)

3. In AI-driven acquisitions, what type of data is commonly analyzed to predict future resource needs? (1 mark)
4. True or False: AI can completely replace human cataloguers without loss of quality. (1 mark)
5. Briefly state one advantage and one risk of using AI in digital preservation. (2 marks)
6. Which African university's case study showed a 65% reduction in metadata processing time for ETDs? (1 mark)
7. Give one example of an AI ethics consideration in technical services. (2 marks)

B. Assignment (20 marks)

To be submitted after one week — encourages deeper exploration.

Title: *Evaluating AI's Role in Enhancing Technical Services in University Libraries*

Instructions:

1. Choose **one** function of technical services (e.g., acquisitions, cataloguing, metadata enrichment, or preservation).
2. Research at least **two AI tools or systems** that can enhance this function.
3. Discuss:
 - The workflow changes introduced by AI.
 - The benefits and measurable improvements.
 - The risks, challenges, and ethical implications.
4. Provide at least **five APA-formatted references**, including at least **two peer-reviewed articles**.

Word Count: 1,000–1,500 words.

Marking Criteria:

- Depth of analysis (8 marks)

- Relevance of examples and tools (5 marks)
- Critical reflection on risks/ethics (4 marks)
- APA formatting and clarity (3 marks)

C. Class Exercise (Interactive Discussion)

For small group work during a 1–2 hour session.

Scenario:

Your university library has received funding to improve the speed and accuracy of cataloguing 5,000 newly acquired e-books. The library director is considering purchasing an AI-enabled cataloguing tool.

Tasks (in groups of 4–5):

1. Identify **three evaluation criteria** you would use before choosing an AI tool.
2. Draft a **hybrid workflow** combining AI automation with human oversight for this project.
3. Anticipate **two staff concerns** about using AI and propose solutions.
4. Present your plan in **5 minutes** to the class.

D. Practical Questions (Hands-On Activities)

For lab or practicum sessions.

1. Metadata Extraction Test

- Provide students with a PDF of a thesis or journal article.
- Use an **open-source AI tool** (e.g., GROBID, OpenAI API, or DSpace AI plug-in) to extract metadata.
- Compare AI-generated metadata with **MARC or Dublin Core** standards.
- Discuss discrepancies and corrections.

2. Predictive Acquisitions Simulation

- Use a small dataset of **circulation statistics** and **course reading lists**.

- Run a basic **predictive analytics** script (can be Excel, Orange, or a library LSP demo).
- Identify resources likely to be in high demand next semester.
- Write a **short acquisitions recommendation** based on findings.

3. AI Ethics Audit

- Provide a set of AI-generated subject headings for African literature.
- Have students evaluate for **bias, cultural accuracy, and relevance**.
- Suggest dataset improvements or rule modifications to improve fairness.

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