ASSESSMENT OF UNIVERSITY LIBRARIES' READINESS FOR ADOPTING ARTIFICIAL INTELLIGENCE IN KENYA

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JULY 2026

DECLARATION

This thesis is my original work and has not been presented for a degree or any other award in any other institution.

Signed…….……..…...Date…….…….……

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We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

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DEDICATION

This thesis is dedicated to my beloved spouse, Sammy Kitula, and my children, Jeff Kitula and Heidi Rehema, whose love and support inspired this achievement.

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First and foremost, I thank the Almighty God for His grace, strength, and faithfulness throughout this thesis journey. I would have given up if it were not for Him. I am deeply grateful to my supervisors, Prof. Paul Maku Gichohi and Dr. Josphat Karani, for their unwavering support, timely feedback, invaluable guidance, and commitment to my academic success. I also sincerely acknowledge Prof. Laban Peter Ayiro, whose exemplary scholarship, dedication to research, and pursuit of excellence have been a great source of inspiration throughout my academic journey. Finally, I extend my heartfelt gratitude to my family for their love, patience, understanding, and encouragement. Their support and sacrifices, especially during the periods I was away from home, made the completion of this thesis possible.

ABSTRACT

Artificial Intelligence (AI) has the potential to enhance the efficiency and effectiveness of information services in university libraries. However, its adoption in Kenyan university libraries remains low, limiting their ability to provide innovative and user-centred services. This study assessed the readiness of university libraries in Kenya to adopt AI in information service delivery and developed a framework for AI adoption. The study sought to identify information services suitable for AI adoption, assess the status of ICT infrastructure, determine library staff ICT competence, evaluate users' perceptions of AI adoption, and develop an AI adoption framework. It was anchored on the Unified Theory of Acceptance and Use of Technology (UTAUT) and Diffusion of Innovation (DOI) theories. The study employed a descriptive survey design and a mixed-methods approach. The study sampled seven University Librarians, seven systems librarians, 31 library Heads of Sections, 383 undergraduate students, and 13 Heads of Departments using probability and non-probability sampling techniques. Data were collected through questionnaires, interviews, and focus group discussions. Quantitative data were analysed using descriptive and inferential statistics, while qualitative data were analysed thematically. The findings revealed that although staff and users expressed positive perceptions about AI, key barriers included inadequate ICT infrastructure, limited staff ICT competencies, insufficient funding, and lack of policy frameworks. The proposed framework comprises service areas for AI implementation, digital readiness, enabling technologies, capacity building, funding, governance, strategic alignment, stakeholder collaboration, and evaluation mechanisms. The study recommends partnerships, staff training, and enhanced ICT infrastructure to support AI adoption in university libraries.

LIST OF ACRONYMS AND ABBREVIATIONS

4IR	Fourth Industrial Revolution
AACR	Anglo-American Cataloguing Rules
ACC	Automated Content Classification
AI	Artificial Intelligence
AI-LSICF	Library Services Innovative Conceptual Framework
AL	Adaptive Learning
ANOVA	Analysis of Variance
ASRS	Storage and Retrieval System
ATU	Attitude Toward Usage
ERB	Ethics Review Board
CAPM	Comprehensive Access to Printed Material
CBE	Curiosity-Based Experimentation
CCTML	City of Cape Town Metropolitan Libraries
CIPTL	Centre for Intellectual Property and Information Technology Law
COBOL	Common Business-Oriented Language
CSS	Content Summarisation and Synthesis
CU	Contextual Understanding
CUE	Commission for University Education
DDC	Dewey Decimal Classification
DIL	Digital Information Literacy
DL	Deep Learning
DOI	Diffusion of Innovation

DVC	Deputy Vice Chancellor
DW	Durbin-Watson
EE	Effort Expectancy
EP-X	Environmental Pollution Expert
ERB	Ethics Review Board
FAQ	Frequently Asked Question
FC	Facilitating Condition
FGD	Focus Group Discussion
DDPR	General Data Protection Regulation
GPS	Global Positioning System
HAMLET	How about Machine Learning Enhanced Theses
HCI	Human-Computer Interaction
HMI	Human Machine Interfaces
HOD	Head of Department
HOS	Head of Section
HTML	Hyper Text Markup Language
IaaS	Insight as a Service
IAS	Intelligent Alert Systems
ICT	Information and Communication Technology
ILS	Integrated Library Systems
IRS	Intelligent Recommendation Systems
IT	Information Technology
JKUAT	Jomo Kenyatta University of Science and Technology

KCA	Kenya College of Accountancy
LAN	Local Area Network
LIPS	List Processing
LIS	Library and Information Science
LRS	Library Retrieval System
MAI	Machine Aided Indexing
MARC	Machine Readable Cataloguing
MCQ	Multiple Choice Question
MeSH	Medical Subject Heading
ML	Machine Learning
MM	Motivation Model
MPCU	Model of Personal Computer Utilisation
NACOSTI	National Commission for Science, Technology and Innovation
NBE	Need-Based Experimentation
NLP	Natural Language Processing
OPAC	Online Public Access Catalogue
PE	Performance Expectancy
RDA	Resource Description and Access
READ	Reference Effort Assessment Data
RFID	Radio Frequency Identification
RII	Relative Importance Index
RMF	Risk Management Framework
RtIU	Real-time Information Updates

SACU	Southern African Customs Union
SCT	Social Cognitive Theory
SD	Standard Deviation
SDI	Selective Dissemination of Information
SI	Social Influence
STEM	Science, Technology, Engineering, and Mathematics
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TTI	Technical Training Institution
TUK	Technical University of Kenya
UDC	Universal Decimal Classification
UK	United Kingdom
URL	Uniform Resource Locator
USIU	United States International University
UTAUT	Unified Theory of Acceptance and Use of Technology
UTS	University of Technology, Sydney
VIF	Variance Inflation Factor
WAN	Wide Area Network
Wi-Fi	Wireless Fidelity

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CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

This chapter introduces the study on assessment of readiness of university libraries to adopt artificial intelligence (AI) in Kenya. The study background, statement of the problem, purpose and objectives, and the research questions are sketched out in this chapter. Towards the end, the chapter explains the justification and significance of the study, the scope and limitations of the study, and definitions of operational terms.

1.2 Background to the Study

Libraries are critical components of educational institutions. They are the central points where educational community members can access information, regardless of their gender, age, religion, ethical and political inclinations (Yusuf et al., 2022). Consequently, university libraries have a fundamental role in creating, organising, and providing access to current and precise knowledge for students, faculty, and other users. However, in the age of digitisation, the future of university libraries has reportedly become a point of contention, given that the library structures, as well as their contents, have changed over time (Omame & Alex-Nmecha, 2020).

To remain relevant, university libraries need to leverage advanced technologies such as artificial intelligence (AI) to improve their information services by allowing each library user to enjoy a distinct and personalised learning experience that is carefully tailored to match their needs. Artificial intelligence (AI) refers to the programming of computers to carry out tasks that are often done by humans, such as decision-making, language translation, speech recognition, emotional processing and visual perception

(Ghosh & Thirugnanam, 2021). AI systems can sense their surroundings, think, learn, and act accordingly, which justifies their adoption in university libraries to provide information services to patrons. According to Ali et al. (2022) and Jha (2023), AI technologies have improved fundamental information services, including acquisition, classification, cataloguing, retrieval of information, reference service, circulation and systems for libraries.

Barsha and Munshi (2023) and Abba (2023) claim that many university libraries, particularly in the developed world, have integrated AI into various information services like circulation, shelf reading, and reference. For instance, a study by Hervieux and Wheatley (2021) established that university libraries in the United States and Canada had adopted AI for the provision of information services such as reference, classification, cataloguing, indexing, personalised recommendations, and acquisition. According to the study, these university libraries successfully adopted AI due to availability of advanced technological infrastructure, acceptance of AI systems by both staff and users, possession of advanced Information and Communication Technology (ICT) skills by the library staff, and availability of funds for installation and maintenance AI systems.

However, most university libraries in Africa have lagged behind in adopting AI in information service provision. A study by Moustapha and Ibrahim (2023) on adoption of AI in university libraries in Kwara State, Nigeria established that an average of 90% of the participants indicated that their libraries had not adopted AI tools. Similarly, another study by Amoah and Minishi-Majanja (2023) established that no university library in Ghana had adopted AI for provision of information services. Studies by various scholars such as Echedom and Okuonghae (2021), Madumo and Kimaro (2021) Mgala (2020) and

Yusuf et al. (2022) attribute the slow uptake of AI in African university libraries to financial constraints, lack of adequate ICT skills and competencies, inadequate ICT infrastructure, resistance to change, lack of acceptance by the users, lack of proper policies and frameworks, security and intrusion issues and inadequate power supply.

In East Africa, university libraries hardly ever deploy AI to deliver information services. A study by Bakiri et al. (2024) found that 23% of Tanzanian university libraries had adopted AI for basic AI-based services such as barcoding, classification, cataloguing, Radio Frequency Identification (RFID), labelling, acquisition, stamping and registration. However, advanced AI tools such as chatbots were yet to be adopted. Another study by Nakaziba and Ngulube (2024) revealed that none of Uganda's university libraries had implemented any Fourth Industrial Revolution (4IR) technologies, including AI. Both studies attributed the poor rate of adoption of AI to inadequate funding, poor ICT infrastructure and inadequate ICT skills among library staff.

In Kenya, university libraries continue to lag in adoption of AI for provision of information services. A study by Masinde et al. (2024) established that the adoption of AI tools in Kenyan university libraries was at the initial stage, with variations in adoption rate across different AI tools. The study also established that more complex AI tools like AI classification tools and robots were yet to be adopted. Another study by Sang (2025) also established that only 7% of the respondents indicated that their libraries had adopted AI for provision of information services. Similarly, a study by Kwanya (2023) revealed that none of the university libraries in Kenya has adopted robots to provide information services.

Studies by Kwanya (2023), Masinde et al. (2024) and Sang, (2025) attributed the poor uptake of AI in university libraries in Kenya to a lack of proper legal and regulatory framework, technical skills gap, poor technological infrastructure, negative perception from librarians, resistance to change, lack of funding, security and intrusion issues and fear of job losses. Akello (2022) opines that if these challenges are not resolved, they will prevent university libraries in Kenya from reaping the numerous benefits that AI may provide. Consequently, the present study sought to assess the readiness of university libraries in Kenya to adopt AI in providing information services and develop a framework for AI adoption that will guide Kenyan university libraries on the prerequisites for successful adoption of AI in providing information services.

1.3 Problem Statement

The growing demands of library users and the changing nature of the information landscape require university libraries to continuously modify their service delivery mechanisms to improve their efficiency and effectiveness (Hussain, 2023). Consequently, university libraries must use advanced technologies such as AI to promote information utilisation and enhance their information services. According to Tella (2020), over 60% of university libraries in developed countries have adopted AI to improve the efficiency and effectiveness of their services, in addition to enhancing their users' experience.

However, despite AI's advantages, its uptake in university libraries in Kenya is slow. Confirming this assertion, Jebet and Gichugu (2025) put forward that AI is still a grey idea in Kenyan university libraries; Masinde et al. (2024) established that Kenyan university libraries are still at the initial stage of adopting AI; while Sang (2025) found that only 22.7% of the respondents' libraries had adopted AI. Kwanya (2023) also

established that none of the university libraries in Kenya has adopted robotic technologies. According to Jebet and Gichugu (2025), Masinde et al. (2024) and Sang (2025), this slow uptake is attributed to poor ICT infrastructure, inadequate ICT skills and competencies among library staff, and lack of a policy framework for successful AI adoption. Failure to adopt AI, university libraries in Kenya risk being obsolete due to difficulty retaining existing users and attracting new ones (Sang, 2025) in addition to loss of their competitive edge over third party information providers (Jebet & Gichugu 2025).

Further, studies on the availability of a framework for adopting AI in university libraries revealed that there is no existing framework for adopting AI in university libraries in Kenya. For instance, a study by Jebet and Gichugu (2025) indicated the need for clearly defined protocols for implementation of AI tools in university libraries in Kenya. Mogambi et al. (2025) and Awere and Jebet (2025) also recommended the need for clear AI policies and framework for AI adoption to be established before large-scale deployment of AI in university libraries in Kenya. Given that an AI adoption framework is necessary to help university libraries integrate AI into their operations, there is need to develop one for Kenyan university libraries, hence the necessity of the present study.

1.4 Purpose of the Study

This study aimed at assessing the readiness of university libraries in Kenya to adopt AI in providing information services and develop a framework for adopting AI in university libraries in Kenya.

1.5 Objectives of the Study

The study was guided by the following objectives:

i. To determine the information services where AI can be adopted in university libraries in Kenya.
ii. To examine the status of ICT infrastructure readiness in adopting AI in university libraries in Kenya
iii. To assess the library staff level of ICT competence in readiness for AI adoption in information provision in university libraries in Kenya
iv. To evaluate the users' perception readiness towards adopting AI in university libraries in Kenya
v. To develop a framework for adopting AI in university libraries in Kenya

1.6 Research Questions

The study sought to answer the following questions:

i. What services can be handled by AI applications in university libraries in Kenya?
ii. Is the ICT infrastructure in university libraries in Kenya ready for the adoption of AI?
iii. What is the ICT competence level of library staff in readiness for AI adoption in information provision in university libraries in Kenya?
iv. What is the users' perception towards the use of AI in university libraries in Kenya?
v. What is the suitable framework for the adoption of AI in university libraries in Kenya?

1.7. Justification of the Study

This study was motivated by the observation that AI, which enables computer systems to perform tasks with a level of intelligence comparable to human capabilities, was being utilised by university libraries in developed nations to offer information services. In contrast, university libraries in Kenya were not keeping pace. This lag persists despite the current and evolving environment, which is marked by new developments and technologies, such as AI, that profoundly influence and transform daily life and work. Therefore, the findings of this study are intended to inform managerial, practical, and policy interventions aimed at enhancing infrastructure, building capacities, raising public awareness, establishing institutional frameworks, and providing financial support to facilitate the implementation of AI for delivering information services in Kenyan university libraries.

1.8 Significance of the Study

This research elucidates the essential conditions requisite for the effective integration of AI in the provision of information services, as well as the diverse array of information services and library operations that AI can enhance. Consequently, the findings of this study are anticipated to be of significant value to the management of university libraries in determining optimal strategies for the adoption and utilisation of AI in information service provision. Furthermore, the study offers guidance on the prerequisites for AI adoption in information service delivery, encompassing ICT infrastructure, ICT skills and competencies for library staff, as well as a framework for the implementation of AI within the library setting.

The researcher envisaged this study as a pivotal resource, providing comprehensive information on AI implementation in university libraries for the reference of Library and Information Science (LIS) students during their academic pursuits and research endeavours. The study's findings are also expected to enhance students' comprehension of the requisite processes for implementing AI in university libraries. Additionally, it is anticipated that the study's insights will inform the formulation of policies and practical strategies by the Kenyan Government to support university libraries, particularly public university libraries, in the adoption of AI for information provision.

By elucidating the ICT skills and competencies necessary for the utilisation of AI in information provision within university libraries, the study provides a foundation for Library and Information Science (LIS) institutions to develop curricula that equip their students with the requisite skills and competencies for AI-enabled information service provision. Moreover, the study contributes novel knowledge that may serve as a foundational reference for future researchers, addressing the current dearth of literature on AI applications in Kenyan libraries.

This research also highlights various information services that could be enhanced through AI integration, offering potential benefits to library users with disabilities, such as those with visual impairments. The study's findings provide insights into how libraries can employ inclusive AI technologies to deliver information services that cater to the specific information needs of individuals with visual impairments.

1.9 Scope of the Study

The study's primary goal was to assess the readiness of university libraries in Kenya to adopt AI to provide information services and develop a framework for AI adoption in Kenyan university libraries. The study specifically sought to determine the information services where AI could be adopted in university libraries in Kenya, examine the status of ICT infrastructure readiness in adopting AI in university libraries in Kenya, assess the library staff level of ICT competence in readiness for AI adoption in university libraries in Kenya, evaluate the users' perception towards adopting AI in university libraries in Kenya and to develop a framework for adopting AI in university libraries in Kenya.

This study confined itself to university libraries in chartered public and chartered private universities in Kenya. The researcher understood the differences between Kenya's public and private universities, thus, the inclusion of public and private universities in the study enabled the researcher to get more inclusive findings that could be generalised since university libraries have the same mission and operate in similar environments. The time scope of this study covered the period between January 2024 and December 2025. During this period, data were collected, analysed, and interpreted to assess the readiness of university libraries to adopt artificial intelligence in Kenya.

1.10 Limitations of the Study

The study was constrained by scarcity of literature on the integration of AI in university libraries in Kenya. To address this limitation, the researcher dedicated additional time and effort to sourcing information from diverse platforms, including

electronic journals, conference papers, electronic theses, and online books, among others. Furthermore, the researcher examined literature from developed nations and other African countries where AI had already been implemented in university libraries to deliver information services.

Considering that the implementation of AI in university libraries was a relatively new topic in Kenya, with limited literature available, the study faced challenges due to the varying levels of knowledge among respondents regarding AI and its applications within library contexts. This disparity in knowledge potentially affected their capacity to accurately assess and report on the current status and future potential of AI in their respective libraries. To mitigate this constraint, the researcher explained the concept of AI and its applications in libraries to the study participants prior to data collection. Additionally, the data collection instruments incorporated clear definitions of AI and its applicability in university libraries.

1.11 Assumptions of the Study

The study was conducted with the following assumptions, that:

i. Respondents would provide truthful, unbiased answers that reflect Kenyan university libraries' actual situation regarding the adoption of AI.
ii. The views from the sample selected for the study would be representative of the situation in Kenyan universities' libraries regarding the adoption of AI.
iii. The participants in the study know about the adoption of AI in the provision of information services and have knowledge and experience that would allow them address the research questions.

iv. The participants would be genuinely interested in the study and would not participate to impress the researcher or their bosses.

1.12 Operational Definition of Terms

Artificial intelligence (AI): This is the programming and development of computers to carry out tasks often done by humans, such as decision-making, language translation, speech recognition, emotional processing and visual perception.

Information services: These include services through which librarians provide users with information directly, in addition to interfaces that they have developed so that users can locate information on their own.

Library: This is an organised collection of information materials in various formats and staff whose primary responsibility is to assist in providing and facilitating the use of these materials to satisfy the users' educational, research, informational and recreational needs.

Library staff: These are personnel who organise, manage and facilitate access to information resources in libraries.

Library user: This refers to anyone who visits a library or accesses its digital resources to satisfy their information need, often referred to as patron or reader.

University Library: This is a library that promotes learning and instruction in university settings with the fundamental duties of creating, organising, and giving students, faculty, and other patrons convenient access to current and precise information.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter systematically reviews the literature pertinent to the study's topic. It provides an analysis of empirical literature in relation to the study's primary variables, which include: the existent information services that can be supported by AI, ICT infrastructure readiness for adoption of AI, staff ICT skills and competencies readiness for adoption of AI, users' perception readiness for adoption of AI in university libraries in Kenya and the framework for adoption of AI in university libraries. The chapter concludes with a discussion on the theoretical and conceptual frameworks, including a description of the main variables.

2.2 Artificial Intelligence as a Concept

Artificial intelligence (AI) is the programming of computers to carry out tasks often performed by humans, such as decision-making, language translation, speech recognition, emotional processing and visual perception (Ghosh & Thirugnanam, 2021). "Artificial" refers to something created or manufactured by humans instead of something existing naturally (Samad et al., 2023), whereas "intelligence" is the ability to reason, learn, and use knowledge when needed (Göde & Kalkan, 2023). These two definitions suggest that AI is the study of creating computers or other devices with human-like perception, learning, reasoning, and behaviour (Faga & Yusuf, 2023).

In the library setting, AI is considered a collection of information management tools, including Natural Language Processing (NLP), image processing, experts systems, text mining, pattern recognition, and robotics that help in the processing of information

for users, management of digital resources, and making of recommendations on what to read to the library users (Ali, 2021). Some scholars, such as Dhanda and Verma (2021) and Bory et al. (2025) have classified AI into three levels: weak AI, strong AI, and super AI. It is said that humans have mastered weak AI, but strong AI and super AI are yet to be realised (Johnsen, 2025; Liu, 2021).

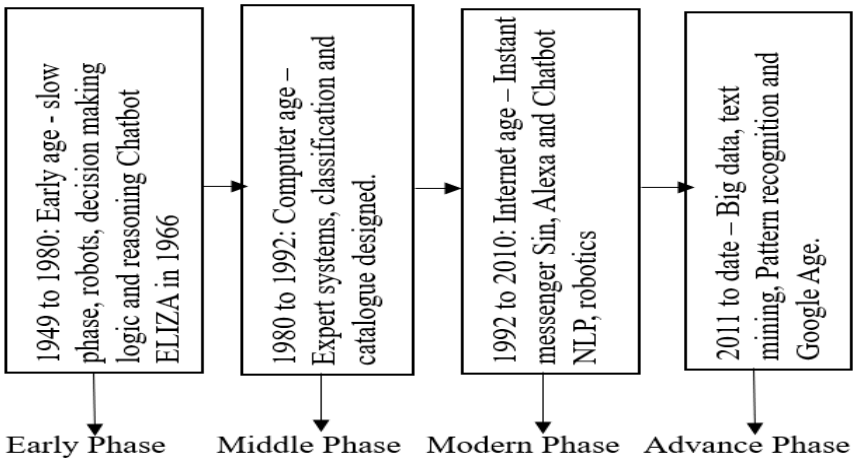
2.2.1 Historic Development of Artificial Intelligence in Libraries

Libraries started using AI in the late 1980's (Chigwada & Chisita, 2021). The eighties and early nighties saw the implementation of library automation systems and expert systems in the libraries (Ridley, 2024). According to Ali (2021), between 1993 and 2011, advances in computational capacity and a stronger focus on problem-solving were made in AI research, which led to increased application of AI in various sectors, including libraries. AI made headlines in 2010 with the development of chatbots using Natural Language Processing (NLP) (Ali, 2021). This resulted in the development of Alexa, Amazon's personal assistant which libraries use for reference services (Fatouh & Hamam, 2024).

According to Ali (2021), 2015 was regarded as a historic year for AI, with several software-related sectors expressing interest in implementing AI in their initiatives. AI in libraries has since advanced to an amazing degree in the modern era, with data mining, deep learning, pattern recognition, and Big Data being used to develop AI applications in libraries (Vasishta et al., 2025). However, Barsha and Munshi (2023) opine that to preserve user confidence and data security in libraries, ethical issues and privacy concerns must be addressed, in addition to guaranteeing openness in the application of AI algorithms. The history of AI in libraries is summarised in Figure 2.1.

Figure 2.1

History of AI in Libraries



Source: Ali (2021)

2.2.2 Components of Artificial Intelligence

Artificial intelligence (AI) comprises many components that depend on the ability to mimic human intelligence and work with symbols (Anderson & Fisher, 2025). According to Håkansson and Hartung (2025), some components used in emerging AI fields are pattern recognition, machine learning (ML), Natural Language Processing (NLP), expert systems and robotics. Expert systems are computer programs that offer expert opinions, suggestions, or solutions for a particular situation (Gupta, 2021). These automated knowledge systems provide platforms for enabling users to access databases and relevant information (Adejo & Misau, 2021).

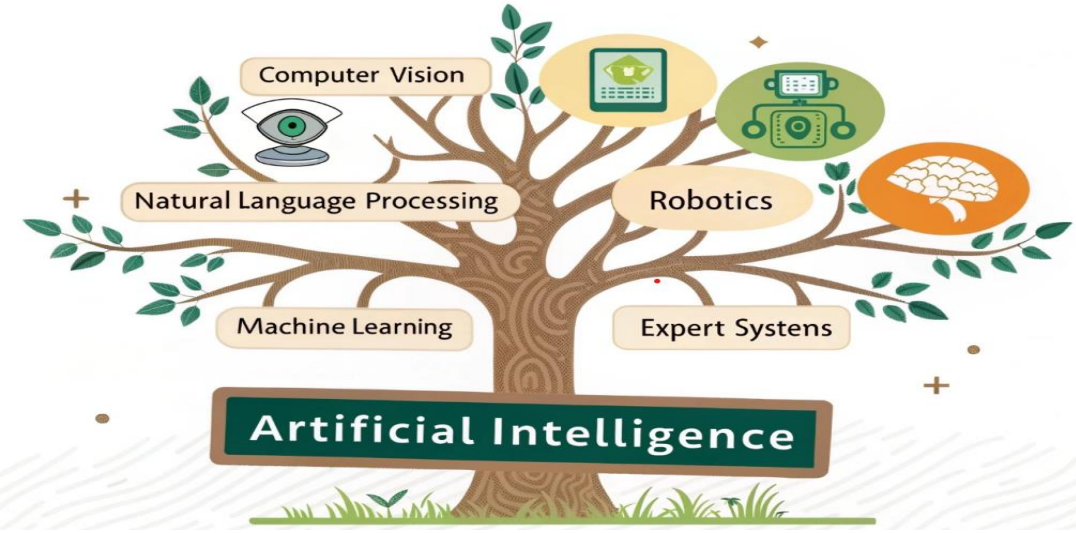
Omame and Alex-Nmecha (2020) define Natural Language Processing (NLP) as the computer evaluation and production of text in spoken language. Adejo and Misau (2021) opine that using NLP to understand critical linguistic concepts, a computer can interpret a query and its answer, which enables libraries to use chatbots for reference

services. According to Adejo and Misau (2021), pattern recognition results in a close coincidence between the pre-stored and current stimuli. Pattern recognition can be used in data analysis to automatically identify trends and regularities in the data (Nasir, 2024).

The field of robotics in computer science and engineering aims to create machines that can carry out preprogrammed tasks without requiring extra human intervention (Håkansson & Hartung, 2025). Robots are widely utilised to perform tasks that humans would find challenging to complete such as shelving and retrieval of information resources in libraries (Adejo & Misau, 2021). Massaron and Mueller (2025) define machine learning as the ability of a computer to acquire knowledge and skills without having been explicitly programmed. The cataloguing and retrieving of digital resources in libraries can be made easier using machine learning techniques (Nasir, 2024). The components of AI are illustrated in Figure 2.2.

Figure 2.2

Artificial Intelligence Components Diagram



Source: Vijayakumar & Sheshadri (2019)

2.3 Information Services Where Artificial Intelligence Can Be Adopted

Libraries have taken a keen interest in AI because it can organise and make large volumes of information available to users (Jha, 2023). Hussain (2023) opines that libraries that are enhanced by AI will give users trustworthy information and work as a valuable tool to facilitate readers' and libraries' natural integration. It is anticipated that the use of AI will heavily affect several areas in the libraries, including collection development, cataloguing, classification, indexing, information literacy, virtual service and circulation (Jha, 2023; Winkler & Kiszl, 2022). Determining information services where AI can be adopted in university libraries is essential in assessing the readiness of university libraries in Kenya to adopt AI to provide information services. This involves evaluating the staff's familiarity with the various AI technologies for information services. It also involves finding out the existing information services provided by university libraries that would benefit most from AI. Finally, it involves evaluating how AI adoption would improve these services.

2.3.1 Collection Development

Collection development is the process of satisfying the information needs of library patrons promptly and cost-effectively through purchases or donations from individuals, organisations, or other bodies (Johnson & Weber, 2025). In the recent past, AI systems that can handle collection development in the library have been developed (Abba, 2023). Isiaka (2023) provided evidence to support this claim, stating that AI systems can make suggestions depending on user preferences or previous purchases. A study conducted by Subaveerapandiyan and Gozali (2024) in India established that 49 (12.7%) of the respondents indicated their libraries were using recommender systems to

assist in acquiring information resources. This study, however, relied on a closed-ended questionnaire, which limited the breadth of responses. The present study filled this gap by including open-ended questions in the questionnaire and using interviews for data collection to better understand complex viewpoints and personal experiences with AI in university libraries in Kenya.

A study by Barsha and Munshi (2023) also established that librarians can make wise decisions about resource allocation, acquisitions, and weeding by using AI algorithms to examine usage patterns and user preferences. This study, however, used a systematic literature review, which is susceptible to bias, that can undermine the reliability and validity of the findings. To address this gap, the researcher adopted a survey research design, where data was collected using questionnaires and interviews followed by triangulation. Similarly, a study by Adejo and Misau (2021) on how Nigerian academic libraries could utilise AI suggested that Nigerian university libraries could use AI to improve acquisition. Bakiri et al. (2024) also sought to assess the adoption of AI for service provision by academic libraries in Tanzania, where 11% of the respondents indicated they used AI to acquire library resources. However, this study did not consider the users, who also play a big role in adopting AI in university libraries. The present study sought to establish the readiness of university libraries in Kenya to adopt AI to provide information services from the perspective of both librarians and users.

2.3.2 Cataloguing

According to Srikanth and Kumar (2023), AI approaches can be applied to cataloguing through using an expert system connected to an online publishing system to catalogue information resources fully, or using Human Machine Interfaces (HMI), where

the expert system and an intermediary share the cataloguing work. Brzustowicz (2023) studied how language models, like ChatGPT, can revolutionise library cataloguing by using ChatGPT free research preview version to generate Machine Readable Cataloguing (MARC) records using Resource Description and Access (RDA) for various items. The study revealed that ChatGPT could produce MARC records using RDA and additional standards, like the Dublin Core metadata element set. Amzat and Adewojo's research from 2023 on the utilisation of AI technologies in academic libraries also established that integrating AI can transform resource management in libraries by automating metadata creation and cataloguing. The study suggested protecting user privacy and data security and providing fair access to technology for academic libraries to benefit from AI fully.

A study by Echedom and Okuonghae (2021) on the use of AI in African academic libraries found that the robots acquired by the University of Lagos library stored cataloguing information of the library resources, which made it easy for the users to inquire from the robot whether certain information materials were available. The study recommended the need for a proper framework to guide AI adoption in academic libraries. This is one of the gaps the present study addresses. A study by Bakiri et al. (2024) on how Tanzanian university libraries used AI also revealed that 14% of the respondents used AI to catalog their information resources.

2.3.3 Classification

Classification is the intellectual description of a material with a view of locating it at a specific location in the collection of a system (Olubiyo, 2023). Coal Sort, Environmental Pollution Expert (EP-X), and Biosis are examples of how expert systems are used in classification (Adejo & Misau, 2021; Asemi et al., 2021). A study on utilisation

of expert systems in libraries by Gupta (2021) established that several expert systems, such as n-Cube, CUTT-X, and Shelf Pro, were used to classify library resources. While another study by Moustapha and Ibrahim (2023) on AI adoption by Nigerian university libraries in Kwara State found that 205 (50%) participants strongly agreed that AI could be used to create subject headings, classify information, and describe metadata.

Tella and Odunola (2023) also studied using AI in cataloguing and classifying library resources. According to the study, most respondents (70%) thought AI improved automatic classification and cataloguing through optical character recognition Furthermore, most respondents (90%) indicated that their libraries had no strategy for deploying AI. A study by Masinde et al. (2024) on the level of adoption of AI in Kenyan university libraries also established that only 6% of the study's participants indicated that their libraries had adopted AI for classification of information resources.

2.3.4 Indexing

Indexing is the systematic process of arranging entries so that users can easily find information within a document (Idemudia & Makinde, 2022). Expert systems can index library resources by identifying concepts and translating these concepts into verbal descriptions (Gupta, 2021). An investigation into the utilisation of AI in Taiwanese university libraries by Huang (2024) found that 33.8% of the libraries already used AI for classification and indexing. However, data collected for the study only represented the opinions of academic librarians in Taiwan regarding AI applications and, thus, could not be generalised to the rest of the world. The present study sought to fill this gap by collecting data from University Librarians in Kenya, which gave an insight into their views on using AI to provide information services.

Similarly, a study by Jazimatul (2022) on managing bibliographic data in library tasks like indexing using knowledge base systems established that expert systems were crucial to indexing library resources by selecting the appropriate terms to describe the subject matter of documents in the library based on its knowledge base. Isiaka (2023) also studied using AI in Nigeria's Kwara Stare University libraries where the findings indicated that 50 (52.1%) of respondents had adopted AI for indexing. The study recommended the development of an AI adoption framework for university libraries, which was the goal of the present study.

2.3.5 Circulation Services

Circulation services include all activities involved in making library books, journals, and other materials directly available to the people who need (Abdulhamid, 2021). Using AI, the staff at the circulation desk can make pertinent and timely decisions by understanding the patrons' needs and behaviors. A research on the use of AI in libraries by Srikanth and Kumar (2023) found that one of the applications of AI in circulation was the self-checkout system, where users could lend books to themselves, check in books on their own, renew the library books in their possession, and pay any accrued library fines. RFID technology is usually used to monitor this process with the support of AI technology.

Similarly, Jakati and Kumar (2022) researched AI applications in libraries where the findings revealed that AI could help users in deciding on the right resource to check out, send reminders to users regarding when they need to return library resources, calculate overdue fines, alert librarians regarding no further issuing, and make suggestions of places where users can purchase lost library books. Harisanty et al. (2024) also studied

the use of AI in Indonesian academic libraries. According to the study, libraries that had adopted AI found it very useful in providing routine tasks such as circulation. This study, however, did not assess the users' perception of using AI in libraries. This study fills that gap.

Further, a study by Abba (2023) on the use of AI in African academic libraries established that Vaal University used AI-enabled RFID technology to self-check books, while the University of Pretoria adopted a robot, Libby, to circulate library resources. The study suggested that appropriate policies be developed and implemented before, during, and after the adoption of AI in university libraries in Africa. The present study therefore sought to develop a framework for implementing AI in university libraries in Kenya. A study by Masinde et al. (2024) on the use of AI in Kenyan university libraries also established that 44% of the participants indicated that their libraries had adopted RFID for circulation.

2.3.6 Services for Visually Challenged People

According to Jakati and Kumar (2022), AI can be utilised to give services to the visually handicapped through the use of mobile apps like Microsoft's "Seeing AI" program. A study by Mishra (2023) on how to enhance the accessibility of library materials for those with visual impairments using assistive technologies established that the visually impaired can use AI-powered assistive technologies in libraries, such as voice assistants like Amazon's Alexa, navigation systems, wearable technology, Global Positioning System (GPS) -based apps, and screen reading software that translates text on a computer's screen into braille or speech.

Panda and Kaur (2023) also studied ChatGPT's feasibility as a replacement for conventional chatbots in libraries and information centres. The study established that ChatGPT can help users with hearing or vision impairment by providing more accessible text-based responses. Further, Chemnad and Othman (2024) examined the use of AI in improving digital accessibility for individuals with disabilities. According to the study, using a variety of AI approaches, such as Computer Vision, Natural Language Processing (NLP), machine learning (ML), deep learning (DL), and edge AI, can make digital systems, such as digital libraries, more accessible for individuals with impairments. However, there was geographic bias in this study, as indicated by most studies from developed nations, which could limit the generalisation of the study's findings to other contexts worldwide, particularly in areas with diverse socioeconomic and technical circumstances such as Kenya.

2.3.7 Reference Service

Reference services refer to individualised support initiatives provided by libraries to patrons seeking information (Cassell & Hiremath, 2023). Expert systems such as chatbots can be created to work in the library's reference section using Natural Language Processing (NLP) (Srikanth & Kumar, 2023). Ehrenpreis and DeLooper (2022) conducted a case study on implementing a chatbot, Ivy, on Lehman College's library website. The study established that the chatbot successfully responded to users' inquiries concerning library's services and resources. The study concluded that a chatbot can significantly improve a library's website by answering common reference queries, finding information to answer inquiries, and displaying student search subjects.

Tella (2023) also studied the use of AI by university libraries worldwide in reference services. The findings showed that 64 universities worldwide had adopted AI for reference services, with China and Canada's university libraries leading. However, a systematic literature review was used in this study, which may have greatly affected the validity and reliability of the findings.

Similarly, Yao et al. (2015) researched using robots to enhance information services in China, where 60% of respondents said they were satisfied with the frequently asked questions (FAQs) function of the Xiaotu robot, while 40% indicated that its rate of accuracy and knowledge needed to be improved to make it a more reliable source of reference information.

Chen (2026) also studied the use of ChatGPT in provision of reference services in university libraries in Taiwan. The study established that ChatGPT is suitable for answering indicative and recommendation questions in reference service and browsing the library website and collections. The study suggested the need for users to assess the responses from ChatGPT for accuracy before using them, and that library staff should upskill in order to enhance the integration of AI technologies in information services. However, the findings of this study could not be generalised across different types of libraries due to the sample size and participant demographics.

Oniovoghai et al. (2023) studied how Nigerian academic libraries use AI to provide information services. The study found that expert systems were utilised in the reference unit to help patrons locate library resources on the shelves, learn how to use the library's information resources, and get further guidance on the types of information resources available. The study pointed out that to enhance AI adoption in libraries, there

is need for having AI adoption frameworks. The present study addressed this gap by developing a framework for implementing AI in university libraries in Kenya. A study on the level of adoption of AI in Kenyan university libraries by Masinde et al. (2024) also established that 74% of the participants had adopted virtual assistants while 38% had adopted chatbots for provision of reference services.

2.3.8 Information Retrieval

Information retrieval is recalling resources or information from a file or database (Ibrihich et al., 2022). The amount of new information being created nowadays is increasing exponentially, which has prompted the development and application of computerised and intelligence retrieval systems to enhance searching and retrieval of information (Omame & Alex-Nmecha, 2020). A study conducted by Tella (2020) on whether librarians were ready to accommodate robots in the library established that robots can be used in Automated Storage and Retrieval Systems (ASRSs). According to the study, acquiring technology literacy was the first step toward setting up scenarios where people and robots can work together.

De Sarkar (2023) also found that robots were being used in university libraries for information retrieval. The study concluded that employing robotics results in prompt service, easier integration of different service components, and an understanding of users' methods. Kamble (2023) also studied how libraries can be transformed using AI tools. The study established that libraries use Natural Language Processing (NLP) tools to assist users in information retrieval. The study concluded that AI tools can transform libraries by enhancing search, making tailored recommendations, and offering round-the-clock support.

A case study on AI's use in Pakistani university libraries by Ali et al. (2021) also established that Aga Khan University had started offering discovery services to its library patrons through having a single search AI-based interface and voice searching. However, this study adopted a case study design, which limited the findings to the Pakistani university library context, hence the need to research the use of AI technologies in university libraries in other geographic regions such as Kenya. A study by Khanzode and Sarode (2020) also found that libraries were applying NLP to search databases such as Online Public Access Catalogue (OPAC) and dialog database searches. Further, the study established that libraries use robots for Comprehensive Access to Printed Material (CAPM), enabling real-time browsing of print materials via an online interface enhancing information retrieval.

2.3.9 Selective Dissemination of Information (SDI)

Selective Dissemination of Information (SDI) identifies and disseminates pertinent information to patrons according to each person's unique interests or information demands (Saeidnia, 2023). Personalised recommendation systems create user profiles by gathering and evaluating data, such as browsing and click histories, demographic information, and social media interactions. This enhances the SDI system's ability to filter content to provide accurate, individualised information that meets each user's needs.

Soleymani et al. (2023) found that AI could be used to enhance SDI through Natural Language Processing (NLP), Content Summarisation and Synthesis (CSS), Intelligent Recommendation Systems (IRS), Automated Content Classification (ACC), and Contextual Understanding (CU), Real-time Information Updates (RtIU) and Adaptive

Learning (AL) and Intelligent Alert Systems (IAS). The study concluded that AI systems for SDI should put user privacy first to ensure secure handling of personal information, and users must have control over their data and how it is used. Gyang (2020) also studied AI-based methods for SDI. According to the study, AI-powered systems that use Big Data and machine learning can improve SDI services by providing highly precise recommendations, real-time broadcasting, chained follow-up services, a highly customisable user interface, intermittent data generation, intelligent backend resource management, and sensible pattern recognition.

Panda and Navkiran (2023) established that 130 (71.82%) of the respondents benefited a lot from the personal recommendations made by the library system. Additionally, 62 (34.25%) of respondents indicated that the recommendations from the library system were consistent and precise. The study concluded that ethical concerns and privacy safeguards should be prioritised to adopt libraries effectively. The present study addressed these concerns through the proposed AI adoption framework.

2.4 ICT Infrastructure Readiness in Adopting Artificial Intelligence

The term ‘Information and Communication Technology" (ICT) infrastructure describes the networks, systems, and physical and digital assets that let an organisation process, store, and transfer data (Oyile et al., 2023). Hardware infrastructure is the equipment and devices required for ICT activities, including servers, routers, storage devices, switches, desktops, scanners, printers, tablets, laptops, and other peripheral devices (Oyile et al., 2023). These hardware elements are the cornerstone for building a dependable and effective ICT system. Software infrastructure comprises operating systems such as Windows, Linux, or macOS; application software such as Google

Workspace or Microsoft Office and databases; and other specialised software needed for administrative work (Sarangi & Pradhan, 2020).

To measure the readiness of ICT infrastructure to adopt AI technologies, it was necessary to examine the quality, capacity, and availability of technical resources required to support AI services. The primary indicators used to assess how ready the ICT infrastructure was for the adoption of AI were the availability of high-performance computing resources such as high performance servers and super computers, large scale data storage systems, high-speed networking, specialised software and operating systems, and cloud computing infrastructure (Gathu, 2024) and the availability of AI development tools and platforms such as software and tools that support the development, application and maintenance of AI models (Tursunbayeva & Chalutz-Ben Gal, 2024). It also included an assessment of the availability of network Infrastructure, which includes the quality, speed, and reliability of Internet and network connections within the institution (Masawi & Matthee, 2024), as well as cybersecurity procedures' robustness and comprehensiveness in preventing illegal access, breaches of security, and attacks on AI systems and data (Sangwan et al., 2023).

A study by Farag et al. (2021) in Saudi academic libraries established that all the respondents, 29 (100%), indicated that the obstacles they faced in adopting AI were inadequate ICT infrastructure and insufficient technical skills and competencies among the staff. The study noted that the existent ICT infrastructure was weak, and could not support emerging technologies such as AI. Another study conducted by Idhalama and Nwachukwu (2025) through a systematic literature review established one of the major barriers to adoption of AI and machine learning technologies in libraries in Africa is

inadequate ICT infrastructure. The researchers attributed this to inadequate funding which limited the libraries' capacity to invest in the necessary hardware, software and connectivity for adoption of AI.

Nkomo and Matli (2025) also studied the barriers to adoption of AI in university libraries in Africa through an integrated systematic literature review. The findings of the study indicated that one of the main challenges in adoption of AI was inadequate ICT infrastructure, which was characterised by slow Internet access and insufficient hardware and software. The literature reviewed in this study did not cover every African country and area, which could have resulted in conclusions that were not entirely reflective of the variety of library environments seen throughout the continent. The present study limited its scope to university libraries in Kenya with the objective of establishing the current state of ICT infrastructure in readiness to adopt AI.

A study by Amoah and Minishi-Majanja (2023) on the readiness of Ghanaian university libraries ICT infrastructure for the Fourth Industrial Revolution (4IR) established that 85 (39%) of the respondents indicated that they were somehow ready, 77 (35.3%) were not sure, 36 (16.5%) were sure, and 20 (9.2%) had no idea. This study used a mixed methods approach, which is the same approach that was adopted for the current study. Additionally, this study assessed Ghanaian libraries' preparedness for the 4IR by looking at the perceptions of the library staff, the existent ICT infrastructure, and the library staff's ICT skills and competencies, which are the same aspects that present study sought to assess in Kenyan university libraries to determine their readiness to use AI in provision of information services.

A study by Eiriemiokhale and Sulyman (2023) on the awareness of University Librarians in Kwara State, Nigeria towards AI, also found that among factors impeding university libraries' deployment of AI, poor ICT infrastructure, such as poor Internet connectivity, had the highest mean (x = 1.76). Nakaziba and Ngulube (2024) also researched the state of digitisation in Ugandan university libraries, where 42 (55.3%) of the participants indicated that insufficient ICT infrastructure was one of the impediments to digital transformation. A study by Mwilongo and Mwageni (2022) on the potential uses of AI in Tanzanian academic libraries also revealed that poor ICT infrastructure, such as low Internet bandwidth, hindered the deployment of AI in the libraries.

A study by Rutto et al. (2025) on the challenges faced by university libraries in Kenya in provision of ICT-based library services highlighted poor ICT infrastructure as the major challenge. The respondents listed slow Internet connectivity (79.5%), limited variety of ICT facilities (73%) and inadequate number of ICT facilities in the library (68%) as the main impediments to provision of ICT-based services. However, this study used a case study research design, with only three university libraries participating in the study, thus, the findings could not be generalised to all university libraries in Kenya. The present study adopted a survey research design, where seven university libraries were sampled, allowing for broader generalisation of the findings.

Musungu and Maina (2023) researched the accessibility and use of library resources in Kenyatta University and Meru University of Science and Technology libraries in the post-COVID-19 era. According to the study, 85 (27.5%) of the respondents cited unreliable Internet as a challenge in access to information resources during the COVID period. Kibuku et al. (2020) also established a great digital divide in Kenya’s rural

and urban universities concerning Internet connectivity and essential ICT infrastructure, which averages 69%.

2.5 Readiness of Staff's ICT Skills and Competencies to Adopt Artificial Intelligence

The integration of ICT in the operations of libraries has resulted in changes to various activities within the library, including the automation of previously manual processes for information gathering, processing, and dissemination (Bagewadi et al., 2025). Consequently, librarians need to upgrade their ICT skills and competencies to stay relevant (Abdullahi et al., 2024). Alam et al. (2024) opine that the level of AI literacy among librarians and information professionals greatly influences the successful integration of AI technologies into information services.

Therefore, providing ongoing training and ensuring that library staff have the requisite skills and competencies is essential to ensuring that library staff can effectively use AI technologies to provide information services (Nzioki, 2021). The assessment of staff's ICT skills and competencies in readiness for the adoption of AI involves the evaluation of various indicators that demonstrate the staff's capacity to interact and use AI technology. These indicators include the library staff's technical proficiency in basic, intermediate, and advanced ICT skills (Edelmann et al., 2023), the availability and uptake of AI-focused training programs, such as workshops, courses, and certifications (Nguyen et al., 2022), and assessment of the degree of confidence library staff have in their capacity to utilise AI technologies successfully (Bhargava et al., 2021).

2.5.1 Kinds of ICT Skills and Competencies Required for Adoption of AI

A smart librarian should be proficient in ICT and interpersonal skills to deliver quality services to library patrons. According to Chen et al. (2024), the ICT skills needed

in developing nations differ from those in third-world nations. As a result, what is thought to be advanced ICT skills in developing nations may be regarded as basic in the developed world. Based on this justification, Adedara et al. (2022) contend that ICT skills must be divided into multiple levels to fulfill the requirements of different professions in first and third-world nations.

ICT skills have been divided into different tiers in several studies. According to Martínez-Alcalá et al. (2021), ICT skills can be classified as basic, intermediate, or advanced. According to Adedara et al. (2022), basic skills require significant ICT proficiency for fundamental data analysis and processing of data, intermediate skills require the ability to use ICT tools extensively to accomplish essential tasks and operations, while advance ICT skills are distinguished by their specialised nature, which includes involvement in both software and hardware development and maintenance. According to Anthonia and Idiodi (2024) and Jan et al. (2024), besides possession of basic and intermediate ICT skills, librarians should possess advanced ICT skills such as Natural Language Processing (NLP), cloud computing, machine learning (ML), Big Data analytics, algorithm design and programming to effectively utilise AI technologies.

A study by Popa et al. (2024) on requisite and sufficient ICT competencies for the efficient application of AI technology in Romanian university libraries found a strong correlation between proficiency and efficiency in using AI tools. However, this study did not consider the ethical issues concerning using AI and its wider impact on libraries. Moreover, the authors proposed that future research should use a bigger sample size of respondents to produce more generalisable findings.

Another study on the digital literacy skills among African University Librarians by Subaveerapandiyan et al. (2024) found that while majority of the staff had basic ICT skills, they were found lacking in advanced ICT skills. The study recommended that librarians should upgrade, and learn about advanced ICT skills in order to better utilise ICT in provision of information services. Moreover, the study suggested that for librarians to be equipped with the skills they need to survive in the digital age, training workshops must be offered by local library associations and other professional organisations focusing on libraries, such as International Federation of Library Associations and Institutions (IFLA).

Oyedokun et al. (2018) studied the ICT capabilities of library personnel at selected universities in Nigeria's Kwara State. The study established that an average of 43% of the participants indicated that their basic ICT skills, including word processing, digitisation of information resources, data analysis, and electronic presentation, were very high. On the contrary, only 25% of participants rated their advanced ICT skills, including networking, programming, library automation, and knowledge taxonomy, very high. The results indicated that while the library staff possessed basic ICT skills, they lacked advanced ones.

Antidius (2018) studied the use of ICT in supporting innovative information services in the University of Dar es Salaam. According to the study, most library staff (72.5%) had basic ICT abilities, 20% had intermediate skills, 5% thought their skills were very low or insufficient, and 2.5% had no idea. The study also found that the staff lacked the advanced ICT skills required for libraries to implement AI. The study recommended

that the library implements an ICT plan that lays out short- and long-term skill development initiatives and serves as a roadmap for enhancing the ICT infrastructure.

Maina and Muthee (2020) also studied the readiness of Kenyan academic libraries to adopt cloud computing technologies. The study found that, except for Microsoft Office packages, where most respondents (70%) were experts, nearly three-quarters of the respondents had only basic skills in practically all categories. The least skilled areas with library professionals were institutional repository administration (7.5%), library networks management (7.5%), and installation and modification of Koha and Linux (5%). A study conducted by Rutto et al. (2025) across three Kenyan universities revealed that while library staff had foundational ICT skills, they were found lacking in advanced ICT skills that are necessary for them to remain relevant in the rapidly digitising academic landscape. The study recommended ongoing professional development for library staff to enhance their ICT skills.

2.5.2 Source of ICT Skills Acquisition

Providing ongoing training and equipping library personnel with the necessary skills and expertise is essential for successfully integrating AI into information services. Consequently, University Librarians need to be proficient in ICT skills to embrace the disruptive technologies of this era, such as AI (Nzioki, 2021). Some strategies for library staff to learn and advance their ICT competencies, as described by Bello (2022), are formal continuing education, learning from colleagues, informal education, self-study, supplier training, workshops, conferences, attending IT programs and courses.

A study on the ICT proficiency of LIS professionals employed at the University of Delhi affiliated college libraries was conducted by Bajpai and Margam in 2019. The

study established that the methods used by librarians for acquisition of ICT skills were workshops 42 (70%), colleagues or friends 41 (68.3%), self-study or trial and error 41 (68.3%), training by software suppliers 38 (63.3%), formal education 37 (61.7%), on the job training 32 (53.3%), web-based tutorial 29 (48.3%), orientation courses or short-term courses 26 (43.3%) and refresher courses 19 (31.7%). The study concluded that librarians should regularly refresh their ICT skills and competencies in a constantly evolving technological environment to stay relevant.

Adamu et al. (2021) researched the importance of ongoing professional development in improving the librarians' performance at work. The study found that most respondents indicated the existence of ongoing professional development, including workshops, conferences, seminars, career advancement, orientation programs, in-house training, assigning responsibilities, peer coaching and mentoring, and job rotation, as indicated by their mean scores being above the benchmark mean of the 3.50 criterion point, which indicated availability. However, the universities did not organise regular training for their staff. Namaganda (2019) also conducted a study on the ongoing professional development of librarians in Uganda's public university libraries which established that librarians engaged in conventional forms of continuing professional development such as workshops (92.3%) and conferences and seminars (76.9%).

Agava and Underwood (2020) studied the ICT proficiency skills of Tangaza University librarians. The study established that all respondents (100%) indicated they would rather take refresher courses through workshops, conferences, and seminars, 80% indicated they would prefer to acquire the ICT skills through furthering their education in LIS education, 70% of all respondents indicated they preferred free online courses on ICT

proficiency while another 70% of all respondents suggested on-the-job training because they felt it would be more relevant and practical to acquire ICT skills in this way.

2.6 Users' Perception Readiness in Adopting Artificial Intelligence

The biggest obstacle to AI's widespread adoption is how users and consumers view the technology (Bitkina et al., 2020). In Library and Information Science (LIS), a user is anybody who enters a library or remotely accesses the library's portals or websites intending to use its resources to meet their information needs (Ajegbomogun, 2021). The users of university libraries, therefore, include faculty, staff, students, and researchers. User perception, according to Modiba (2023), includes users' perceived usefulness and the behavioural intention to use new technology. How users perceive AI can determine whether university libraries succeed or fail in adoption of AI for provision of information services (Haris et al., 2025). In support of this claim, Owolabi et al. (2019) contend that accepting AI for information service provision in university libraries is contingent upon the user's readiness for these technologies.

The users' perception readiness to adopt AI technologies was measured by indicators reflecting the users' attitudes, beliefs, and readiness towards the use of AI in provision of information services. These indicators included the extent to which users thought AI would improve their efficiency, productivity, or ability to make decisions (Jain et al., 2022) and the perception of users on how simple or complex it was to understand and apply AI technologies in their day to day lives (Alhumaid et al., 2023). It also included an evaluation of the perception of users on the challenges they are likely to face when making use of AI technologies (Wang et al., 2021).

Using the extended Technology Acceptance Model (TAM), Seonghun et al. (2022) investigated how librarians and students perceived using AI-related educational content recommendation systems. The study established that all the respondents (100%) intended to use the AI-related educational content recommendation system. The factors influencing this intention were task suitability, perceived benefits and perceived ease of use. This study used a mixed-method research approach, which was also adopted for the present study. Shaheen and Khurshid (2023) conducted a study on Pakistani library users to determine their perceptions and experiences with using AI in libraries. The study found that users were generally positive about using AI in libraries. However, the study noted concerns about privacy and the ethical use of information collected by AI systems. The present study sought to develop a framework for adopting AI in libraries, which would address these privacy and security concerns.

Owolabi et al. (2019) also used the Unified Theory of Acceptance and Use of Technology (UTAUT) model to study the readiness of Nigeria's polytechnic students to use AI. Based on the Relative Importance Index (RII), the study established that performance expectancy (0.862), effort expectancy (0764), social influence (0.640), and facilitating conditions (0.568) were the variables that influenced the behavioural intention of the students to use AI. The study recommended the need to conduct further studies that examine the readiness of students and librarians to adopt AI technologies, not only in polytechnic libraries, but also in other higher learning institutions. This gap was addressed in the present study, where the perceptions of users in university libraries in Kenya towards AI were established.

Masinde et al. (2024) researched on the adoption of AI in academic libraries in Kenya using the maturity model. The findings of the study indicated that the users had a positive perception towards integration of AI in academic libraries, with a general consensus among the respondents regarding the perceived usefulness of AI tools in enhancing customer service and streamlining library processes. An overwhelming 97% of the respondents indicated that AI tools can effectively automate the cataloguing processes, 82% reported positive experiences with AI technologies in the library, 66% expressed confidence in their own skills to utilise AI tools effectively, while 72% agreed that AI tools and services could be seamlessly integrated within the existent library systems. However, this study used purposive sampling, which is a non-probability sampling technique, in the selection of the university libraries that took part in the study, which limits the generalisability of the findings to all university libraries in Kenya. The present study used stratified random sampling which led to a sample that reflected the real population structure of university libraries in Kenya.

2.7 Framework for Adoption of Artificial Intelligence in University Libraries

A framework for the adoption of AI is essential in ensuring libraries experience a seamless and efficient integration of AI in their services. Yang et al. (2024) argue that no "one-size-fits-all" approach is practical to AI adoption. Dasgupta and Wendler (2019) opine that adopting a complex technology such as AI requires consideration from several viewpoints when developing the framework for its adoption. Therefore, understanding the context around AI is key to utilising existing and emerging adoption frameworks for organisations (Dasgupta & Wendler, 2019).

Tinholt et al. (2018) created an AI readiness benchmark for various developed and developing countries. According to this benchmark, institutional AI readiness can be measured in terms of ICT maturity, IT skills advancement as well as an institutional environment. However, the framework's indicators inherently favoured developed nations with more developed infrastructure and resources, ignoring innovative or adaptable AI strategies that were being developed in developing countries. Furthermore, this index did not adequately account for other nations or regions' distinct political, social, and cultural environments. This necessitates the development of an AI adoption framework for university libraries that considers the infrastructure and resources in developing countries such as Kenya.

Intel Corporation (2019) also published a framework for AI readiness in organisations such as university libraries. According to this model, AI readiness can be measured in the context of foundational readiness, such as the presence of appropriate ICT infrastructure, operational AI readiness, such as adequate AI skills and competencies, security and ethical considerations, and acceptance of AI technology. However, this model overemphasises technological aspects, ignoring subtle aspects like organisational culture, change management, and human capital. This could result in organisations scoring highly in technological readiness, but struggling with actual AI adoption due to a lack of staff engagement, resistance to change, or insufficient leadership support. The present study sought to propose a framework that would factor in the staff's ICT skills and competencies and the users' perception of using AI in university libraries to ensure seamless integration of AI in university libraries in Kenya.

Another study on how to leverage AI technologies in libraries through experimentation-driven frameworks was conducted by Gupta and Gupta (2023). Their research suggested two frameworks for experimentation-driven AI adoption in libraries: The Need-Based Experimentation (NBE) Framework and the Curiosity-Based Experimentation (CBE) Framework. To link technology adoption with strategic objectives, NBE strongly emphasises addressing specific library needs through controlled experimentation. In contrast, CBE cultivates a culture of inventive research by motivating librarians to investigate AI technology out of natural curiosity. The study found that both NBE and CBE combine to provide a comprehensive approach for implementing AI in libraries that accommodates both practical requirements and innovative experimentation.

However, the NBE framework's emphasis on experimenting in certain areas may lead to fragmented AI adoption, in which several library divisions independently develop AI solutions without a coherent plan. This might lead to insufficient integration between information services, resulting in inefficiencies and possibly incompatible AI systems. The present study, therefore, sought to propose an AI adoption framework that would standardise the adoption of AI across all the sections in the library. In order to put their proposed CBE framework to the test, Gupta and Gupta (2023) conducted a case study on the adoption of a real AI technology that allowed people to create professional videos from texts in one of the libraries. The librarian used these technologies to create videos for the social media profile, enhancing user interactivity. The trial was successful since patrons were leaving more good reviews and sharing them, which led to increased user involvement, as seen by the patrons spending more time on the library's social media pages. The study concluded that libraries may improve user experiences and remain at the

forefront of finding new potential for AI integration by implementing AI technology and encouraging an experimental mindset.

Shahzad et al. (2024) studied the readiness of librarians to use AI creative learning environments and intelligent information services to propose a framework for AI adoption. The variables included in their proposed framework were skilled human resources, adequate financial resources, strategic planning, formal documentation, collaborative approach, training opportunities, adequate IT infrastructure, and technical support. However, this framework was too generalised and did not consider the various needs, resources, and contexts of various university libraries. Consequently, libraries may find it difficult to implement the framework successfully due to differences in their technological infrastructure, funding, user demographics, and sizes, which could result in improper AI adoption strategies or underutilisation. The present study collected data across diverse universities to develop a framework that can be used across various university libraries in Kenya.

Okunlaya et al. (2022) studied AI information services to develop a new conceptual framework that would offer fresh perspectives on how AI technology may be applied to provide value-added, creative information services to accomplish digital transformation. The study examined previous research to create a framework for AI service innovation in university libraries. The study's findings enabled the authors to create the Artificial Intelligence Information Services Innovative Conceptual Framework (AI-LSICF), which incorporated AI functions and applications into the digital transformation framework's elements and discussed using a service innovation framework. The AI-LSICF framework included a new service delivery concept, a new

service delivery system, technological options, and a new client interface. These researchers, however, admitted that their proposed framework was based only on findings from the literature, hence the need to test it in practice. Consequently, the present study sought to propose a framework that would be informed by the study's findings. Moreover, the comprehensive and theoretical nature of the AI-LSICF makes it complicated and challenging to apply in real-world situations.

Nkomo and Matli (2025) proposed a framework for adoption of AI in university libraries in Africa. This framework was derived from the findings of a systematic literature review on the adoption of AI in university libraries in Africa. The pillars of the proposed framework were AI literacy, AI policy initiators, AI awareness, and AI access, which were all interlinked. However, systematic literature review-based frameworks often lack context-specific applicability, as they synthesise findings from studies conducted in diverse environments (Asemi et al., 2021). The present study seeks to fill this gap by proposing an AI adoption framework that is derived from empirical findings that provide context-specific, statistically validated, and actionable insights. Consequently, the AI adoption framework proposed by the present study is more appropriate for guiding AI implementation in university libraries in Kenya.

2.8 Summary of Research Gaps

AI can greatly improve the efficiency and effectiveness of library information services (Hussain (2023). However, most of the studies on information services can be supported by AI, used systematic literature review, which was susceptible to bias that could impact the validity and reliability of the findings. The present study used questionnaires, interview schedules and focus group discussions (FGDs) for data

collection, followed by triangulation of the data sets from each data collection method when reporting the findings. The purpose of this approach was to ensure the validity and reliability of the findings.

Further, most of the studies on services that AI can support were conducted in the developed world, which made generalisation of the findings difficult. Consequently, there was need to find out the existent information services in Kenyan university libraries that could be enhanced by adopting AI, which was one of the objectives of the present study. The generalisation of the present study's findings was achieved by using a sample size that was representative of the population, using the mixed methods research approach, and collecting data from different universities spread across the country.

For AI to be effectively adopted in university libraries, there is need for a sufficient ICT infrastructure that is backed by sufficient Internet access and electricity (Barsha & Munshi, 2023). The literature reviewed on ICT infrastructure readiness for adoption of AI revealed that no study had been conducted to establish the state of ICT infrastructure in university libraries in Kenya in readiness for adoption of AI. Most research concentrated on university libraries' challenges when implementing new technologies such as AI, with poor ICT infrastructure standing out as the major challenge. The present study therefore sought to assess the status of the existing ICT infrastructure in university libraries in Kenya to establish if it could adequately support the utilisation of AI in delivering information services.

Successful integration of AI in providing information services also depends on the kind of ICT skills and competencies the library staff possess (Alam et al., 2024). The relevant literature reviewed revealed that most studies were conducted in developed

nations. On the contrary, research carried out in Africa primarily concentrated on the general ICT skills and competencies librarians needed to use ICT tools in providing information services. The present study, therefore, sought to find out the kind of ICT skills and competencies that librarians in Kenyan university libraries possess and whether these skills were adequate to enable them provide information services using AI technologies.

The perception of users towards AI could determine whether they succeed or fail in using AI-enhanced information services (Haris et al., 2025). The literature reviewed on users' perception of AI in provision of information services revealed that most users positively perceived AI-enhanced information services, even though they raised concerns about ethical use of AI in libraries. However, most of these studies were conducted in developed nations, with only one study conducted in Africa, in Nigeria. This necessitated a study on the perception of users in university libraries in Kenya towards adopting AI.

According to the International Federation of Library Associations and Institutions [IFLA] (2020), libraries must have AI adoption\n frameworks in place before they can fully utilise AI to provide information services. The literature reviewed on the frameworks for the adoption of AI revealed that an AI adoption framework should indicate the expertise, skills, and knowledge that library staff should possess to work with AI, responsible and ethical use of AI in libraries as well as the necessary ICT infrastructure for the adoption of AI. The reviewed literature also established that the existent AI adoption frameworks either overemphasised technological aspects, resulted in fragmented AI adoption, did not take into consideration the various needs, resources, and contexts of various university libraries and geographic regions or were developed as a result of reviewed literature without having been tested.

Consequently, the present study sought to propose a framework that could be used by university libraries in Kenya to adopt AI in provision of information services. The framework was based on the variables that should be included in the AI adoption framework, as revealed in the reviewed literature and empirical findings of the study. The framework also sought to standardise the adoption of AI across different library departments by considering the various needs, resources and contexts of different university libraries in Kenya.

2.9 Theoretical Framework

To investigate the readiness of university libraries in Kenya to adopt AI for provision of information services, this study anchored on two theories: The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and Diffusion of Innovation Theory (DOI) (Rogers, 1962).

2.9.1 Unified Theory of Acceptance and Use of Technology (UTAUT)

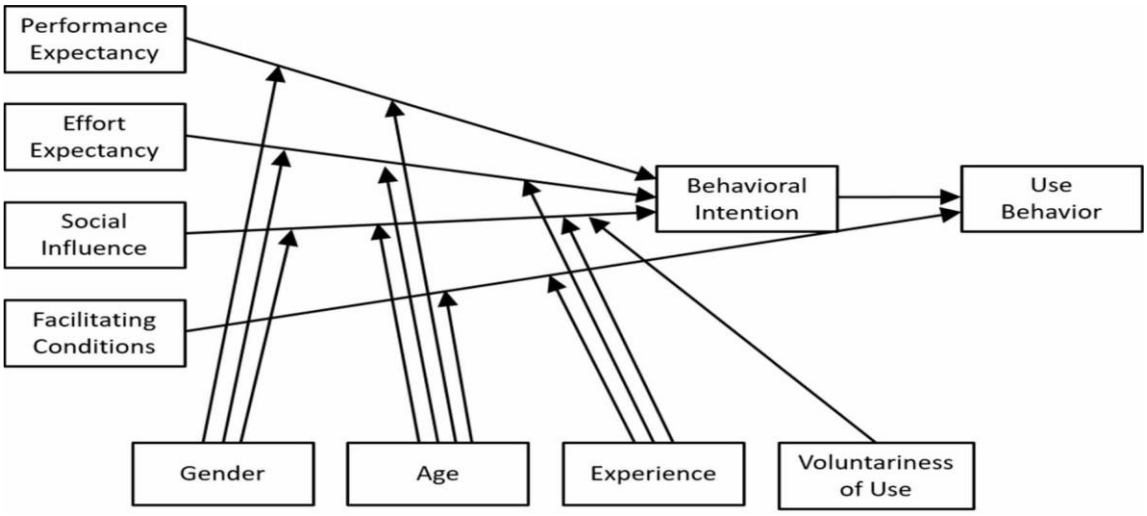
The Unified Theory of Acceptance and Use of Technology (UTAUT) claims that behavioural intention determines technology use (Andrews et al., 2021). This theory, therefore, seeks to forecast a user's behavioural intent for utilising a certain technology. In organisations, including university libraries, the adoption and utilisation of technologies are influenced by both technical factors, such as the existence of required infrastructure, the suitability of software systems, and the effectiveness of policies and guidelines, and human-related aspects, such as abilities and attitudes (Owolabi et al., 2019).

According to Venkatesh et al. (2003), the foundation of this model is eight acceptance models, which include the Technology Acceptance Model (TAM) Diffusion

of Innovation Theory (DOI) (Rogers 1962) Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975), Model of Personal Computer Utilisation (MPCU) (Thompson et al. 1991), Motivation Model (MM) (Davis et al. 1992), Theory of Planned Behaviour (TPB) (Taylor and Todd 1995), Social Cognitive Theory (SCT) (Bandura 1986) and Combined TAM and TPB (C-TAM-TPB) (Taylor and Todd 1995). According to Momani (2020), Performance Expectancy (PE), Social Influence (SI), Facilitating Condition (FC), and Effort Expectancy (EE) are the model's four constructs, while gender, age, voluntariness, and experience all act as moderating factors for these constructs as shown in Figure 2.3.

Figure 2.3

The UTAUT Model



Source: Venkatesh et al. (2003)

2.9.1.1 Main Variables of UTAUT Model

The first variable of the UTAUT model is Performance Expectancy (PE), which reflects “the degree to which an individual thinks that utilising the system will help them

perform better at work" (Venkatesh et al., 2003, p.159). Extant literature has indicated that five constructs from previous models are related to Performance Expectancy (PE). These are perceived usefulness, extrinsic motivation, job fitness, relative advantage, and outcome expectations. According to this model, age and gender influence how behavioural intention and performance expectancy relate.

The second variable, Effort Expectancy (EE), is related to the "degree of ease associated with the use of a system" (Venkatesh et al., 2003, p.159). Extant literature has indicated that three elements from previous frameworks are related to Effort Expectancy (EE). These are ease of use, perceived ease of use, and complexity. This indicates that one of the crucial aspects of accepting Information Technology (IT) is the extent to which the system's architecture enables user-friendliness. Age and gender differences have been demonstrated to have an impact on effort expectations in earlier studies (Natarajan et al., 2017; Terblanche & Kidd, 2022)

Social Influence (SI) is the third variable. It is "the extent to which consumers perceive that important others, like family and friends, believe they should use a particular technology" (Venkatesh et al., 2003, p.159). Extant literature has indicated that three constructs from previous models are related to Social Influence (SI)**.** These are social factors, subjective norms, and image. Venkatesh et al. (2003) state that moderating factors, including gender, age, experience, and voluntary use, would impact how social influence and use intention relate.

The last variable, Facilitating Conditions (FC), can be defined as "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003, p.159). Extant literature has

indicated that three constructs from previous models are related to Facilitating Conditions (FC). These are perceived behavioural control, facilitating conditions, and compatibility. The moderating elements between collaborating circumstances and behavior are experience and age.

2.9.1.2 Justification for Adoption of UTAUT Model

UTAUT has successfully been used in several studies that focused on the adoption of AI, such as Andrews et al. (2021), Chatterjee and Bhattacharjee (2020), Hasija and Esper (2022), and Venkatesh (2022). Many of these studies used survey research design and mixed methods approach, which were adopted for the current study. UTAUT was also chosen because the researcher believed its four key variables, which include Performance Expectancy (PE), Social Influence (SI), Effort Expectancy (EE), and Facilitating Conditions (FC), were fit and pertinent in determining the readiness of university libraries in Kenya to adopt AI for provision of information services.

Additionally, Venkatesh et al. (2003) argued that UTAUT is preferred over other technology adoption and utilisation models since it is detailed and effective. The previous test result by Venkatesh et al. (2003) found that the UTAUT model explained 70% of the variation in usage intention, surpassing the eight original models studied. This implies that it is more effective than any previously employed models in explaining technology use behavior. Wu et al. (2019) further note that compared to other models and theories of a similar nature, the model has been embraced because it improves comprehension of how new technologies are accepted and used within organisations.

Lastly, many scholars in developing countries have utilised the UTAUT model to study the adoption of new technologies. Quadri and Garaba (2019) used UTAUT to

investigate how ICT affects South West Nigerian librarians' knowledge sharing, Akullo and Nsibirwa (2024) used it to study the adoption of linked open data in Ugandan university libraries, while Waithaka et al. (2022) used this model to study how public universities in Kenya were implementing and using open access scholarly publishing. The researcher, therefore, concludes that UTAUT is adaptable and can be employed in several contexts and scenarios.

2.9.1.3 Main Variables of UTAUT Model mapped to the Study

In the present study, Performance Expectancy (PE) is the perception of users and staff in university libraries in Kenya about how using AI to provide information services would improve the quality, efficiency, and effectiveness of the information services. At the same time, Effort Expectancy (EE) is the perception of users in Kenyan university libraries about how easy it is to use AI systems and technologies. Social Influence (SI), which is the third variable, is the extent to which users in university libraries in Kenya perceive that their fellow users believe they should use AI-based information services. The last variable, Facilitating Conditions (FC), refers to the existent conditions in the Kenyan university libraries that can facilitate the adoption of AI, such as the availability of existent services that can be enhanced by AI, an AI adoption framework, good ICT infrastructure, staff with the necessary ICT skills and competencies for using AI technologies to provide services and users with a positive perception towards AI-enhanced services.

2.9.1.4 UTAUT Model Application in Adoption of AI in Libraries

Andrews et al. (2021) adopted the UTAUT model to study North American librarians' intent to adopt AI. According to the study, Social Influence (SI) and Effort

Expectancy (EE) had no noticeable effect on librarians' intent to use AI, while Attitude Toward Usage (ATU) and Performance Expectancy (PE) of AI and related technologies did. Ali et al. (2022) also used the UTAUT model to establish how librarians' attitudes affect AI adoption in Pakistani university libraries. The study established that Performance Expectancy (PE), Effort Expectancy (EE), and Facilitating Conditions (FC) had an impact on the librarians' attitudes toward the adoption of AI, while Social Influence (SI) did not. Another study based on the UTAUT model was conducted on Nigeria's polytechnic students by Owolabi et al. (2019) to determine their readiness for AI implementation in their libraries. The study established that Effort Expectancy (EE), Performance Expectancy (PE), and Social Influence (SI) were three of the UTAUT variables that influenced the student's attitude toward the adoption and use of AI technologies in their libraries.

2.9.1.5 Criticism of UTAUT Model

Other scholars have challenged the UTAUT model even though it has been used and has achieved positive results in several studies (Alkhwaldi & Kamala, 2017). Bagozzi (2007) criticised the model and its subsequent modifications, claiming that while UTAUT is an admirably thoughtful and well-intentioned presentation, it provides a model with at least eight independent variables for predicting behaviour and 41 independent variables for predicting intentions, which has led to studies on technological adoption getting to the point of confusion. Bagozzi (2007) instead provided a comprehensive theory to account for decision-making that is coherent with the many knowledge splinters.

The UTAUT model, according to Shachak et al. (2019), concentrates on the acceptance stage of the implementation process, which happens after the organisation has

already taken an adoption decision and its users need to support it. On the contrary, implementation is not a static, one-off event but rather a continuous process. The UTAUT model was also criticised by Van Raaij and Schepers (2008) for being less efficient than the TAM and TAM2 since its high regression is only possible when moderating significant correlations with a maximum of four variables. They further pointed out that the grouping and labelling of items and constructs was a challenge, given that several desperate items were combined to represent one psychometric construct.

Kessler and Martin (2017) also pointed out that when it came to using AI, compatibility, data security, and relationships with the device type were more significant than the hedonic characteristics linked with acceptance in earlier work. Despite the criticism, UTAUT provides constructs that should be considered for the readiness of university libraries in Kenya to adopt AI to provide information services. Performance expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Conditions (FC) can be used to define university libraries' readiness for adoption and use of AI for information service provision.

2.9.2 Diffusion of Innovation (DOI) Theory

The Diffusion of Innovation (DOI) Theory was created by Rogers (1962), making it one of the earliest social science theories. It was initially used in communication to explain how a product or idea gains momentum and spreads throughout a specific group or social structure over time (Dearing & Cox, 2018). According to Rogers (2003), diffusion is a social process people go through when learning about an innovation. In the end, diffusion results in people's adoption of a new idea, habit, or product and its integration into their social structure.

2.9.2.1 Main Variables of Diffusion of Innovation Theory

This theory states that innovation, communication channels, time, and social system are the four primary components influencing new ideas' diffusion (Rogers, 2003). The first component, innovation, can be defined as an idea, behaviour, or item that a person or other adoption unit views as new, while adoption is when someone changes their conduct from what they used to do (Guidolin, 2023). Rogers (2003) suggests in this theory that adopting an innovation is a process that takes place over time rather than a single action. According to this theory, when engaging with an innovation, potential adopters go through five stages: knowledge, persuasion, decision, implementation, and confirmation.

The second component is communication channels, which are the methods used by individuals in a social system to spread messages about innovation. The information exchange that occurs when one person introduces a new concept to another is the fundamental component of the diffusion process. Rogers (2003) opines that persuading someone to embrace a new thought works better when interpersonal channels connect two or more people with similar socioeconomic and educational backgrounds.

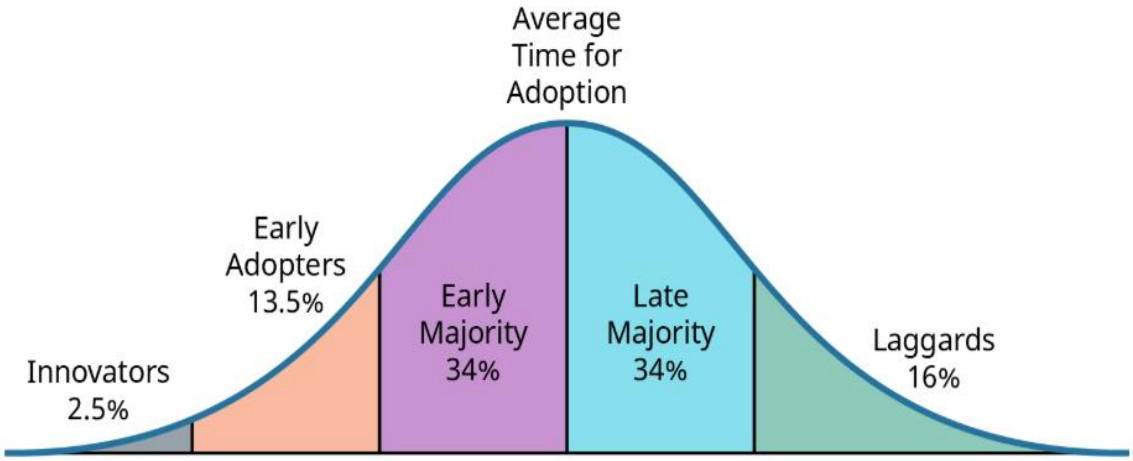
Diffusion time is the third component. This theory holds that innovations are not adopted simultaneously by all individuals in a social system; hence, innovativeness, or the extent to which a person adopts a new idea comparatively earlier than other members of a social system, is the criterion for adopter categorisation (Guidolin, 2023). Based on their level of innovation, adopters can be divided into five categories: innovators, who are bold and proactive in seeking out new ideas; early adopters, who are reputable individuals who hold the highest level of opinion leadership in most systems; early majority, who may take some time to embrace a new idea fully; late majority, who approach innovations

cautiously and wait to adopt until others in their system have done so; and laggards, who adopt ideas slowly and take a long time to make decisions about them (Guidolin, 2023).

Rogers (2003) expounded upon the concept of adopter categories. According to the concept, 2.5% of people will readily accept any innovation, 13.5% will be early adopters, 34% will be the early majority, and 16% will be laggards or those who willfully reject the innovation, as shown in Figure 2.4.

Figure 2.4

Diffusion of Innovation Adopter Categories

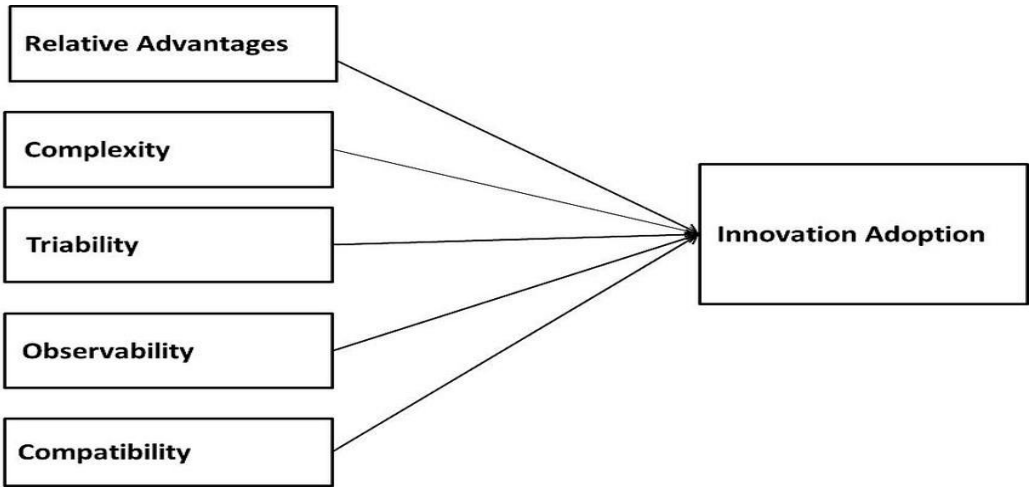


Source: Rogers (2003)

Moreover, according to Rogers (2003), the recipient's adoptability of an innovation is influenced by compatibility with existing values, past experiences, and needs of potential adopters, complexity, relative advantage, trial-ability and observability that spurs peer conversation and validates the importance of the innovation. Figure 2.5 shows the factors influencing the adoption of innovations.

Figure 2.5

Factors Influencing Adoption of Innovations



Source: Rogers (2003)

The social system is the final component, dealing with the communication and social structures of a system and influencing how easily or poorly innovations spread within it. Different factors, including opinion leaders, change agents, and norms, impact the process of diffusion within a social system.

2.9.2.2 Justification for Adoption of Diffusion of Innovation Theory

The researcher chose the DOI theory because it provides a sufficient explanation for why ICT innovations such as AI are diffused, adopted, or not adopted in libraries, unlike any other theory. Corroborating this statement, Minishi-Majanja and Kiplang'at (2005) in their study of DOI theory's suitability as a theoretical framework for Library and Information Science (LIS) research, noted that DOI is the best theory for explaining the adoption of ICT innovations in libraries. Additionally, the study established that the theory's broad framework offers a foundation for examining LIS innovations, especially

in distinctive social systems like the one in Sub-Saharan Africa, where the current study was conducted.

The researcher also believed that this theory was relevant to this study since its four key variables, innovation, communication channels, time of diffusion, and social system, impact Kenyan university libraries' readiness to adopt AI for provision of information services. Furthermore, implementing AI for information service provision in university libraries is a multi-step procedure that involves multiple phases, including knowledge, persuasion decision, implementation, and confirmation. In this study, the potential adopters, which are university libraries in Kenya, also go through the five phases that Rogers (2003) outlined while interacting with AI.

Additionally, the researcher believed that relative advantage, compatibility, complexity, trial-ability, and observability, which are factors that influence the adoptability of innovation, as opined by Rogers (2003), have an impact on the readiness of university libraries in Kenya to adopt AI for the provision of information services. According to Dearing and Cox (2018), when explaining the adoption rate, these five attributes were the most crucial characteristics of innovations.

Lastly, numerous impactful studies on the adoption of AI in recent years have employed DOI theory as their theoretical foundation. For instance, Winkler and Kiszl (2022) used DOI to study the views of academic librarians in Hungary on AI, Gürsen et al. (2023) used this theory to study AI utilisation in libraries, while Lund et al. (2020) used it to study the perception of academic library employees across the world towards AI.

2.9.2.3 Main Variables of Diffusion of Innovation Theory Mapped to the Study

In the context of this study, AI is the innovation that is being diffused in Kenyan university libraries, while the university library is viewed as a social system. The individuals responsible for decision-making include the management of the university library, the library staff, the ICT staff, and the users of these libraries (Kamau, 2015). Each of these individuals influences the diffusion process of AI in university libraries. In order to make decisions on adopting AI, these individuals use various communication channels, such as face-to-face and email. Professional conferences, workshops, and seminars can also be used as forums for exchanging ideas and experiences about the use of AI in university libraries.

The time taken for the university libraries to adopt AI to provide information services depends on the speed with which decisions about adoption are made and the number of resources allocated by university administration to these libraries. Additionally, adopting AI in Kenyan university libraries also depends on how the adopters, who in this case are the librarians and users, perceive its relative advantage, complexity, trial-ability, compatibility, and observability.

2.9.2.4 Diffusion of Innovation Theory Application in Adoption of AI in Libraries

The adoption of AI in libraries has been explained by the DOI theory in several studies. Lund et al. (2020) studied academic librarians' perceptions of AI in line with the DOI adopter categories. A significant correlation was found between the adopter category, optimism regarding AI, and one's perception of their level of AI expertise. The study concluded that the DOI theory could be effectively utilised to investigate library staff perceptions regarding AI. Winkler and Kiszl (2022) also used the DOI theory to study the

views of directors of academic libraries in Hungary on AI. The study found that there were almost twice as many innovators in the general population as identified by Rogers (2003), nearly three times as many early adopters, one and a half times as many members of the early majority, and no one self-identified as a laggard or a member of the late majority.

Singh and Paliwal (2020) also employed the DOI theory to examine the variables impacting the uptake of AI-based recommendation systems in Indian academic libraries. According to the study, observability, compatibility, and relative advantage were important indicators of AI acceptance. Further, the study established that adopting AI recommendation systems was higher among librarians who thought the systems were useful and could operate well with current library processes.

2.9.2.5 Criticism of Diffusion of Innovation Theory

Despite the broad acceptance and implementation of DOI's ability to explain innovation adoption and use, there are certain drawbacks to this theoretical framework. First, the DOI theory proposes a linear diffusion model, suggesting a clear-cut route from knowledge to persuasion, decision-making, execution, and confirmation (Lund et al., 2020). This linear model is frequently criticised since adoption procedures are far more complicated and nonlinear, as potential adopters may cycle through several stages multiple times. Studies that have examined AI adoption in university libraries, such as those by Lund et al. (2020) and Winkler and Kiszl (2022), show that a linear diffusion model is not always the case.

According to Minishi-Majanja and Kiplang'at (2005), the DOI theory does not sufficiently offer a foundation for forecasting results or recommendations for accelerating adoption rates. This is because this theory focuses mostly on the decision to adopt and the

early phases of implementation but offers little guidance on post-adoption behaviour and long-term sustainability (Jasperson et al., 2005). To ensure that innovations such as AI have a lasting impact and continue to be successful in Kenyan university libraries, it is essential to comprehend how they are used and incorporated over time. DOI theory, therefore, falls short of providing a sufficient analysis of the factors affecting continuing usage, adaption, and institutionalisation of innovations such as AI (Owano, 2014).

In addition, DOI theory may not adequately account for contextual and cultural changes in modern settings because it was first developed based on research in rural sociology and agriculture in the United States in the middle of the 20th century (Dearing, 2009). In this regard, most of its components are unique to the culture and context in which it was developed, that is, in developed countries, where resources are not as scarce as in developing countries (Straub, 2009). According to Kamau (2015), the adoption of ICT innovations such as AI by university libraries in developing nations like Kenya needs to consider the scarcity of resources such as finances, ICT infrastructure, and ICT skills, among others, that may be prohibitive.

Another flaw is the DOI Theory's emphasis on independent users who have the freedom to accept or reject the innovation (Kamau, 2015). This is because, in an organisation like the university, it is after adopting the technology that the institution helps potential users, who are library staff and patrons, to use it. As a result, the university's decision determines how users react to the diffusion of innovation.

The DOI theory applies to the current study despite its drawbacks. Minishi-Majanja and Kiplang'at (2005) argue that the theory's broad framework offers a platform for examining LIS innovations like AI even in unique social systems like sub-Saharan

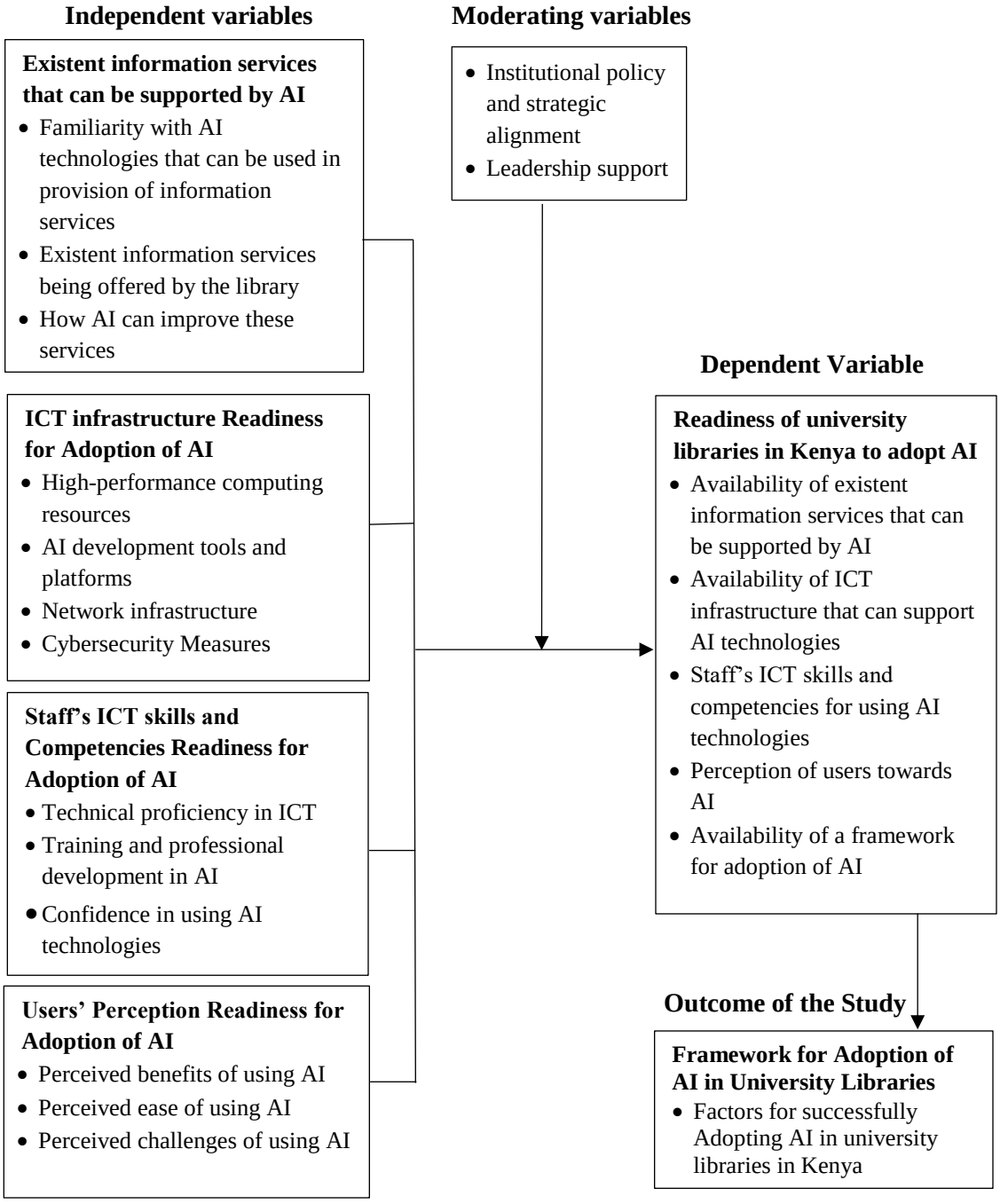
Africa. Additionally, according to this theory, an innovation should stand out by offering real solutions to people's issues (Maritim, 2023). In the current study's context, the use of AI in Kenyan university libraries to provide information services is expected to improve significantly the efficiency and effectiveness of the services delivered to library patrons.

2.10 Conceptual Framework

A conceptual framework is a set of concepts and their types that define a particular area of research (Hall, 2020). A conceptual framework is designed to help the researcher gain knowledge and an understanding of the issue at hand (Salawu et al., 2023). Figure 2.6 indicates the conceptual framework that guided the study.

Figure 2.6

Conceptual Framework



Source: Author

2.10.1 Description of the Conceptual Framework Variables

This study has four independent variables, one dependent variable and two moderating variables. The dependent variable is the readiness of university libraries in Kenya to adopt AI. It is purported to be influenced by the availability of existent information services that AI can support, ICT infrastructure readiness, staff's ICT skills and competencies readiness, and users' perception readiness, which are the independent variables. It is also purported to be moderated by Institutional policy and strategic alignment and leadership support. Figure 2.6 shows the indicators that are vital in characterising each of the variables in the conceptual framework. A brief description of these variables is also provided below to provide a precise characterisation of each of the variables.

Existent information services that can be supported by AI is the first independent variable. This was measured against indicators such as familiarity with AI technologies that can be used to provide information services such as expert systems, machine learning, Natural Language Processing, and robotics. The second indicator is the existence of information services provided by university libraries that would benefit from AI, such as circulation service, reference service, information retrieval, indexing, cataloguing, classification, selective dissemination of information, collection development and service for the visually impaired. The last indicator is how AI adoption would improve these services, such as increased efficiency, better user experience, faster access to information, and personalised recommendations, among others.

ICT infrastructure readiness for the adoption of AI in university libraries in Kenya is the second independent variable. It is characterised by the availability of high-

performance computing resources such as high-performance servers and super computers, high-speed networking, large scale data storage systems, specialised software and operating systems, and cloud computing infrastructure. The second indicator is the availability of AI development tools and platforms, such as software and tools that support AI model development, application and maintenance. The third indicator is network infrastructure availability, which includes the quality, speed, and reliability of Internet and network connections within the institution, such as cable, fiber-optic, wireless and satellite connections. The last indicator is cybersecurity procedures' robustness and comprehensiveness in preventing illegal access, breaches of security, and attacks on AI systems and data.

Library staff's ICT skills and competencies readiness for Adoption of AI is the third independent variable and is characterised by technical proficiency in the basic, intermediate and advanced ICT skills. The second indicator is training and professional development in AI, which is the availability and uptake of AI-focused training programs such as workshops, seminars, on job training, among others. The last indicator is the library staff's confidence in using AI technologies.

Users' perception readiness for the adoption of AI is the fourth independent variable in the study. It was measured against indicators such as perceived benefits of using AI, which is the extent to which users thought AI would improve their efficiency, productivity, or decision-making ability. The second indicator is perceived ease of using AI, which is the perception of users on how simple or complex it is to understand and apply AI technologies in their daily lives. The last indicator is the perceived challenges of

using AI, which is the perception of users on the challenges they are likely to face when using AI technologies.

Institutional policy and strategic alignment as a moderating variable mediate how the ICT infrastructure readiness and staff's ICT skills and competencies readiness influence the actual readiness of university libraries in Kenya to adopt AI. This is because the absence of a policy slows down the adoption of AI, even if the necessary ICT infrastructure and staff's skills and competencies are in place.

Leadership support, as a moderating variable affects how the readiness of ICT infrastructure, users' and staff's readiness for adoption of AI translate into the readiness of the university libraries to adopt AI for information provision. This is because leadership fosters resources allocation for investment in ICT infrastructure, and training for the users and staff, which are key aspects in the readiness of university libraries to adopt AI.

The readiness of university libraries in Kenya to adopt AI for the provision of information services is the dependent variable in this study and is predicted to be affected either positively or negatively by the availability of existent information services that can be supported by AI, availability of ICT infrastructure that can support AI technologies, staff's ICT skills and competencies for using AI technologies, perception of users towards AI and availability of a framework for adoption of AI.

The outcome of this study is the framework for adopting AI to provide information services in university libraries in Kenya. The proposed framework comprised of the factors for successfully adopting AI in university libraries in Keya. The framework was derived from the findings of the present study, in line with the theoretical frameworks the study was anchored on, and the reviewed literature.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter delineates the research methodology and procedures employed in the collection and analysis of data. It encompasses the research philosophy, design, and approach, as well as the study location, target population, and sampling techniques. Additionally, it addresses the research instruments utilised, detailing the measures taken to ensure their validity and reliability, as well as their administration. The chapter subsequently elucidates the processes of data processing and analysis, affirming compliance with ethical considerations throughout the study and the operationalisation of the research variables.

3.2 Research Philosophy

The study employed the pragmatic research philosophy, which emphasises methodological flexibility and practical problem solving (Creswell & Creswell, 2023), to assess the readiness of university libraries in Kenya to adopt AI for provision of information services. Considering that adoption of AI in university libraries is affected by factors such as technological, human and institutional factors, pragmatism allowed the researcher to use both quantitative and qualitative methods to collect data that led to a comprehensive understanding of the readiness of university libraries in Kenya to adopt AI for provision of information services. Moreover, the findings of the study led to actionable insights that informed policy and practices in university libraries in Kenya.

3.3 Research Design

The study employed survey research design, where data was gathered through questionnaires, structured interviews and focus group discussions (FGDs). The survey research was considered ideal for this study since it enabled the researcher to collect data from a more significant number of library staff and users from selected universities in Kenya, whose perspectives and experiences could be generalised to the rest of the library staff and users in university libraries in Kenya. Moreover, it enabled the researcher to quickly and inexpensively collect large amounts of empirical data that was both quantitative and qualitative (Asenahabi, 2019; Pandey & Pandey, 2021). The mixed methods research approach adopted for the study also adheres to this research design (Creswell & Creswell, 2023). Finally, it allowed the researcher to select from various data collection methods (Newhart & Patten, 2023), including questionnaires, interview schedules and focus group discussions (FGDs). The Descriptive survey research design was adopted for this study.

3.3.1 Descriptive Survey Research Design

Descriptive survey research design aims to describe a phenomenon and its features (Creswell & Creswell, 2023) . Adopting descriptive survey research allowed the researcher to describe the phenomenon, which in this case is the readiness of university libraries in Kenya to adopt AI to provide information services. According to Bisaria et al. (2026), a descriptive style of analysis is best for ensuring the data gathered is meaningful and precisely defines the objectives. This justified its adoption in this study since it helped in exploring and explaining the current state of the study's key variables, which were services where AI could be adopted, the status of ICT infrastructure, the library staff's

level of ICT competence and the users' perception towards adoption of AI in university libraries.

A descriptive survey research design was also chosen because it worked well for huge populations, such as undergraduate students in universities in Kenya. Lastly, several studies on AI in university libraries, such as Hervieux and Wheatley (2021), Owolabi et al. (2022), Oyewale (2023), Winkler and Kiszl (2022) and Yoon et al. (2021) employed the descriptive survey design, indicating its effectiveness in a variety of settings and scopes.

3.4 Research Approach

This study adopted a mixed methods research approach, which integrates qualitative and quantitative techniques (Creswell & Creswell, 2023) to fully assess the readiness of university libraries in Kenya to adopt AI for providing information services. From a quantitative perspective, the study benefited from a larger sample size, enabling the researcher to identify patterns and trends within the sample, assess the prevalence of specific issues or phenomena, and even draw conclusions applicable to the entire population (Ghanad, 2023). From a qualitative perspective, the opinions held by the respondents offered more insight into the trends that the quantitative perspective pointed out, allowing the researcher to comprehend questions about the causes, progression, and consequences of these trends while also giving respondents the freedom to share their thoughts and explain their practices in their own words (Oranga & Matere, 2023).

The mixed methods approach was also considered suitable for this study given the complexity of the study's constructs, which were information services in university libraries where AI could be adopted, the status of ICT infrastructure in readiness for

adoption of AI, the library staff's level of ICT competence in readiness for adoption of AI and the users' perception towards adoption of AI in university libraries in Kenya. Using the mixed methods approach enabled the researcher to explore the underlying issues and get the best understanding of these constructs, which was not achievable by using the quantitative or qualitative approach alone. Employing mixed techniques also enabled the researcher to employ inductive methods to identify emergent patterns from qualitative data and deductively apply the theories discussed in Chapter two to quantitative data (Creswell & Creswell, 2023). In addition, the researcher used words and narratives to add meaning; thus, the study enabled the researcher to draw credible conclusions and enhance the generalisability of the findings.

3.5 Location of the Study

This study was conducted in Kenya, a fast-developing East African nation, and well-known for its emphasis on innovation, technology, and education. Kenya is made up of 47 counties. It has a total area of about 580,367 square kilometers. With significant investments in the digital economy, Kenya has established itself as the region's leader in ICT. Kenya has more than 70 public and private universities ranging from big, well-known public universities like the University of Nairobi to small, recently established private universities.

Kenya's geography is characterised by regional variations in infrastructure and development, which may impact the level of ICT integration in various university libraries. As a result, Kenya's geographical diversity provides a unique and comprehensive context for assessing the readiness of university libraries to adopt AI technologies. Therefore, this study examined various university libraries across different geographic

regions of Kenya to consider the variations in infrastructure, technological development, and regional resources. Conducting this study in Kenya is relevant given the country's strong desire for technological improvement, the increasing use of AI in many industries, and the value of university libraries in promoting research and learning

3.6 Target Population

The study's target population comprised University Librarians, library Heads of Sections (HOSs), Systems Librarians, undergraduate students and Heads of Departments (HODs) from the universities sampled for the study. The research participants were categorised into two categories: library staff, comprising University Librarians, systems librarians, and library HOSs, and library users, including undergraduate students and HODs. The library staff category was examined to assess the level of ICT skills and competencies among the staff, the existing information services that could be enhanced by AI, and the current status of ICT infrastructure within the library, as these elements are crucial for the delivery of AI-based information services. The library user's category was analysed to understand users' perceptions of AI, given that they are the recipients of AI-based information services.

The University Librarians were relevant to the study since they were vital in making decisions about using AI to provide information services and were responsible for implementing AI technologies in libraries. In addition, they play an essential role in providing training and support for the library's staff and users, on new technologies such as AI in the library. Librarians are also responsible for ensuring the security of the library's digital assets and user data and influence future library frameworks.

The Systems Librarians were deemed relevant to the study due to their oversight of the library's ICT infrastructure, encompassing hardware, software, and network capabilities. This expertise enabled them to effectively evaluate the infrastructure's capacity to support AI technologies. Furthermore, their experience in integrating various technologies, such as library management systems, discovery tools, and databases, positioned them to assess the potential integration of AI technologies into existing systems. Additionally, their familiarity with the limitations and challenges of current systems, including scalability, interoperability, and cybersecurity, allowed them to identify potential barriers to AI integration within the library. Their involvement also facilitated the assessment of the training and skill development necessary for librarians to effectively implement and manage AI technologies.

The HOSs were considered relevant to the study as they oversee the daily operations of different library sections. Consequently, they were responsible for setting priorities and determining the direction of technology adoption within their sections. Their in-depth knowledge of the workflows and processes in their sections enabled them to identify specific areas where AI could enhance efficiency and to assess the current condition of the ICT infrastructure in their departments. Additionally, their understanding of their team members' skills and competencies, along with their insightful knowledge of users' needs and expectations, was crucial for determining how AI technologies could improve user experience and service delivery.

The sampling frame for University Librarians, systems librarians, and library HOSs was established by obtaining official staff lists from the library administrations of the university libraries of the universities sampled for the study. These lists provided

comprehensive and up-to-date records of all staff within the specified categories across the participating institutions, thereby ensuring accurate identification and coverage of the study population.

Undergraduate students constitute a significant proportion of university library users. Their needs, behaviours, and interactions with library services provide valuable insights into the effectiveness of AI technologies in enhancing library operations. Furthermore, undergraduate students often pursue diverse fields of study and exhibit different information-seeking behaviours and academic needs compared to postgraduate students. Including them in the study ensured that diverse perspectives and needs of library users were captured. Incorporating undergraduate students' perspectives also ensured that AI adoption in university libraries was user-centred, inclusive, and responsive to the needs of the largest group of stakeholders. The sampling frame for undergraduate students was established by obtaining official student enrollment lists from the offices of the Registrars (Academic Affairs) in the universities sampled for the study. These lists provided a comprehensive and up-to-date record of all registered undergraduate students, ensuring accurate identification of the target population

The HODs were considered relevant to the study as they represent the interests and needs of faculty members within their departments. Their inclusion in the study ensured a broad perspective on AI readiness, particularly regarding how AI-enhanced library services could support faculty in their teaching and research roles. As academic leaders, HODs could provide insights into the alignment of AI-driven library services with the institution's strategic goals, such as enhancing research output, improving student learning outcomes, or supporting interdisciplinary collaboration. The HODs also often

influence departmental decisions, including the adoption and use of new technologies within their respective academic units. Therefore, their perceptions and acceptance of AI systems in libraries could impact broader institutional adoption. The sampling frame for the HODs was established by obtaining official lists of all HODs from the offices of the Registrars (Academic Affairs) in the universities sampled for the study. These lists provided comprehensive and up-to-date records of departmental leadership across the institutions, thereby ensuring accurate identification and coverage of the target population. The distribution of the study's target population is shown in Table 3.1.

Table 3.1

Distribution of the Target Population

Target Population	Population size
Librarians	7
Systems Librarians	7
Library Heads of Sections (HOSs)	31
Undergraduate Students	90,091
Heads of Departments (HODs)	168
Total	90,304

3.7 Sampling and Sampling Technique

The chartered universities that took part in the study, the University Librarians, the library HOSs, the systems librarians, undergraduate students and the HODs were sampled as respondents in this study. The study applied probability and nonprobability sampling techniques in determining and selecting samples from the sub-groups. Sub-sections 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5 and 3.7.6 discuss the sampling techniques used to sample the participants and the sample sizes for each category of respondents, respectively.

3.7.1 Sampling and Sample Size for Chartered Universities

Essential inclusion criteria of universities in the study included the fully-fledged public and private universities chartered by the Commission for University Education (CUE) (see Appendix VIII), resulting in 62 chartered universities (35 public chartered universities and 27 private chartered universities). The specialised degree-awarding universities chartered by CUE were excluded from this study. This is because libraries of specialised degree-awarding universities are tailored to support specific areas of study; they offer a narrower range of information services than comprehensive universities and have a small user base. Consequently, this could limit the diversity of information services, AI applications in libraries and the scale at which AI technologies could be implemented, which could skew the study's findings.

Constituent colleges of chartered public universities were also excluded from this study. This is because constituent college libraries are likely to have infrastructural limitations, staff with limited ICT expertise, smaller-scale operations with fewer students, smaller collections, and simpler information services. Consequently, this being a study that focused on assessing advanced technological readiness, the results from these college libraries could be skewed.

The study also focused on the libraries in the main campuses of the selected universities. The branch libraries were excluded to ensure that the study focused on the main libraries, which have greater autonomy, more resources, and broader services. Main libraries typically serve a wider range of users and are more likely to benefit from AI adoption across various functions. By excluding the branch libraries, the researcher was

able to avoid skewed findings that could result from their smaller size, narrow focus, and dependence on centralised systems.

In determining the sample size of the chartered universities that participated in this study, the classical formula by Fisher (1998) for a population of less than 10,000, as explained by Buhat (2019), was used. Buhat (2019) advises that a 10% to 30% sample size of the entire population is adequate for any study. Horn's (1983) 10% sample size rule also asserts that a sample of 10% of a population is sufficient for research in many disciplines and countries as long as the population is small and finite. Additionally, Nyangweso (2022) effectively used this formula to determine the sample size for public Technical Training Institutions (TTIs) in Kenya in their study. The formula was thus selected for sampling the chartered universities to obtain the minimum sample size of 10%, as guided by Bullen (2013), who advises researchers to choose the minimum sample size if they are constrained by time and finances. Below is Fisher's 1998 formula used to calculate the sample size:

$nf = n/1+n/N$

where: nf = sample size, n = working sample of 10 % from the sample frame of 62 chartered universities and N = The finite size of the population.

$nf = (6.2 \div 1) + (n \div 62)$

$nf = (6.2 \div 1) + (6.2 \div 62)$

$nf = 6.2 + 0.1$

$nf = 6.3$

The total number of chartered universities selected to participate in the study were rounded off to the next whole number, seven. The specific chartered universities that participated in the study were then selected using stratified random sampling, which ensured that a representative sample was drawn from each stratum (Haute, 2021). The chartered universities were first divided into two strata, public chartered universities (35) and private chartered universities (27), based on the list of chartered universities in Kenya on the CUE website (see Appendix VIII). Given that each stratum did not have an equal number of chartered universities, a proportionate distribution of the total sample size was applied to ascertain the number of universities sampled from each stratum. To calculate the stratum sample size, the following formula was applied:

$$nh = \frac{Nh}{N} * n$$

Where: nh = sample size for stratum h, Nh = population size for stratum h, N = total population size, and n = total sample size.

Table 3.2 shows the distribution of sample sizes for each stratum.

Table 3.2

Distribution of Strata Sample Size of Chartered Universities in Kenya

Strata	Target population	Strata sample size
Public chartered universities	35	4
Private chartered universities	27	3
Total	62	7

The universities that participated in the study were randomly selected from the list of Kenyan universities chartered by CUE (see Appendix VIII) using Stat Trek's random number generator. For public chartered universities, the random numbers generated were

28,05,04 and 27 (see Appendix IX), representing the University of Embu, Jomo Kenyatta University of Agriculture and Technology (JKUAT), Egerton University, and Murang'a University of Technology, respectively. For private chartered universities, the random numbers generated were 05,16 and14 (see Appendix X), representing United States International University Africa (USIU - Africa), Kenya College of Accountancy (KCA) University and Kenya Highlands University (formerly Kenya Highlands Evangelical University).

3.7.2 Sampling and Sample Size for University Librarians

The population of University Librarians in the selected universities was small since each university had only one university librarian; thus, complete enumeration, otherwise known as census, was used. Thus, all seven University Librarians were selected to participate in this study, as indicated in Table 3.3.

Table 3.3

Sample Sizes for University Librarians

University	Target population	Sample size
University of Embu	1	1
JKUAT	1	1
Egerton University	1	1
Murang'a University of Technology	1	1
USIU - Africa	1	1
KCA University	1	1
Kenya Highlands University	1	1
Total	7	7

3.7.3 Sampling and Sample Size for Library Heads of Sections (HOSs)

The library HOSs were selected using a purposive sampling technique. The inclusion criteria included heading a particular section or department in the library, such as technical, readers' services, or acquisition and having served as a HOS for more than

two years in the university library and being physically based in the main library of the universities taking part in the study.

The HOSs were selected because of their roles in the library, which included responsibility for daily operations of the various sections and departments of the library. Additionally, they could provide insightful information on the library staff's ICT skills and competencies, existent information services that could be enhanced by AI, and the ICT infrastructure available in the library. To sample the HOSs, the census approach was used, resulting in all the HOSs in each of the selected libraries participating in the study. Table 3.4 presents the sample sizes of the HOSs from each participating university.

Table 3.4

Sample Sizes for the Library Heads of Sections (HOSs)

University	Target population	Sample Size
University of Embu	4	4
JKUAT	6	6
Egerton University	7	7
Murang'a University of Technology	3	3
USIU - Africa	5	5
KCA University	4	4
Kenya Highlands University	2	2
Total	31	31

3.7.4 Sampling and Sample Size for Systems Librarians

Each university library has one systems librarian. Therefore, the census approach was used to sample all seven Systems Librarians as indicated in Table 3.5.

Table 3.5

Sample Sizes for Systems Librarians

University	Target population	Sample size
University of Embu	1	1
JKUAT	1	1
Egerton University	1	1
Murang'a University of Technology	1	1
USIU - Africa	1	1
KCA University	1	1
Kenya Highlands University	1	1
Total	7	7

3.7.5 Sampling and Sample Size for Undergraduate Students

The undergraduate student population encompassed all individuals enrolled in undergraduate degree programs at the main campuses of the participating universities, irrespective of their academic year or field of study. This inclusive approach allowed the study to capture a diverse array of needs and library usage scenarios across various stages of undergraduate education, thereby ensuring a comprehensive understanding of how AI could address the requirements of different disciplines. Diploma program students were excluded from the study, as they do not constitute the primary academic population that university libraries are intended to serve, particularly in instances where diploma programs are managed separately by certain universities.

Table 3.6 presents the undergraduate student population figures for each university as of January 2025.

Table 3.6

Population of Undergraduate Students in Each University

University	Population of undergraduate students
University of Embu	14,094
JKUAT	25,670
Egerton University	19,250
Murang'a University of Technology	11,050
USIU - Africa	5,230
KCA University	11,597
Kenya Highlands University	3,200
Total	90,091

Saunders et al.'s (2012) table for calculating sample size with a 5% margin of error was applied to determine the undergraduate students' sample size. The researcher also considered two other models; Krejcie and Morgan (1970) and Israel (1992). However, while Krejcie and Morgan's (1970) model was similar to Saunders et al. (2012), Israel (1992) slightly deviated from it by using slightly bigger sample sizes for every population size. Since Saunders et al.'s (2012) sample table was considered a more contemporary sampling instrument than the other two, it was used for sampling undergraduate students. Moseti (2015) also used Saunders et al.'s (2012) table to sample postgraduate students for their study on management of scholarly content at Kenyan universities.

Using the Saunders et al. (2012) Table, a sample of 383 undergraduate students were selected from a population of 90,091, as shown in Figure 3.1.

Figure 3.1

Saunders Table Used for Calculating Undergraduate Students Sample Size

	Margin of error			
Population	5%	3%	2%	1%
50	44	48	49	50
100	79	91	96	99
150	108	132	141	148
200	132	168	185	196
250	151	203	226	244
300	168	234	267	291
400	196	291	343	384
500	217	340	414	475
750	254	440	571	696
1 000	278	516	706	906
2 000	322	696	1091	1655
5 000	357	879	1622	3288
10 000	370	964	1936	4899
100 000	383	1056	2345	8762
1 000 000	384	1066	2395	9513
10 000 000	384	1067	2400	9595

Source: Saunders et al. (2012)

The sample sizes for each university were then calculated based on the number of undergraduate students in each university using the following formula:

$$nh = \frac{Nh}{N} * n$$

Where: nh = sample size for university h, Nh = population size for university h, N = total population size, and n = total sample size.

The sample sizes of undergraduate students for each selected university are displayed in Table 3.7.

Table 3.7

Sample Sizes for Undergraduate Students in Each University

University	Population of undergraduate students	Sample size (UGS/90,091)*383
University of Embu	14,094	60
JKUAT	25,670	109
Egerton University	19,250	82
Murang'a University of Technology	11,050	47
USIU - Africa	5,230	22
KCA University	11,597	49
Kenya Highlands University	3,200	14
Total	90,091	383

Convenience sampling was then used to select undergraduate students who participated in the study. This sampling method was considered suitable because it enabled the researcher to collect data from undergraduate students who were in the library while the survey was being conducted (Emerson, 2021). This ensured data was collected from undergraduate students who actually use the library services. Therefore, their firsthand experience with library services was key to assessing the library's readiness to adopt AI to provide information services. Additionally, these students directly interact with the library's ICT infrastructure, such as computers, network connectivity, and security, among others, and were therefore able to accurately evaluate the readiness of ICT infrastructure for adopting AI. Moreover, their interaction with the library staff enabled them to evaluate the library staff's level of ICT skills and competencies.

3.7.6 Sampling and Sample Size for the Heads of Departments (HODs)

The HODs, who participated in this study, were selected through a purposive sampling method. The inclusion criteria required that they be the heads of Information Technology (IT) or Library and Information Science (LIS) departments within the selected universities. The heads of IT departments were deemed pertinent to the study due to their dual role as library users and experts in the latest technological advancements, including AI. Consequently, their insights were invaluable in assessing the potential integration of these technologies into library services. Furthermore, their understanding of the university's comprehensive ICT infrastructure and capabilities was essential for evaluating the library's readiness for AI implementation. Given the IT department's significant role in spearheading technological initiatives across the university, their participation provided a comprehensive perspective on the institution's readiness and commitment to AI adoption.

Similarly, the heads of LIS departments were considered relevant due to their dual function as academic stakeholders and potential library users. Their contributions offered critical insights into the capacity of university libraries to support AI-driven services. Additionally, faculty members within LIS departments often have advanced research needs and are well-versed in emerging technologies. Therefore, their feedback was instrumental in determining whether the library was adequately equipped to meet the expectations of advanced users and facilitate research utilising AI tools. Lastly, the heads of LIS teaching departments may exert influence on library policy or advocacy efforts for AI adoption, thus, including them in the study ensured their perspectives on institutional readiness, challenges, and priorities were captured, thereby contributing to a holistic

understanding of the research topic. Table 3.8 delineates the sample sizes of the HODs from each participating university.

Table 3.8

Sample Sizes for the Heads of Departments (HODs)

University	Target population	Sample size
University of Embu	12	2
JKUAT	66	2
Egerton University	51	2
Murang'a University of Technology	15	2
USIU - Africa	10	1
KCA University	6	2
Kenya Highlands University	8	2
Total	168	13

3.7.7 Total Sample

Table 3.9 summarises the sample size from each category of the target population.

Table 3.9

Total Sample

Target population	Sample size
University Librarians	7
Systems Librarians	7
Library Heads of Sections (HOSs)	31
Undergraduate Students	383
Heads of Departments (HODs)	13
Total	441

3.8 Research Instruments

This study employed a combination of questionnaires, interview schedules, and focus group discussion (FGD) guides for data collection. The researcher opted for the integration of these three methodologies to achieve methodological triangulation. This approach facilitated more effective data generation, yielding a comprehensive

understanding of the readiness of university libraries in Kenya to implement AI for information services. The literature reviewed in Chapter Two informed the formulation of questions in the interview schedules, questionnaires, and FGD guides.

3.8.1 Questionnaires

This study used questionnaires for data collection from the undergraduate students and the HOSs. Hall (2020) opines that the questionnaire is the most widely utilised instrument for collecting data among researchers, organisations, and governments. Furthermore, the questionnaires had no interviewer bias, allowing the HOSs and undergraduate students to share their opinions freely. Moreover, they offered them enough time to respond thoughtfully since they could complete the questionnaires at their convenience.

The researcher examined the conceptual framework's indicators and the reviewed literature to develop meaningful statements for the questionnaires. The questionnaires were developed using Multiple-Choice Questions (MCQs) and the Likert scale response format, created in 1932 by Renis Likert, where the five-option Likert response option were used to rate the responses (Koo & Yang, 2025). According to Tanujaya et al. (2022), Likert scales give the researcher more information on a research question than a yes or no response. The questionnaires collected both quantitative and qualitative data. Multiple-Choice Questions (MCQs) and Likert Scale format questions were used to collect quantitative data, while open-ended questions were used to collect qualitative data.

The questionnaires were split into seven sections. The first section provided the participant's demographic information, while the other sections focused on the main

variables of the study, which were existent information services that could be supported by AI, ICT infrastructure readiness for adoption of AI, staff's ICT skills and competencies readiness for adoption of AI, users' perception readiness for adoption of AI, readiness of university libraries in Kenya to adopt AI and development of AI adoption framework (see Appendices III & IV).

3.8.2 Interview Schedules

The researcher developed interview schedules that were used to collect data from the University Librarians and the systems librarians. The interview schedules collected qualitative data through descriptive responses, opinions and perceptions, experiences and insights, and contextual and situational information (Chand, 2025). According to Lim (2025), interviews allow the researcher to have control over the line of questioning while allowing for collection of more information through probing. In this study, structured interviews were considered suitable for data collection from the University Librarians and systems librarians. This is because they are cost-effective, offer a reliable foundation for generalisation, and are frequently employed in descriptive research, which was also adopted for this study.

The structured interview schedules were developed using the indicators noted during the literature review and as reflected in the conceptual framework. The interview schedules were split into seven sections. The first section provided the participant's demographic information, while the other sections focused on the main variables of the study, which were existent information services that could be supported by AI, ICT infrastructure readiness for adoption of AI, staff's ICT skills and competencies readiness for adoption of AI, users' perception readiness for adoption of AI, the readiness of

university libraries in Kenya to adopt AI and development of AI adoption framework (see Appendix V & VI).

3.8.3 Focus Group Discussion (FGDs) Guides

Focus group discussions (FGDs) guides were considered suitable for collecting data from the HODs. This is because the interaction of the HODs in group settings had the benefit of stimulating the development of fresh viewpoints and uncovering opinions on the topics of interest, therefore enhancing the contributions made (Lim, 2025). This gave the researcher a variety of perspectives on the readiness of university libraries in Kenya to adopt AI for provision of information services, as well as allowed for collection of rich data quickly. Moreover, Alam et al. (2025) opine that compared to questionnaires and interviews, FGDs are less expensive, faster, and more effective at capturing huge volumes of data since they enhance recollection and are cumulative and elaborative.

The basis of the FGD guide was the indicators adopted in the literature review. The FGD guide was split into seven sections. The first section provided the participant's demographic information, while the other sections focused on the main variables of the study, which were existent information services that could be supported by AI, ICT infrastructure readiness for adoption of AI, staff's ICT skills and competencies readiness for adoption of AI, users' perception readiness for adoption of AI, the readiness of university libraries in Kenya to adopt AI and development of AI adoption framework (see Appendix VII).

3.9 Piloting of Research Instruments

Piloting of the data collection instruments was conducted prior to the actual collection of data. This testing was crucial for determining whether the instruments were

appropriate for the study sample, evaluating their internal consistency, and improving or changing the questions, structure, and instructions (Creswell & Creswell, 2023). Moreover, insightful answers from the pilot test guided the researcher's decisions about modifying the contents of the data collection instruments. Lim (2025) also opines that piloting the research instruments helps the researcher test their validity and reliability.

The study piloted the questionnaires, interview schedules and FGD guide on selected undergraduate students, HOSs, University Librarians, Systems Librarians and the heads of IT and LIS departments at the Technical University of Kenya (TUK). Random sampling was used in TUK's choice to pilot the research instruments. TUK was considered an excellent pre-test site since it is a public university chartered by CUE, offers undergraduate programs and has both IT and LIS departments. After the piloting exercise, all raised issues were incorporated into the data collection tools, and questions were reworded to guarantee a logical flow of responses, making it simple for respondents to provide information.

3.10 Validity and Reliability of the Research Instruments

To ensure that accurate, comprehensive, and reliable data was gathered, the researcher assessed the reliability and validity of the instruments for data collection.

3.10.1 Validity of Research Instruments

In this study, the research instruments' content, face, and construct validity were considered to ensure that they appropriately measured the intended variable (Gichohi & Kathuri, 2023). The research instruments' content validity was determined through expert judgment, opinions, critiques, and guidance from supervisors and subject matter experts regarding how well the sentiments of the research instrument should be developed in terms

of flow and congruence with a specific research objective. In addition, the literature reviewed on each of the study's variables in Chapter Two was studied to develop specific sentiments addressing the independent and dependent constructs.

To ensure face validity, the researcher ensured that the language of the questions was simple and directly related to the constructs being measured and that the research instruments' layout and design was easy for the respondents to follow and navigate. In addition, the questions in the research instruments followed a logical sequence and were grouped according to the constructs they measured. The researcher also included instructions for the respondents when designing the research instruments, which also contributed to the improvement of face validity.

Construct validity was achieved by piloting the research instruments at TUK, after which any ambiguities or discrepancies were addressed. In addition, expert opinions from supervisors and other subject experts enhanced the research instruments' construct validity. Lastly, research instruments in previous studies on the readiness of university libraries to adopt AI, such as Jan et al. (2024), Owolabi, Okorie, et al. (2022), Shahzad et al. (2024) and Owolabi et al. (2019), were essential reference tools that helped enhance the research instruments' construct validity.

3.10.2 Reliability of Research Instruments

A reliable research instrument elicits consistent results over different periods when made available to a population with similar characteristics (Ayiro, 2023). To test the research instruments' reliability, the researcher distributed the questionnaires to pre-test groups at TUK. The Statistics Package for Statistical Sciences (SPSS) version 29 was then used to calculate the Cronbach alpha value based on the pre-test data. According to Ahmad

et al. (2024), an instrument's reliability can be satisfied with an alpha value of 0.7 or above. This was necessary in determining the degree to which the instruments' contents were reliable in eliciting the same responses each time they were used. After that, the questionnaires were amended to ensure high reliability.

3.11 Data Collection Procedures

To fully understand the research objectives, data was collected from undergraduate students, HOSs, systems librarians, HODs and University Librarians. The data collection methods employed were self-administered questionnaires for undergraduate students and HOSs, interviews for University Librarians and Systems Librarians and FGDs for the HODs.

3.11.1 Procedure for Administering Questionnaires

The researcher used Google Forms to create online questionnaires. This platform was selected since it was easy to use, had customisable templates, allowed for multiple types of questions such as Multiple-Choice Questions (MCQS), Linkert Scale, and short answer questions, and allowed the researcher to collect participant responses automatically. The researcher recruited seven research assistants, one from each participating university, to help with data collection. The research assistants were taught how to distribute the shareable links to the questionnaires via WhatsApp, behave ethically while in the field, and respectfully treat the respondents while explaining the study's purpose. The researcher first sent the Google Forms links to the research assistants, who helped distribute them to the undergraduate students and library HOSs.

To ensure that participants did not submit the questionnaire more than once, the researcher limited the number of responses from each respondents' email to one response.

In addition, the researcher set up an automated reply that confirmed receipt of the responses upon submission, thus discouraging participants from resubmitting the questionnaire. On the day of data collection, the research assistants explained to the respondents the study's goal and guaranteed them the confidentiality of the data that was collected before sending them the Google Forms link via WhatsApp. Once the respondents received the Google Forms link via WhatsApp, they completed it at their convenience by clicking on the link and providing their responses.

Upon completion of the questionnaire, the respondents had an opportunity of reviewing their responses before submitting them. After submission, the respondents received a confirmation message, which indicated that their responses had been received. Since the questionnaires were online, the researcher immediately received the responses. The filled questionnaires were then chronologically numbered before being sorted.

3.11.2 Procedure for Conducting the Interviews

The researcher contacted the University Librarians and Systems Librarians by telephone to agree on the best day and time for the interviews. The researcher also placed a phone call to the University Librarians and Systems Librarians a day prior to the actual day of the interview to remind them of the day and time of the appointment. The researcher then conducted the interviews in person at the locations decided upon in consultation with each participant. Before conducting the interviews, the researcher sought each participant's permission to record the conversation on audio. The recordings, which were transcribed later using Otter AI, were conducted using a smartphone. The researcher then offered an oral appreciation to each participant at the interview's conclusion.

3.11.3 Procedure for conducting Focus Group Discussions

The FGDs were conducted with two groups, one with the HODs from the IT departments and another one with the HODs from the LIS departments of the selected universities. This was to ensure that the discussions were focused since the discussion with the HODs from the IT departments delved deeper into topics like the library's ICT infrastructure readiness, technical challenges, and the scalability of AI tools, while the discussion with the HODs from the LIS departments emphasised the human and practical aspects, such as staff competence, ethical concerns, and AI's role in improving library services. The researcher used the Zoom meeting platform for the FGDs. This platform was chosen since it was reliable and user friendly. An email detailing the Zoom link, date and time for the FGD for each group was shared with the participants in advance. A day prior to the actual day of the FGD, the researcher sent a reminder to all the participants, reminding them of the day and time of the meeting.

Before the conversations began the researcher sought informed consent from the participants to record the meeting. Each group then received a clear explanation of the objectives of the research and an assurance of the confidentiality of the information shared. The researcher moderated each group’s discussion, guiding the discussions with well-crafted open-ended questions that facilitated in-depth conversations and revealed participant responses. Following Alam et al.'s (2025) advice, the moderator was considerate of each participant's point of view and made sure that everyone's voice was heard. To make sure that no important topic was overlooked during the analysis process, the meetings’ recordings were transcribed using Otter AI. Each of the FGDs took between

45 to 60 minutes. The researcher then appreciated each participant at the end of the discussion.

3.12 Data Processing and Analysis

The study collected both quantitative data and qualitative data. This data was presented sequentially, while the final results incorporated the analysis, interpretations, and discussions. The data collected from each data set was first processed before analysis was done. Data processing was critical in ensuring the quality and integrity of the datasets before analysis (Hall, 2020). An analysis of the quantitative data from the questionnaires was conducted separately from the qualitative data from the open-ended questions in the questionnaires, interviews and FGDs before being merged into the final results.

3.12.1 Analysis of Quantitative data

Quantitative data was collected using the questionnaires that were completed by the HOSs and the undergraduate students. Using Microsoft Excel, this data was first cleaned by handling missing data and correcting errors in the responses. Missing or incomplete questionnaire data were handled using appropriate coding and statistical procedures based on the pattern and extent of missing responses, in order to enhance the quality, consistency, and validity of the data for analysis. Data coding was then done to ensure the MCQs, and Likert Scale responses were converted into numeric codes for analysis. The cleaned data was then imported into the data analysis software, SPSS version 29, for analysis.

Descriptive statistics were used to summarise and understand the distribution and characteristics of the data collected from the HOSs and undergraduate students. Descriptive statistics provided an overview of the data, facilitating the interpretation and

communication of trends regarding the adoption of AI in Kenyan university libraries. The researcher used statistics such as mean, frequency distribution, and standard deviation to provide a clear overview of the data collected from the HOSs and undergraduate students regarding the readiness of university libraries to adopt AI. These statistics helped in comparison of views from the two groups, highlighting key patterns that informed the development of a framework for adopting AI in university libraries in Kenya.

Inferential statistics were also used to uncover relationships between variables of the study and make generalisations about the readiness of university libraries in Kenya to adopt AI, based on the data collected from the samples. Additionally, regression analysis was conducted to examine the correlation between the study's independent variables, which were existent information services that could be supported by AI, readiness of ICT infrastructure, readiness of staff ICT skills and competence, and readiness of user perception towards the adoption of AI, and the dependent variable, which was the readiness of university libraries in Kenya to adopt AI, ultimately contributing to the development of an AI adoption framework.

3.12.2 Analysis of Qualitative data

Qualitative data was collected from the open-ended questions in the questionnaires for the library HOSs and undergraduate students, the interviews with the University Librarians and Systems Librarians and FGDs with the HODS. These data sets were first processed before analysis to ensure accuracy and consistency. The data from the open-ended questions in the questionnaires was first formatted to ensure standardisation and categorisation of the responses into themes based on the study's objectives for more straightforward analysis. Coding was then done, followed by thematic analysis.

The interview and FGD recordings were first transcribed using Otter AI, followed by data cleaning, where any omissions in the transcriptions were corrected. During transcription, sections of the audio that were not clearly audible were marked as "[inaudible]." Where possible, these sections were verified by replaying the recordings and consulting field notes. Any remaining unclear segments were excluded from coding to maintain the integrity of the analysis. Any identifying information in the transcriptions was also removed to anonymise the data. The responses were then organised into themes based on the study's objectives. Coding of the responses was done, followed by thematic analysis. To provide all findings concerning each research objective and question, the identified themes were divided into categories based on the patterns utilised in the analysis. Deductive and inductive analysis techniques were used to accomplish this (Creswell & Creswell, 2018).

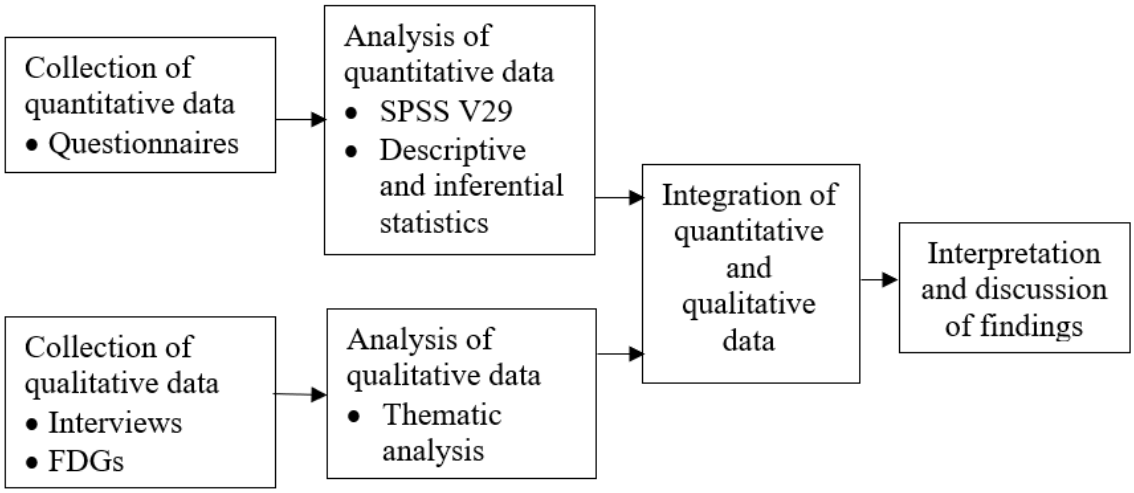
3.12.3 Integration of The Quantitative and Qualitative Data

Ayiro (2021) suggests that a common method of illustrating integration is having a discussion where the quantitative and qualitative findings are discussed one after the other in a parallel order. This entails discussing the quantitative results first, followed by qualitative results and an indication of the convergence of the two. Consequently, to provide insightful interpretations of the findings of this study, the results were triangulated during the interpretation and discussion phases. This involved comparing the results in all three data sets to identify convergence, divergence, and mixed responses for an in-depth analysis of the research problem.

Figure 3.2 shows the summary of the data processing and analysis procedures.

Figure 3.2

Summary of Data Processing and Analysis Procedures



Source: Author

3.13 Operationalisation of Variables

Operationalisation of variables refers to the process of determining how a variable or concept is observed and measured in a particular study (Putri, 2025). Operationalisation guaranteed that variables could be meaningfully compared or evaluated and were measured consistently.

Table 3.10 demonstrates how each of the variables of the study was operationalised.

Table 3.10

Operationalisation of Variables

Variables	Sub-variables	Indicators	Values (data)	Types of Data
Existent information services that can be supported by AI	Existent information services being offered by the library	Circulation Reference Information retrieval Indexing Cataloguing Classification Selective Dissemination of Information (SDI) Collection development Service for the visually impaired	Strongly Agree Agree Neutral Disagree Strongly Disagree	Ordinal
	Familiarity with AI technologies that can be used in provision of information services	Pattern recognition Machine learning Expert systems Robotics Natural Language Processing (NLP)	Not at all familiar Slightly familiar Somewhat familiar Moderately familiar Extremely familiar	Ordinal
	How AI can improve existent information services	Increased efficiency Better user experience Faster access to information Personalized recommendations Improved reference services Automated cataloguing and classification Accessibility by diverse users Enhanced security of library resource	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal

Variables	Sub-variables	Indicators	Values (data)	Types of Data
ICT infrastructure Readiness for Adoption of AI	High-performance computing resources	High-speed Internet Advanced computer systems Cloud computing services Digital libraries and databases Up-to-date security systems Machine Learning platforms Robust server capacity	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal
	AI development tools and platforms	Data analytics tools Pattern recognition software Machine Learning frameworks AI model management platforms AI-based research tools Natural Language Processing (NLP) tools	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal
	Network infrastructure	Cable Fibre-optic Wireless (Wi-Fi) Satellite	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal
		Quality Speed Reliability	Very Poor Poor Fair Good Very Good	Ordinal
	Cybersecurity Measures	Antivirus and malware protection Firewall systems Data Encryption Multi-factor authentication (MFA) for accessing resources Regular security updates and patches User education and awareness programs	Large Extent Significantly Implemented Moderate Extent Slightly Implemented Not Implemented	Ordinal

Variables	Sub-variables	Indicators	Values (data)	Types of Data
Staff's ICT skills and Competencies Readiness for Adoption of AI	Technical proficiency in ICT	Level of competence in basic ICT skills	Very High High Moderate Low Very Low	Ordinal
		Level of competence in intermediate ICT skills	Very High High Moderate Low Very Low	Ordinal
		Level of competence in advanced ICT skills	Very High High Moderate Low Very Low	Ordinal
	Training and professional development in AI	Types of training needed to prepare library staff for AI adoption such as: Basic AI Concepts Data analytics Machine learning applications in libraries Digital literacy training Cybersecurity and data privacy	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal
		Methods used to acquire ICT skills and competencies such as: Seminars Web tutorials Further studies in LIS training Personal training Workshops and conferences Friends and colleagues On the job training Training by software suppliers	Strongly Prefer Prefer Neutral Do Not Prefer Strongly Do Not Prefer	Ordinal

Variables	Sub-variables	Indicators	Values (data)	Types of Data
Users' Perception Readiness for Adoption of AI	Perceived benefits of using AI	Enhanced user experience Improved library operational efficiency Enhanced students' productivity Remote access to library resources and services Improved searching for retrieval of information Personalising user experiences Automating routine tasks Providing personalised recommendations Creating virtual assistant Improving accessibility	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal
	Perceived ease of using AI	Overall, I believe AI powered information services are easy to use I believe I can easily learn how to use AI powered information services Utilising information services enabled by AI doesn't take a lot of mental effort. Making use of AI-powered information services doesn't take a lot of effort With AI, I could easily accomplish my goals I would easily communicate with AI library systems. Using AI for provision of information services takes too much time.	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal
	Perceived challenges of using AI	Inadequate funding Intermittent power supply Technophobia Privacy and security concerns Lack of training Resistance to change Over-reliance on technology Inaccuracy of AI tools Resistance to change Lack of AI expertise Failure to have policy guideline	Strongly Agree Agree Neutral Strongly Disagree Disagree	Ordinal

Variables	Sub-variables	Indicators	Values (data)	Types of Data
Readiness of university libraries in Kenya to adopt AI	Availability of existent information services that can be supported by AI	Whether AI can improve the existent library services	Strongly Agree Agree Neutral Disagree Strongly Disagree	
	Availability of ICT infrastructure that can support AI technologies	Adequacy of ICT infrastructure in supporting AI based services	Very inadequate Inadequate Neutral Adequate Very adequate	Ordinal
	Staff's ICT skills and competencies for using AI technologies	Adequacy of staff's ICT skills and competencies for provision of AI based services	Very inadequate Inadequate Neutral Adequate Very adequate	Ordinal
	Perception of users towards AI	Likelihood of users making use of AI based information services	Very unlikely Unlikely Neutral Likely Very likely	Ordinal
Developing a Framework for AI Adoption in Libraries	Factors for successfully adopting AI in university libraries	Strong ICT Infrastructure Regular staff training on AI and ICT User education and awareness campaigns Funding and resource allocation Collaboration with AI experts Government or institutional policies on AI adoption	Strongly Agree Agree Neutral Disagree Strongly Disagree	Ordinal
	Stakeholders that should be involved in the development of the framework	University administration Library staff ICT department Government bodies Library users	Strongly Agree Agree Neutral Disagree Strongly Disagree	Ordinal

3.14 Ethical Considerations

The researcher first got clearance from Kirinyaga University before starting the data collection process, after which the researcher sought ethical clearance from the Ethics Review Board (ERB). After receiving the ERB clearance, the researcher used the introduction letter from the university to apply for the research license for data collection from the National Commission for Science, Technology and Innovation (NACOSTI). Permission to collect data from the librarians, undergraduate students and HODs of the universities participating in the study was sought from the Deputy Vice Chancellors (DVCs) of academic affairs through emails detailing a brief cover letter (see Appendix II) outlining the study's title and objectives.

The purpose of the study was clearly explained to the respondents taking part in the study, after which the volunteers and the researcher signed the consent form (see Appendix I). The participants were also encouraged to volunteer information to make the study successful. Also, the information collected from respondents was not shared with any other parties except with the authorised individuals for data analysis.

The online questionnaires, which were distributed through WhatsApp, included a brief explanation of the study's aim and the researcher's contacts. Additionally, they mentioned that participation in the study was optional, free of charge, and that respondents' anonymity was protected through codes as they were not required to reveal their identities on the questionnaire. Allowing the respondents to complete the questionnaire at their convenience further ensured their freedom to participate in the study. Furthermore, participants were free to leave the study if they chose to.

The interviewees and the interviewer agreed on the appropriate time and location of the interviews. After introducing herself and outlining the study's purpose, the interviewer provided the interviewees with a copy of the interview schedule and allowed them to ask any questions they might have. The interviewer also requested consent to use the mobile phone to record the interviews. The interviewees' identities were hidden by coding.

Before the FGDs were conducted, the researcher first explained the purpose, objectives and procedures of the FGD to the participants in addition to emphasising that participation was entirely voluntary, and participants could withdraw at any time without consequences. The researcher also verbally obtained informed consent from the participants to record the meeting, before the discussion began. Additionally, participants were assured that their contributions would remain confidential and would not be linked to their identity in any reports or publications.

Data collected for this study was securely stored, with access being granted to authorised personnel only for purposes of data analysis. Additionally, data analysis was performed, and accurate, non-fabricated reports provided. As required by the Kirinyaga University postgraduate students' handbook, all information sources used were cited and referenced following the American Psychological Association Publication (APA) Manual, 7th edition. The final thesis was also checked for plagiarism using the DrillBit software. A copy of the thesis was also shared with the universities that participated in the study as a way of disseminating the research findings.

CHAPTER FOUR

DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study, structured according to the study's variables: the information services where AI can be adopted, the readiness of ICT infrastructure for AI adoption, the preparedness of staff's ICT skills and competencies for AI adoption, the readiness of users' perceptions for AI adoption, the readiness of university libraries in Kenya for AI adoption, and the framework for AI adoption in these libraries. The chapter commences with an overview of the response rate, reliability results, and biographical details of the respondents. This is immediately followed by the findings from diagnostic tests, which were conducted to inform the selection of appropriate statistical analysis techniques for the main data sets.

Descriptive statistics, including percentages, mean values, and standard deviations, were calculated for all aspects related to each objective, with the findings summarised in tables and subsequently interpreted and discussed. Qualitative results were also presented, and any convergence was identified and discussed. Additionally, the study provided an integrated discussion of the results, examining the convergence of ideas. These findings were then corroborated and compared with previous empirical literature and theories as reported in Chapter Two.

4.2 Response Rate

The study involved the distribution of questionnaires to undergraduate students and Heads of Sections (HOSs) within the libraries. Furthermore, it involved conducting interviews with University Librarians and system librarians, alongside focus group

discussions (FGDs) with Heads of Departments (HODs). The response rates for each respondent category are delineated in Table 4.1.

Table 4.1

Summary of Respondents for the Various Categories

University	UL		Systems Librarians		HOSs			Undergraduate Students			HODs		
	Target	Response	Target	Response	Target	Response	Percentage	Sample size	Response	Percentage	Target	Response	Percentage
1.Murang'a	1	1	1	1	3	3	100%	47	43	91%	2	2	100%
2. KCA	1	1	1	1	4	4	100%	49	46	94%	2	1	50%
3. Embu	1	1	1	1	4	4	100%	60	55	92%	2	2	100%
4.Kenya Highlands	1	1	1	1	2	2	100%	14	13	93%	2	1	50%
5. JKUAT	1	1	1	1	6	5	83%	109	104	95%	2	2	100%
6. Egerton	1	1	1	1	7	7	100%	82	77	94%	2	2	100%
7. USIU - Africa	1	0	1	0	5	5	100%	22	21	95%	2	1	50%
Total	7	6	7	6	31	30	97%	383	359	94%	13	11	84.6%

Of the 383 questionnaires distributed to undergraduate students, 359 were returned as valid, resulting in a response rate of 94%. This high response rate reflects the students' willingness to participate in this study. Concerning the HOSs in the libraries, 31 questionnaires were distributed, with 30 returned, yielding a response rate of 97%. For interviews with University Librarians and systems librarians, the study initially planned to interview seven individuals from each group, but six (85.7%) were available for both categories. Additionally, focus group discussions (FGDs) with HODs were conducted, with an expected attendance of 13 members, but only 11 (84.6%) participated. The combined responses from all respondent categories resulted in an overall response rate of

89.76%. According to Babbie (2020), a response rate of at least 70% is very good for most research purposes. The high response rate in the study demonstrates the eagerness of the respondents to contribute to the study (Junkins et al., 2024).

4.3 Reliability of the Data

The data pertaining to each primary variable underwent reliability testing to ascertain its suitability prior to its incorporation into the analysis. Consequently, Cronbach's Alpha coefficients were calculated for both library HOSs and undergraduate students across the six study variables: existent information services that can be enhanced by AI, ICT infrastructure readiness for AI adoption, staff ICT skills and competencies readiness for AI adoption, users' perception readiness for AI adoption, readiness of university libraries in Kenya to adopt AI, and the development of a framework for AI adoption in libraries. The resulting Cronbach's Alpha coefficients for each of these variables are delineated in Table 4.2.

Table 4.2

Reliability of Data Based on Main Variables of the Study

Main constructs of the study	Cronbach's Alpha (HOSs)	Cronbach's Alpha (undergraduate students)
Existent information services that can be supported by AI (X1)	0.975	0.828
ICT Infrastructure Readiness for adoption of AI (X2)	0.944	0.886
Staff's ICT skills and Competencies Readiness for Adoption of AI (X3)	0.924	0.706
Users' Perception Readiness for Adoption of AI (X4)	0. 916	0.950
Readiness of university libraries in Kenya to adopt AI (Y)	0.811	0.704
Developing a Framework for Adoption of AI in Libraries (Y2)	0.937	0.919

These reliability findings suggest that data for each variable had a Cronbach's alpha coefficient exceeding 0.7. According to Ahmad et al. (2024), a reliability that is above 0.7 is considered as a good reliability measure in social sciences. This meant that each aspect and indicators within a given variable consistently and reliably measured what was intended. The study therefore held that data collected regarding the existent information services that can be supported by AI, ICT infrastructure readiness for adoption of AI, staff's ICT skills and competencies readiness for adoption of AI, users' perception readiness for adoption of AI, readiness of university libraries in Kenya to adopt AI, and developing a framework for AI adoption in libraries were therefore suitable for subsequent analysis.

4.4 Profiles of Respondents

The background profile information of respondents played a crucial role in this study. It facilitated enhanced objectivity and comprehension of the responses regarding the existent information services that could be supported by AI, the readiness of ICT infrastructure for AI adoption, the readiness of staff's ICT skills and competencies for AI adoption, the readiness of users' perceptions for AI adoption, the readiness of university libraries in Kenya to adopt AI, and the development of a framework for AI adoption in libraries. The study focused on several background aspects, including gender, age group, highest level of academic qualification, and years of work experience. The findings on the demographic characteristics of each respondent category are presented and discussed in the subsequent sections.

4.4.1 Demographic Characteristics of Heads of Sections (HOSs) in the Library

The results on demographic characteristics of the HOSs in the library department are shown in Table 4.3.

Table 4.3

Demographic Characteristics of the Library Heads of Sections (HOSs)

Gender (n=30)	Frequency	Percent
Male	17	56.7
Female	13	43.3
Total	30	100.0
Age of staff		
21-30	3	10.0
31-40	13	43.4
41-50	7	23.3
51-60	7	23.3
Total	30	100.0
Highest academic level attained		
Diploma	1	3.3
Degree	15	50.0
Master's	14	46.7
Total	30	100.0
Name of section where one works in the library		
Reader services	8	26.7
Technical	8	26.7
Reference	7	23.3
Multimedia /digital library	3	10.0
Special Collection Research &Postgraduate Studies	4	13.3
Total	30	100.0
Years one has been a librarian		
Less than 3 years	3	10.0
3-5 years	1	3.3
9-10 years	3	10.0
More than 10 years	23	76.7
Total	30	100.0
Name of the University		
Egerton University	7	23.3
JKUAT	5	16.7
KCA University	4	13.3
Kenya Highlands University	2	6.7
Murang'a University of Technology	3	10.0
University of Embu	4	13.3
USIU-Africa	5	16.7
Total	30	100.0

The demographic characteristics of HOSs in the library reveal a nearly balanced gender distribution, with 17 males (56.7%) and 13 females (43.3%). These findings corroborate with the findings by Bladek (2019) who established that in the United States of America libraries, women still remain underrepresented in top administrative roles. Mars (2018) attributes this to gender stereotyping, wage gaps and leadership biases. However, contrary to these findings, a study by Wandahi and Njoroge (2021) established that in Kenyan public university libraries, there were more women in higher positions in comparison to men.

Most of the staff (43.3%) fall within the 31-40 age bracket, followed by those aged 41-50 years (23.3%) and 51-60 years (23.3%), while the youngest group (21-30 years) constitutes only 10.0% of the total. These findings correlate with a study by Owolabi (2013) in Nigeria where majority of the library staff (66%) were in the age bracket of 31-60 years. A study by Maina and Muthee (2020) in Kenyan university libraries also established that 55% of the library staff were in the age bracket of 31-40, 22.5% in the age bracket of 26-30 years, 17.5% were over 40 years, while only 5% were below 25 years. According to Musangi (2015), the aging workforce in Kenyan libraries is attributed to limited mentorship opportunities for young professionals in addition to delays in hiring of library staff. The lower representation of younger professionals (21-30 years at 10.0%) could mean a gap in digital fluency, as younger professionals may be more inclined to adopt and adapt to AI technologies, according to Dwivedi et al. (2021).

Regarding academic qualifications, half of the library HOSs (50.0%) held a degree, while a significant proportion (46.7%) possessed a master's degree. Only one individual (3.3%) had a diploma. These findings on the academic qualifications of staff,

with 50.0% holding a degree and 46.7% having a master's degree, indicate a well-educated workforce. These findings are in line with the findings of a study by Maina and Muthee (2020) where 60% of the librarians had bachelor's degree, 17.5% had master's degree, 15% had diploma, while 7.5% had PhDs. However, academic qualifications alone do not guarantee AI readiness since the integration of AI in libraries requires specialised knowledge in fields like machine learning and large datasets needed which librarians may not acquire through academic qualifications (Shahzad et al., 2024).

Similarly, in terms of work experience, a vast majority (76.7%) had served as librarians for more than 10 years. A smaller group (10.0%) had between 9-10 years of experience, while 3-5 years of service was the least represented category (3.3%). Notably, 10.0% had been in the profession for less than three years. The high proportion of staff with over 10 years of experience (76.7%) suggests that while they bring expertise in traditional library management, they may require upskilling to handle emerging AI technologies effectively (Mabweazara et al., 2020). The limited representation of digital library staff (10.0%) suggests that AI adoption in libraries was still in its early stages.

The distribution of staff across various library sections such as Reader Services (26.7%), Technical Services (26.7%), and Reference (23.3%) suggests that diverse library functions were already in place. AI can enhance these services by automating cataloguing, improving search and retrieval systems, and enhancing user interactions through chatbots and other systems (Jha, 2023). The presence of a special collection, research & postgraduate studies section (13.3%) also indicates potential areas where AI-powered data analytics and research assistance tools can be applied (Hussain, 2023). Additionally, the dominance of traditional library roles such as reader services and technical services (both

at 26.7%) implies that AI integration will require a structured approach, including training, infrastructure investment, and change management.

Furthermore, the presence of a multimedia/digital library section (10.0%) suggests that some level of digital infrastructure exists in these university libraries. However, the relatively small proportion of staff in this section may indicate limited infrastructure or underutilisation of digital resources. The staff members were from various universities, with Egerton University having the highest representation (23.3%), followed by JKUAT and USIU-Africa (each at 16.7%). KCA University and the University of Embu contributed 13.3% each, while Murang'a University of Technology had 10.0%, and Kenya Highlands University had the least representation at 6.7%.

The presence of university libraries in different institutions, including Egerton University (23.3%), JKUAT (16.7%), and USIU-Africa (16.7%), suggests that AI adoption may be influenced by institutional culture and policies. Universities with strong STEM (Science, Technology, Engineering, and Mathematics) and ICT programs, such as JKUAT and USIU-Africa, might have a more favourable perception of AI integration compared to institutions with a more traditional academic orientation. This is because according to Ayanwale (2024), STEM students have a positive perception on the complexity and intention to use AI tools and services such as AI-powered library services.

4.4.2 Demographic Characteristics of Undergraduate Students

The results on demographic characteristics of undergraduate students from the seven universities are shown in Table 4.4.

Table 4.4

Demographic Characteristics of Undergraduate Students

Gender (N = 359)		
Characteristic	Frequency	Percent
Age of Undergraduate Student		
Below 20	92	25.6
21-30	221	61.6
31-40	35	9.7
41-50	10	2.8
50+	1	.3
Total	359	100.0
Field of Study		
Natural Sciences	10	2.8
Social Sciences	168	46.8
Engineering and Technology	108	30.1
Humanities	70	19.5
Health Sciences	3	0.8
Total	359	100.0
Rate of using Library		
Daily	52	14.5
Weekly	144	40.1
Monthly	50	13.9
Rarely	113	31.5
Total	359	100.0
Name of the University		
Egerton University	77	21.4
JKUAT	104	29.0
KCA University	46	12.8
Kenya Highlands University	13	3.6
Murang'a University of Technology	43	12.0
USIU- Africa	21	5.8
University of Embu	55	15.3
Total	359	100.0

The demographic characteristics of undergraduate students show that the majority were within the 21-30 age group (61.6%), followed by those below 20 years (25.6%). A smaller proportion consisted of students aged 31-40 years (9.7%), 41-50 years (2.8%), and above 50 years (0.3%). These findings corroborate the findings of Tella and Odunola

(2021) whose study in West Nigerian university libraries established that 60.5% of the students were within the 21-30 age group, 38.3% were below 20 years and only 1.2% were above 30 years. This distribution reflects a typical undergraduate student population, predominantly composed of young adults.

In the context of academic disciplines, the predominant cohort of students was enrolled in the social sciences, constituting 46.8% of the total, followed by those in engineering and technology, representing 30.1%. Humanities students comprised 19.5%, whereas natural sciences and health sciences students were the least represented, with 2.8% and 0.8%, respectively. The predominance of social sciences indicates a substantial demand for library resources pertinent to this field. Conversely, the lower representation of health sciences students may imply a greater reliance on laboratory-based learning or digital resources.

Library usage statistics revealed that 40.1% of students utilised the library on a weekly basis, while 14.5% visited daily. This underscores the necessity for AI-driven solutions, such as smart book retrieval, automated checkouts, and digital reference services, to enhance the efficiency and accessibility of library services. However, a considerable portion of students, 31.5%, rarely used the library, and 13.9% visited monthly. The fact that nearly a third of students rarely utilised library services suggests potential barriers to information services, such as a preference for digital resources, limited library hours, or inadequate study facilities, which could be mitigated through the adoption of AI in university libraries.

The significant proportion of students who rarely (31.5%) or monthly (13.9%) use the library may also indicate a reliance on alternative resources, potentially digital

platforms. The observation that only 14.5% of students use the library daily suggests a possible discrepancy between the services provided and students' expectations, which could be addressed by enhancing existing library services with AI. The implementation of AI in information service provision could improve user engagement through AI-powered reference services, digital repositories, and adaptive learning technologies.

Regarding university representation, the largest number of respondents were from Jomo Kenyatta University of Agriculture and Technology (JKUAT), accounting for 29.0%, followed by Egerton University at 21.4% and the University of Embu at 15.3%. Other institutions represented include KCA University (12.8%), Murang'a University of Technology (12.0%), USIU-Africa (5.8%), and Kenya Highlands University (3.6%). This diversity suggests that the findings may be indicative of library usage patterns across various types of universities in Kenya, encompassing both public and private institutions.

4.4.3 Demographic Profiles of University Librarians

The profile of the University Librarians included their work experience. The responses provided by University Librarians regarding their years of experience indicated that most had worked in the library sector for an extended period, with some having over 25 years, 32 years, and more than 20 years of experience. A study by Adekunle and Ikegune (2024) in South West Nigeria's university libraries also established that 43.9% of the librarians had 11-20 years of experience, while 8% had 21-30 years of experience. This suggests that the workforce in university libraries was highly experienced, which is beneficial for knowledge retention and service continuity. However, it also implies that a significant portion of the workforce may be accustomed to traditional library management practices, which could present challenges such as resistance to change when integrating

new technologies such as AI (Mabweazara et al., 2020). Therefore, structured training programs and awareness campaigns will be necessary to enhance AI literacy among librarians and encourage a positive attitude toward technological transformation

Another important implication and consideration were the need for upskilling and capacity building. The responses suggest that while the librarians have extensive experience in traditional library services, they may require specialised training to familiarise themselves with AI-powered tools such as automated cataloguing systems, AI-driven search engines, and virtual research assistants. Investing in professional development initiatives will therefore ensure that librarians are not only equipped to work with AI technologies but can also leverage them to improve library service delivery.

Notably, the readiness for AI adoption will vary depending on the workforce composition in different university libraries (Jan et al., 2024). On the one hand, university libraries with a younger workforce may find it easier to implement AI-driven library services, as younger professionals tend to have higher digital literacy and are more open to technological change. On the other hand, university libraries with an older workforce may require a more structured transition plan that includes mentorship programs, peer learning initiatives, and gradual AI integration to ensure that all staff members were comfortable with the new systems.

4.4.4 Demographic Profiles of Systems Librarians

The responses provided by system librarians regarding their work experience in the library sector reveal a wide range of professional tenure, from as little as six months to as much as 25 years. This diversity in experience levels suggests that system librarians in university libraries in Kenya have a mix of highly seasoned professionals with deep

institutional knowledge and newer entrants who may be more adaptable to emerging technologies such as AI. This variation was an essential factor in assessing the readiness of university libraries for AI adoption, as system librarians play a critical role in the integration, management, and maintenance of AI-driven solutions (Obuh, 2019).

The extensive professional background of some system librarians suggests that many have developed strong expertise in managing library ICT infrastructure, digital repositories, and automation systems. Their experience means they possess an in-depth understanding of legacy systems, Integrated Library Systems (ILS), and digital resource management, which are crucial when transitioning to AI-powered solutions. However, their long tenure could also present a challenge in adopting disruptive technologies like AI, as they may be more accustomed to conventional library ICT systems. Overcoming this challenge requires continuous professional development programs that focus on AI literacy, machine learning applications in libraries, and data-driven decision-making to ensure that experienced system librarians were well-prepared for AI integration (Hussain, 2023).

New system librarians in Kenya's university libraries were bringing in fresh talent with strong digital and AI skills, making them valuable assets in guiding AI adoption initiatives. This presents an opportunity for intergenerational knowledge transfer programs, where experienced librarians can share insights and introduce modern AI applications. However, university libraries must address potential resistance to change by offering AI-focused training, fostering a culture of continuous learning, and incentivising technology-driven innovation (Barsha & Munshi, 2023). Consequently, a structured

approach, including AI training programs, digital skills enhancement, and infrastructure modernisation is needed for successful AI adoption.

4.4.5 Demographic Profiles of Heads of Departments (HODs)

Most HODs, who were from the departments of Information Technology (IT) and Library and Information Science (LIS), had also served as program coordinators. Their roles primarily involved academic leadership, program coordination, student affairs management, and faculty administration. Some respondents also highlighted their responsibilities in handling student performance records, transcripts, and academic analysis, which suggests that they work closely with institutional information systems. These roles are significant in the context of AI adoption in university libraries, as they indicate that the respondents directly influence ICT policies, curriculum development, and decision-making regarding digital transformation in their institutions.

This was a positive indicator for AI adoption, as these leaders were well-versed in technological advancements, data management, and information systems. Their expertise can contribute to the strategic planning and implementation of AI-driven solutions in university libraries, such as automated cataloguing, AI-powered search engines, and intelligent recommendation systems for academic resources. According to Cox (2021), for AI integration to be effective, there must be collaboration between academic departments and university libraries to ensure that AI technologies align with teaching, research, and administrative needs.

The data regarding the duration of faculty members' professional experience exhibits a wide spectrum, with some respondents possessing as few as six years and others exceeding two decades of tenure. A considerable proportion had dedicated ten years or

more to their roles, with some reporting 15, 18, and even 20 of experience within the academic sphere. This extensive experience suggests that faculty leadership within IT and ILS departments was robust, characterised by a profound comprehension of academic processes, institutional challenges, and technological advancements.

In the context of AI adoption within university libraries, seasoned faculty members contribute institutional knowledge, research expertise, and leadership capabilities that facilitate the integration of AI technologies. Their understanding of the needs of both students and faculty enables them to advocate for AI solutions that enhance access to academic resources, optimise library operations, and enrich digital learning experiences. Furthermore, their leadership roles empower them to influence university policies and funding decisions, ensuring that AI implementation in libraries is prioritised and adequately resourced.

4.5 Diagnostic Tests of the Study Data

Data on main variables, the existent information services that can be supported by AI, ICT infrastructure readiness for adoption of AI, staff's ICT skills and competencies readiness for adoption of AI, users' perception readiness for adoption of AI, readiness of university libraries in Kenya to adopt AI, and developing a framework for AI adoption in libraries, were checked for non-violation of assumption related to inferential statistical analysis. The assumptions tested were normality, linearity, auto-correlation, heteroscedasticity and multicollinearity assumptions. The study's variables, which were latent, were measured through multiple indicator sentiments. These sentiments were hence regrouped and transformed to consolidate them into single variables for analysis.

In this study, the independent variables, X1 represents the existent of information services that can be supported by AI, X2 ICT infrastructure readiness for adoption of AI, X3 staff's ICT skills and competencies readiness for adoption of AI, X4 users' perception readiness for adoption of AI; while, Y represents the dependent variable, the readiness of university libraries in Kenya to adopt AI.

4.5.1 The Normality Test

The study used the Kolmogorov-Smirnov (Kolmogorov, 1933; Smirnov, 1948) and Shapiro-Wilk (Shapiro & Wilk, 1965) tests statistics values for assessing the normality of each variable whose findings are shown in Table 4.5.

Table 4.5

Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
X1	.156	30	.059	.768	30	.051
X2	.124	30	.200*	.963	30	.370
X3	.159	30	.052	.966	30	.438
X4	.158	30	.056	.920	30	.057
Y	.097	30	.200*	.977	30	.753

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

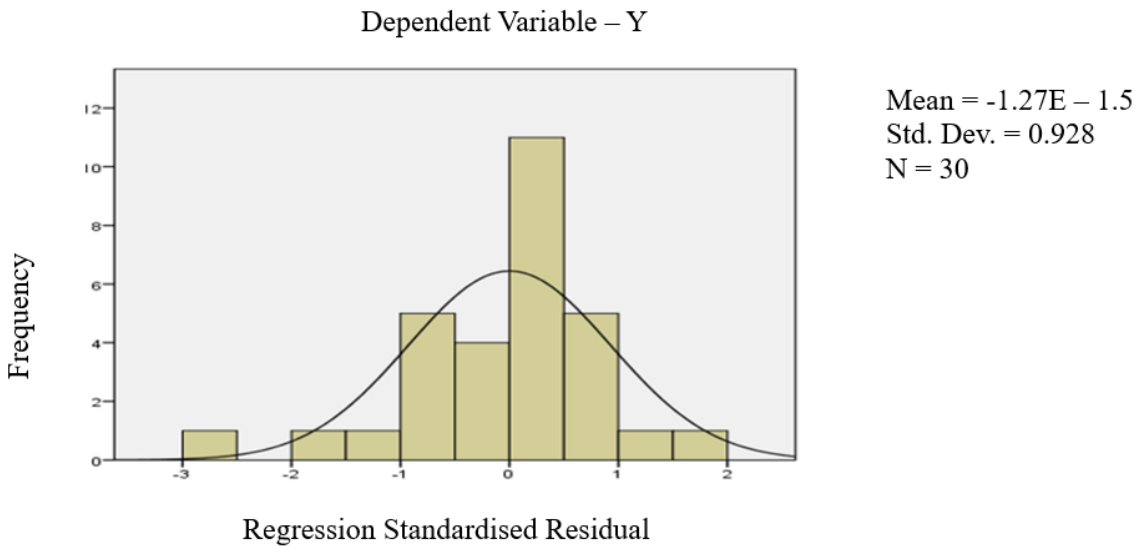
The test results presented in Table 4.5 include significance (Sig.) values for each variable. According to the Kolmogorov-Smirnov test, all variables had significant values greater than 0.05, except for X1 (.059), X3 (.052), and X4 (.056), which were marginally below the threshold. Similarly, the Shapiro-Wilk test showed that all variables had significant values above 0.05, except for X1 (.051) and X4 (.057), which were slightly lower but still close to the normality threshold. Notably, X2 (.200) and Y (.200, .753)

exhibited the highest significance values in both tests, suggesting stronger evidence of normality.

These findings show that all variables approximately follow a normal distribution, as their significance values were either above or very close to 0.05. The slight deviations observed in X1, X3, and X4 do not indicate severe violations of normality, suggesting that parametric statistical methods can be reliably applied in further data analysis (Field, 2018). The use of Shapiro-Wilk test statistics, which was considered more reliable for small sample sizes by de Souza et al. (2023) further supports the assumption of normality. The results indicate that the dataset was suitably distributed for parametric statistical techniques. A further histogram for (readiness of university libraries in Kenya to adopt AI) the dependent variable was generated which helped to check the normality status of the data as shown in Figure 4.1.

Figure 4.1

Histogram on Readiness of University Libraries in Kenya to Adopt AI



Source: Research Data

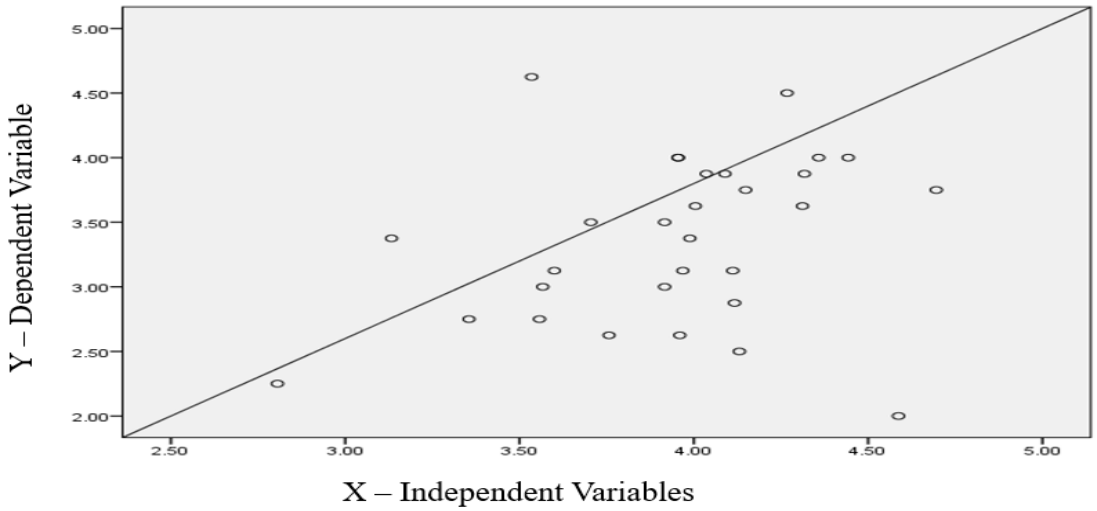
The data depicted in Figure 4.1 demonstrates that the dependent variable Y, representing the readiness of university libraries to adopt AI, exhibits skewness. This indicates a deviation from the normality assumption across all instances. The findings from Figure 4.1 provide substantial evidence to support the assertion that the data do not adhere to a normal distribution. Notably, no significant outliers were identified in the histograms.

4.5.2 The Linearity Test

The linearity condition was ascertained graphically by generating scatter plots and drawing a line of best fit as shown in Figure 4.2.

Figure 4.2

Scatter Plots Showing the Linearity of Predictors and Dependent Variables



Source: Research Data

A linearity test was conducted to determine whether a linear relationship exists between the independent variables, existent information services that can be supported by

AI (X1), ICT infrastructure readiness for adoption of AI (X2), staff's ICT skills and competencies readiness for adoption of AI (X3), and users' perception readiness for adoption of AI (X4), and the dependent variable, readiness of university libraries in Kenya to adopt AI (Y).

The scatter plots indicate that the relationships between the predictor variables and the dependent variable follow a linear trend, as evidenced by the alignment of data points along the line of best fit. This suggests that as each independent variable increases or decreases, the dependent variable also changes in a predictable manner, confirming the assumption of linearity. Furthermore, the absence of significant curvature or non-random patterns in the scatter plots suggests that nonlinear transformations were not required for further analysis (Tabachnick & Fidell, 2019).

4.5.3 The Auto-correlation Test

The study tested for autocorrelation among the independent variables using Durbin-Watson (Durbin & Watson, 1950) test. Table 4.6 presents the results of this test.

Table 4.6

The Autocorrelation Test on Preparedness to Adopt Artificial Intelligence

Variables	Durbin-Watson
X1	2.376
X2	2.652
X3	2.349
X4	2.363

An autocorrelation test was performed to evaluate the presence of serial correlation in the residuals of the regression model, utilising the Durbin-Watson (DW) test. The findings, as detailed in Table 4.6, present the DW values for the independent variables:

existent information services that can be supported by AI (X1), ICT infrastructure readiness for adoption of AI (X2), staff's ICT skills and competencies readiness for adoption of AI (X3), and users' perception readiness for adoption of AI (X4).

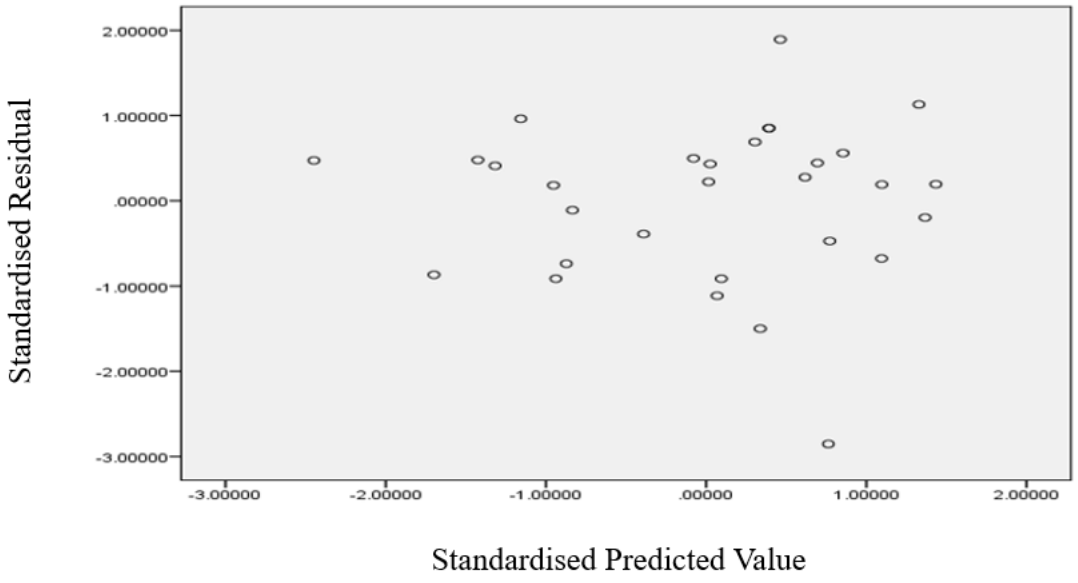
The Durbin-Watson values range from 2.349 to 2.652, which fall within the acceptable range of 1.5 to 2.5 (Field, 2018). A DW value approaching 2 indicates the absence of significant autocorrelation, suggesting that the residuals in the regression model are independent and do not display systematic patterns over time. In this context, the values for X1 (2.376), X2 (2.652), X3 (2.349), and X4 (2.363) imply that autocorrelation was not a significant concern within the dataset. The lack of autocorrelation enhances the reliability of the findings by ensuring that predictor variables do not influence one another over time, thereby minimising bias in estimating the readiness of university libraries to adopt AI.

4.5.4 The Heteroscedasticity Test

Research requires the dataset to be free from heteroscedasticity. To check this assumption visually, a scatter plot comparing standardised predicted residuals against standardised residuals was created. The pattern of data point dispersion served as an indicator for potential heteroscedasticity issues. Figure 4.3 displays the results of this test.

Figure 4.3

Heteroscedasticity Test on Readiness to Adopt Artificial Intelligence



Source: Research Data

A heteroscedasticity test (Figure 4.3) was conducted to determine whether the variance of residuals in the regression model remains constant across different levels of the independent variables. The scatter plot analysis indicates that the residuals were randomly and evenly dispersed around zero, suggesting that the assumption of homoscedasticity holds. No clear funnel-shaped or systematic pattern was observed, which means that the variance of the residuals does not increase or decrease systematically with changes in the independent variables (Field, 2018). This finding implies that heteroscedasticity was not a major concern in the dataset (Tabachnick & Fidell, 2019)

4.5.5 The Multicollinearity Test

The primary objective of this study was to conduct a regression analysis by regressing all independent variables against the dependent variable to achieve the study's

aims. In the context of multivariate regression analysis, it is imperative for the predictor variables to adhere to the assumption of multicollinearity. To assess multicollinearity, the Variance Inflation Factor (VIF) was computed for each predictor variable (X1, X2, X3 and X4). The findings of this evaluation are presented in Table 4.7.

Table 4.7

Multicollinearity Test

	Collinearity Statistics	
Independent Variables	Tolerance	VIF
X1	.767	1.304
X2	.937	1.067
X3	.515	1.942
X4	.643	1.555

The multicollinearity analysis presented in Table 4.7 includes both Tolerance and Variance Inflation Factor (VIF) statistics for four independent variables (X1, X2, X3, X4). The Tolerance values range from 0.515 to 0.937, while the VIF values range from 1.067 to 1.942. VIF values quantify the extent to which the variance of the estimated regression coefficients is inflated due to multicollinearity. Typically, a VIF value exceeding 10 indicates problematic multicollinearity. In this instance, all VIF values are below 2, suggesting that multicollinearity does not present a significant concern for any of the independent variables in the model.

The results of the multicollinearity test indicate that there is no substantial multicollinearity among the independent variables, as all Tolerance values exceed the threshold of 0.10 and all VIF values are significantly below the critical value of 10. Consequently, it can be concluded that multicollinearity does not constitute a major issue

in this model, and the independent variables maintain appropriate independence from one another.

4.6 Information Services where Artificial Intelligence can be Adopted in the Library

The aim of this objective was to identify the information services within university libraries in Kenya where AI can be effectively integrated. This objective focused on circulation services, reference services, information retrieval services, indexing services, cataloguing services, classification services, selective dissemination of information services, and services tailored for the visually impaired. To accomplish this objective, both quantitative and qualitative data were gathered. Quantitative data was collected from HOSs in the library and from the undergraduate students using open and closed-ended questionnaires. The closed-ended questions were subjected to analysis using SPSS software. Qualitative data were collected via open-ended questions from the questionnaires, interview schedules administered to University Librarians and systems librarians, and FGDs with HODs. The qualitative responses pertaining to a specific question or aspect were coded, thematically analysed, and presented in narrative descriptions, thematic categories, and occasionally supplemented with excerpts.

4.6.1 Findings from Heads of Sections in the Library regarding Information Services where Artificial Intelligence can be Adopted

The first question in the questionnaire employed a five-point Likert scale to assess knowledge of AI technologies applicable in libraries for the delivery of information services. The response options ranged from “strongly disagree” to “strongly agree.” The results, as delineated in Table 4.8, indicate varying levels of awareness and familiarity with AI technologies among the HOSs in university libraries. The analysis of responses

amalgamates “Strongly Agree” and “Agree” to quantify agreement, while “Disagree” and “Strongly Disagree” are combined to measure disagreement. Neutral responses were analysed independently.

Table 4.8

HOSs Responses Regarding the Level of Awareness and Familiarity with AI Technologies

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). I am familiar with the use of Natural Language Processing (NLP) for improving information retrieval in university libraries.	7(23.3%)	14(46.7%)	4(13.3%)	4(13.3%)	1(3.3%)	3.73	1.081
(ii). I am aware of the role of expert systems in enhancing decision-making for library operations.	4(13.3%)	19(16.3%)	3(10.0%)	3(10.0%)	1(3.3%)	3.73	.944
(iii). I recognise the importance of pattern recognition in understanding user behaviour and improving service delivery.	10(33.3%)	16(53.3%)	2(6.7%)	2(6.7%)	0	4.13	.819
(iv). I understand how machine learning can be used to personalise information services in university libraries.	9(30.0%)	12(40.0%)	6(20.0%)	3(10.0%)	0	3.90	.960
(v). I am familiar with robotics as a tool for automating tasks like digital assistance and physical book retrieval in university libraries.	6(20.0%)	12(40.0%)	8(26.7%)	4(13.3%)	0	3.67	.959

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(vi). I am aware that that AI can improve the efficiency of cataloguing and classification of library resources.	13(43.3%)	15(50.0%)	2(6.7%)	0	0	4.37	.615
(vii). I understand the importance of predictive analytics, powered by AI, in anticipating user needs and managing library resources effectively.	10(33.3%)	14(46.7%)	2(6.7%)	4(13.3%)	0	4.00	.983

The majority of respondents (n=21, 70.0%) expressed familiarity with the application of Natural Language Processing (NLP) for enhancing information retrieval within university libraries. Four respondents (13.3%) adopted a neutral stance, whereas 5 (16.6%) indicated disagreement or strong disagreement (M = 3.73, SD = 1.081). The findings demonstrate that the majority of library HOSs acknowledge the potential of NLP to improve search and retrieval systems. However, a significant minority are still not familiar with its applications.

A total of 23 respondents (76.6%) concurred with the assertion that expert systems play a significant role in enhancing decision-making processes. In contrast, 3 (10.0%) respondents maintained a neutral stance, while 4 (13.3%) either disagreed or strongly disagreed with this statement (M = 3.73, SD = 0.944). The notably high level of consensus indicates a comprehension of the potential for AI-driven expert systems to enhance library operations, although some degree of skepticism or limited exposure remains.

A significant majority of respondents 26 (86.6%) expressed agreement or strong agreement regarding the importance of pattern recognition in comprehending user

behaviour and enhancing service delivery. In contrast, only 2 (6.7%) respondents adopted a neutral stance, while an additional 2 (6.7%) expressed disagreement (M = 4.13, SD = 0.819). The substantial level of consensus underscores a profound acknowledgment of the potential for AI to analyse user behaviour, thereby facilitating enhanced service optimisation.

The findings indicate that 21 respondents (70.0%) acknowledged the potential of machine learning to personalise information services. In contrast, 6 (20.0%) respondents adopted a neutral stance, and 3 (10.0%) expressed disagreement (M = 3.90, SD = 0.960). The findings indicate an increasing recognition of AI's significance in customising library services to meet the specific needs of individual users. However, it is noted that some respondents may possess an incomplete comprehension of its implementation.

A total of 18 respondents (60.0%) expressed agreement or strong agreement regarding the potential application of robotics in automating library tasks, including digital assistance and book retrieval. In contrast, 8 (26.7%) respondents maintained a neutral stance, while 4 (13.3%) disagreed with the proposition (M = 3.67, SD = 0.959). The moderate level of agreement indicates that although some librarians acknowledge the potential of robotics to enhance operational efficiency, a considerable number either lack exposure to or remain uncertain regarding its practicality.

The HOSs demonstrated the most substantial level of consensus, with 28 respondents (93.3%) recognising AI's potential to enhance the efficiency of cataloguing and classification processes. Only 2 (6.7%) respondents expressed neutrality, and there were no instances of disagreement among the participants (M = 4.37, SD = 0.615). The

high mean and low standard deviation indicate a robust consensus regarding the role of AI in automating and enhancing metadata management within university libraries.

A majority of 24 respondents (80.0%) expressed agreement or strong agreement regarding the significance of predictive analytics in foreseeing user needs and efficiently managing library resources. In contrast, 2 (6.7%) respondents maintained a neutral stance, whereas 4 (13.3%) expressed disagreement (M = 4.00, SD = 0.983). The findings demonstrate a favourable perception of AI-driven predictive analytics in the context of library service planning and resource allocation.

The findings suggest that the adoption of AI in university libraries in Kenya is viable, characterised by a comparatively high level of awareness among library HOSs. Notably, the greatest familiarity was observed in the application of AI for cataloguing and classification purposes (M = 4.37), followed by pattern recognition (M = 4.13) and predictive analytics (M = 4.00). However, a moderate level of awareness was noted in the domain of robotics (M = 3.67) and expert systems (M = 3.73) indicating the need capacity-building initiatives. This study's findings corroborate the findings from the studies by Abayomi et al. (2020) and Oyewale (2023) which established that librarians in Nigerian universities are aware of AI and how it can be used to enhance library services. The results also confirm the findings of Masinde et al. (2024) and Sang (2025) which revealed that librarians in Kenyan university libraries are aware of AI and its application in information services. However, these findings differ from the findings of Ali et al. (2021 and Hussain (2020) whose studies established that the librarians were unaware of the potential applications of AI in the libraries.

The presence of neutral responses (ranging from 6.7% to 26.7%) highlights areas where training or exposure was required to enhance understanding. Barsha and Munshi (2023) opine that libraries and educational institutions should provide workshops and training programs to the library staff to enhance their AI literacy skills to enable them to offer AI-enhanced information services. Additionally, the proportion of disagreement (ranging from 6.7% to 16.6%) suggests that some library professionals may be resistant to AI adoption due to lack of practical experience or concerns about implementation challenges. According to Hussain (2023), to facilitate AI integration in university libraries, targeted professional development programs, AI literacy initiatives, and pilot projects should be introduced to demonstrate the practical applications of AI in enhancing library services

The HOSs in the library were asked to rate information services indicating how each could benefit from adoption of AI. Their responses were summarised as shown in Table 4.9.

Table 4.9

HOSs Responses Regarding Services That Could Benefit from Adoption of AI

Information Services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Circulation service	20(66.7%)	8(26.7%)	0	1(3.3%)	1(3.3%)	4.50	.938
(ii). Reference service	17(56.7%)	12(40.0%)	0	0	1(3.3%)	4.47	.819
(iii). Information retrieval	22(73.3%)	5(16.7%)	2(6.7%)	0	1(3.3%)	4.57	.898
(iv). Indexing	16(53.3%)	10(33.3%)	2(6.7%)	1(3.3%)	1(3.3%)	4.30	.988
(v). Cataloguing	21(70.0%)	8(26.7%)	0	0	1(3.3%)	4.60	.814
(vi). Classification	20(66.7%)	9(30.0%)	0	0	1(3.3%)	4.57	.817

Information Services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(vii). Selective Dissemination of Information	21(70.0%)	7(23.3%)	0	0	2(6.7%)	4.50	1.042
(viii). Collection development	17(56.7%)	11(36.7%)	1(3.3%)	0	1(3.3%)	4.43	.858
(ix). Service for the visually impaired	17(56.7%)	9(30.0%)	2(6.7%)	1(3.3%)	1(3.3%)	4.33	.994

According to the findings presented in Table 4.9, a majority of 28 respondents, representing 93.4%, expressed agreement or strong agreement that the integration of AI could enhance circulation services. In contrast, 1 (3.3%) respondent adopted a neutral stance, whereas 2 (6.7%) respondents indicated disagreement or strong disagreement (M = 4.50, SD = 0.938). The substantial level of consensus reflects a robust conviction in the potential of AI to improve circulation services, including automated check-in and check-out systems, self-service kiosks, and user notifications.

The findings further reveal that 29 respondents (96.7%) expressed support for the integration of AI in reference services, with a mere 1 (3.3%) respondent opposing this initiative (M = 4.47, SD = 0.819). The near-unanimous consensus indicates that AI-driven virtual assistants and chatbots may significantly contribute to reference assistance, enhance response times, and guarantee the 24/7 availability of services. A total of 27 respondents (90.0%) expressed agreement or strong agreement that AI could improve information retrieval, whereas 2 (6.7%) respondents maintained a neutral stance, and 1 (3.3%) disagreed (M = 4.57, SD = 0.898). The substantial consensus highlights the potential of AI-driven search algorithms, semantic search, and machine learning techniques in enhancing the efficiency and accuracy of information retrieval systems.

The majority of participants (n = 26, 86.6%) recognised the potential of AI to improve indexing, while 2 (6.7%) respondents maintained a neutral stance, and 2 (6.7%) expressed disagreement or strong disagreement (M = 4.30, SD = 0.988). These findings indicate a favourable view of AI's capacity to automate indexing processes, thereby facilitating expedited and more precise metadata generation.

A total of 29 respondents, representing 96.7% of the sample, concurred that AI could enhance cataloguing processes, whereas only one respondent, constituting 3.3% of the sample, dissented (M = 4.60, SD = 0.814). The substantial support underscores AI's potential to automate cataloguing tasks, diminish human labor, and maintain consistency in bibliographic records. The findings indicate that 29 respondents (96.7%) endorsed the adoption of AI in classification services, whereas only 1 (3.3%) respondent opposed it (M = 4.57, SD = 0.817). The substantial level of consensus indicates confidence in artificial intelligence's capacity to improve classification efficiency via automated subject tagging and taxonomy management.

A total of 28 respondents (93.3%) expressed agreement or strong agreement that AI could enhance SDI services, whereas 2 (6.7%) respondents indicated disagreement (M = 4.50, SD = 1.042). The findings suggest that AI-driven recommendation systems have the potential to significantly enhance the tailoring of information delivery to meet the specific needs of individual users.

A majority of respondents (n=28, 93.4%) expressed agreement or strong agreement that AI could facilitate collection development. In contrast, 1 (3.3%) respondent maintained a neutral stance, and another respondent (3.3%) disagreed (M = 4.43, SD = 0.858). The results indicate that AI has the potential to aid in the examination

of usage patterns, the anticipation of future resource requirements, and the optimisation of procurement decisions. A significant majority of 26 respondents (86.7%) concurred that AI could improve services for visually impaired individuals, whereas 2 (6.7%) respondents maintained a neutral stance, and 2 (6.6%) expressed disagreement (M = 4.33, SD = 0.994). These findings underscore the potential of AI-driven assistive technologies, including text-to-speech conversion, voice-assisted navigation, and AI-powered accessibility tools, in enhancing the inclusivity of library resources.

The findings demonstrate substantial endorsement for the integration of AI within diverse university library services in Kenya. The most significant level of consensus was noted in the area of cataloguing (M = 4.60), information retrieval (M = 4.57), and classification (M = 4.57) indicating a strong perception of AI as being highly advantageous in the automation of bibliographic processes. Furthermore, reference services (M = 4.47) and library circulation services (M = 4.50) garnered substantial support, suggesting that AI-driven systems have the potential to improve user interactions and optimise borrowing and lending procedures. These findings are in line with the findings of Adejo and Misau (2021) in a study conducted in Nigeria where university libraries used AI for various library services such as reference service, cataloguing, indexing, classification and information retrieval. A study conducted in Taiwan by Huang (2024) also established that university libraries used AI for provision of information services such as indexing and classification, information retrieval, reference, circulation, acquisition and administrative work. Other studies that corroborate these findings are Jha (2023), Ogwo et al. (2023), Okpokwasili (2019) and Sridevi and Shanmugam (2017)

The relatively high standard deviations, particularly in SDI services (SD = 1.042) and indexing (SD = 0.988), suggest some variations in perceptions, possibly due to differences in exposure or understanding of AI applications. The findings underscore the necessity for targeted AI training programs to address gaps in awareness and implementation readiness (Barsha & Munshi, 2023). Libraries should consider investing in AI-powered tools for cataloguing, classification, and information retrieval while also leveraging AI-driven chatbots and personalised recommendation systems to improve user experience. These findings suggest that AI adoption in university libraries has significant potential to improve service efficiency, accessibility, and user satisfaction. However, according to Jha (2023), successful implementation will require strategic investment in AI technologies, capacity building among library staff, and ongoing evaluation of AI-driven solutions to ensure they meet user needs effectively.

The library HOSs were also presented with a list of benefits of adopting AI in provision of information services and asked to indicate by ticking their level of agreement or disagreement with the statements. The rating scale was from 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. The responses analysis combined "Strongly Agree" and "Agree" as a measure of agreement, "Disagree" and "Strongly Disagree" as a measure of disagreement, while neutral responses were analysed separately. The results are summarised in Table 4.10.

Table 4.10

HOSs Responses Regarding Benefits of Adopting AI in the Provision of Information Services

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). AI systems effectively reduce wait times for basic information services.	21(70.0%)	8(26.7%)	0	0	1(3.3%)	4.60	.814
(ii). AI-powered virtual assistants improve the speed of reference query responses.	18(60.0%)	10(33.3%)	1(3.3%)	0	1(3.3%)	4.47	.860
(iii). The implementation of AI helps library staff focus on more complex patron needs.	14(46.7%)	13(43.3%)	1(3.3%)	1(3.3%)	1(3.3%)	4.27	.944
iv). AI-enhanced search capabilities make it easier to find specific information within digital collections.	19(63.3%)	10(33.3%)	0	0	1(3.3%)	4.53	.819
(v). Automated cataloguing using AI improves the accuracy of resource classification.	16(53.3%)	11(36.7%)	2(6.7%)	0	1(3.3%)	4.37	.890
(vi). Predictive analytics help in better understanding user research patterns and needs.	13(43.3%)	13(43.3%)	3(10.0%)	0	1(3.3%)	4.23	.898
(vii). AI implementation leads to more efficient allocation of library staff resources.	10(33.3%)	16(53.3%)	3(10.0%)	0	1(3.3%)	4.13	.860
(viii). AI-driven analytics help in making better collection development decisions.	13(43.3%)	12(40.0%)	3(10.0%)	1(3.3%)	1(3.3%)	4.17	.986

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(ix). Automated systems reduce operational costs in the long term.	17(56.7%)	9(30.0%)	0	3(10.0%)	1(3.3%)	4.27	1.112
(x). 24/7 AI assistance enhances the library's accessibility to users.	22(73.3%)	6(20.0%)	1(3.3%)	0	1(3.3%)	4.60	.855
(xi). Personalised AI recommendations improve the user research experience.	14(46.7%)	15(50.0%)	0	0	1(3.3%)	4.37	.809
(xii). AI systems help create more inclusive library services.	17(56.7%)	12(40.0%)	0	0	1(3.3%)	4.47	.819
(xiii). AI tools improve the organisation of digital collections.	19(63.3%)	9(30.0%)	1(3.3%)	0	1(3.3%)	4.50	.861
(xiv). AI-powered analytics provide valuable insights into collection usage patterns.	13(43.3%)	12(40.0%)	4(13.3%)	0	1(3.3%)	4.20	.925
(xv). Automated data processing increases the efficiency of library operations.	19(63.3%)	10(33.3%)	0	0	1(3.3%)	4.53	.819
(xvi). AI adoption creates opportunities for staff to develop new skills	19(63.3%)	9(30.0%)	9(30.0%)	0	1(3.3%)	4.50	.861
(xvii). Implementation of AI promotes innovation in library services	21(70.0%)	6(20.0%)	2(6.7%)	0	1(3.3%)	4.53	.900
(xviii). Integration of AI enhances the library's reputation as a modern institution	20(66.7%)	8(26.7%)	1(3.3%)	0	1(3.3%)	4.53	.860

A total of 29 respondents (96.7%) agreed or strongly agreed that AI systems effectively reduce waiting times for basic information services, while only 1(3.3%) respondent disagreed (M = 4.60, SD = 0.814). Similarly, 28 respondents (93.3%) indicated

that AI-powered virtual assistants improve the speed of reference query responses, while 1 (3.3%) respondent remained neutral and another 1 (3.3%) disagreed (M = 4.47, SD = 0.860). These findings suggest that AI-driven automation can enhance service delivery efficiency, particularly by handling routine inquiries and reducing response time.

Most respondents (n = 29, 96.6%) agreed or strongly agreed that AI-enhanced search capabilities make it easier to locate specific information within digital collections, while 1 (3.3%) respondent disagreed (M = 4.53, SD = 0.819). Similarly, 27 respondents (90.0%) agreed or strongly agreed that automated cataloguing using AI improves the accuracy of resource classification, while 2 (6.7%) respondents remained neutral and 1(3.3%) disagreed (M = 4.37, SD = 0.890). These findings emphasise AI's potential in improving search algorithms, metadata tagging, and overall information organisation.

A total of 27 respondents (90.0%) agreed or strongly agreed that AI helps library staff focus on more complex patron needs, while 1 (3.3%) respondent remained neutral and 2 (6.6%) disagreed (M = 4.27, SD = 0.944). Similarly, 26 respondents (86.6%) agreed that AI leads to a more efficient allocation of library staff resources, while 3 (10.0%) remained neutral and 1 (3.3%) disagreed (M = 4.13, SD = 0.860). The findings suggest that AI could handle routine tasks, allowing librarians to focus on specialised services such as research consultation and collection curation.

A total of 28 respondents (96.7%) agreed or strongly agreed that 24/7 AI assistance enhances the library's accessibility to users, while 1 (3.3%) respondent disagreed (M = 4.60, SD = 0.855). Similarly, 29 respondents (96.7%) agreed that AI-powered analytics provide personalised research recommendations, improving user experience, while only 1 (3.3%) respondent disagreed (M = 4.37, SD = 0.809). Additionally, 29 respondents

(96.7%) acknowledged that AI tools contribute to creating more inclusive library services, with only 1 (3.3%) respondent disagreeing (M = 4.47, SD = 0.819). These findings highlight AI's role in improving accessibility for diverse users, including those with disabilities.

Findings show that 26 respondents (86.6%) agreed or strongly agreed that predictive analytics help in better understanding user research patterns and needs, while 3 (10.0%) respondents remained neutral and 1 (3.3%) disagreed (M = 4.23, SD = 0.898). Similarly, 25 respondents (83.3%) agreed that AI-driven analytics help in making better collection development decisions, while 3 (10.0%) respondents remained neutral and 2 (6.7%) disagreed (M = 4.17, SD = 0.986). The results suggest that AI can support data-driven decision-making in resource acquisition and allocation.

A total of 26 respondents (86.7%) agreed or strongly agreed that automated systems reduce operational costs in the long term, while 3 (10.0%) respondents disagreed and 1 (3.3%) remained neutral (M = 4.27, SD = 1.112). Additionally, 28 respondents (93.3%) agreed that AI fosters innovation in library services, while 2 (6.7%) respondents remained neutral (M = 4.53, SD = 0.900). Furthermore, 28 respondents (93.3%) stated that AI integration enhances the library's reputation as a modern institution, while 1 (3.3%) respondent disagreed and another 1 (3.3%) remained neutral (M = 4.53, SD = 0.860). These findings underscore AI's potential in reducing operational costs while positioning libraries as forward-thinking institutions. A total of 28 respondents (93.3%) agreed or strongly agreed that AI adoption creates opportunities for staff to develop new skills, while only 1 (3.3%) respondent disagreed and 1 (3.3%) remained neutral (M = 4.50,

SD = 0.861). This suggests that AI integration requires ongoing staff training, potentially leading to professional growth and enhanced service delivery.

The study's findings highlight the widespread recognition of AI's benefits in university libraries, particularly in improving efficiency, user experience, and service innovation. The highest agreement levels were observed in AI's ability to reduce wait times (M = 4.60), enhance accessibility through 24/7 assistance (M = 4.60), and improve digital collection organisation (M = 4.50). These areas present immediate opportunities for adoption of AI. Additionally, AI's role in optimising staff workload, reducing operational costs, and driving innovation (M = 4.53) suggests that universities should invest in AI-powered tools to improve service efficiency. These findings corroborate the findings of studies by Faga and Yusuf (2023) where respondents indicated the benefits of AI adoption as improved operational efficiency, reduction in routine tasks and improved user experience. Confirming these findings, a study by Masinde et al. (2024) also established that there was a unanimous agreement among the respondents that AI tools can enhance the efficiency of information services and the overall user experience, in addition to carrying out routine tasks such as cataloguing. However, the relatively high standard deviations in some responses, particularly regarding operational cost reductions (SD = 1.112), indicate variations in perspectives, possibly due to concerns about implementation costs or institutional readiness.

The findings show that libraries can drive successful AI adoption by strategically investing in AI-powered tools that automate cataloguing, reference services, and digital search capabilities, while simultaneously training staff to develop essential skills for maximising these technologies. According to Jakati and Kumar (2022) university libraries

can also leverage AI to enhance accessibility and inclusivity for diverse user groups including those with visual impairments. Moreover, Romero (2018) opines that implementing AI analytics enables data-driven decision-making for more responsive collection development and precise assessment of user needs. Through these focused AI initiatives, university libraries can strengthen their innovation capacity and enhance their reputation as modern, forward-thinking institutions that remain relevant in an increasingly digital information landscape. These results suggest that AI has the potential to transform university library services by improving efficiency, reducing costs, and enhancing user experiences. However, its success will depend on strategic investments in AI infrastructure, training programs, and continuous evaluation to ensure sustainable implementation.

4.6.2 Findings from Undergraduate Students regarding Information Services where Artificial Intelligence Can Be Adopted

The first question in the undergraduate student's questionnaire used a five-point Likert scale about how often they used the information services offered by libraries. The question had choices ranging from never, rarely, sometimes, often to always. The findings, as presented in Table 4.11 reveal varying levels of utilisation of information services offered by libraries by undergraduate students.

Table 4.11

Undergraduate Students' Responses Regarding the Use of the Information Services Offered by Libraries

Information Services	Never	Sometimes	Often	Always	Mean	Std. dev.
(i). Circulation service	54(15.0%)	99(27.6%)	157(43.7%)	49(13.6%)	3.41	1.192
(ii). Reference service	33(9.2%)	110(30.6%)	149(41.5%)	67(18.7%)	3.60	1.080
(iii). Information retrieval	33(9.2%)	107(29.8%)	146(40.7%)	73(20.3%)	3.63	1.093
(iv). Indexing	63(17.5%)	100(27.9%)	147(40.9%)	49(13.6%)	3.33	1.246
(v). Cataloguing	66(19.4%)	90(25.1%)	149(41.5%)	54(15.0%)	3.35	1.279
(vi). Classification	47(13.1%)	104(29.0%)	149(41.5%)	59(16.4%)	3.48	1.169
(vii). Selective dissemination of information	73(20.3%)	94(26.2%)	144(40.1%)	48(13.4%)	3.26	1.298
(viii) Service for the visually impaired	178(49.6%)	45(12.5%)	100(27.9%)	36(10.0%)	2.49	1.551

The findings indicate that circulation services, a key component of the core library offerings, were utilised with notable frequency. Specifically, (n=157, 43.7%) students reported using the service "Often," whereas 49 students (13.6%) indicated "Always" usage. Additionally, 99 students (27.6%) utilised the service "Sometimes," and 54 students (15.0%) reported "Never" using the service (M = 3.41, SD = 1.192). Similarly, reference services were extensively used, with 149 students (41.5%) indicating they utilised them "Often" and 67 students (18.7%) reporting they used them "Always." Additionally, 110 students (30.6%) accessed the service "Sometimes," while only 33 students (9.2%) indicated they "Never" used it (M = 3.60, SD = 1.080). These findings indicate that fundamental services such as circulation and reference services continue to be crucial in facilitating students' academic requirements.

The results further demonstrate that information retrieval services were extensively utilised, with 146 students (40.7%) indicating they employed them “Often” and 73 students (20.3%) using them “Always.” Additionally, 107 students (29.8%) utilised the service “Sometimes,” while 33 students (9.2%) reported “Never” using it (M = 3.63, SD = 1.093). Likewise, classification services exhibited relatively high levels of engagement, with 149 students (41.5%) utilising them “Often,” 59 students (16.4%) employing them “Always,” and 104 students (29.0%) indicating occasional use (M = 3.48, SD = 1.169). These findings indicate that students often depend on information retrieval and classification services to efficiently locate academic resources.

The research revealed that indexing services were utilised “Often” by 147 students (40.9%), “Always” by 49 students (13.6%), and “Sometimes” by 100 students (27.9%). Conversely, 63 students (17.5%) reported that they “Never” used indexing services (M = 3.33, SD = 1.246). Similarly, cataloguing services were utilised “Often” by 149 students (41.5%) and “Always” by 54 students (15.0%). Additionally, 90 students (25.1%) reported using them “Sometimes,” and 66 students (19.4%) indicated “Never” using them (M = 3.35, SD = 1.279). The Selective Dissemination of Information (SDI) service exhibited lower utilisation rates, with 144 students (40.1%) indicating “Often” usage and 48 students (13.4%) reporting “Always” usage. Additionally, 94 students (26.2%) utilised the service “Sometimes,” whereas 73 students (20.3%) indicated “Never” using it (M = 3.26, SD = 1.298). The moderate utilisation of these services indicates that, although students acknowledge their significance, there may be deficiencies in awareness or accessibility that impede their comprehensive use.

Library services for visually impaired students were the least utilised, with 178 students (49.6%) indicating they "Never" used the service. In contrast, 100 students (27.9%) reported "Often" using it, and 36 students (10.0%) stated they used it "Always." Additionally, 45 students (12.5%) used the service "Sometimes" (M = 2.49, SD = 1.551). The comparatively low mean values indicate that accessibility services may not be effectively incorporated into students' academic endeavors. This could be attributed to insufficient awareness, inadequate facilities, or a limited perceived need among many respondents.

The findings indicate that while university libraries provide a broad range of information services, students primarily utilise circulation (M = 3.41), reference (M = 3.60), and retrieval services (M = 3.63). Tella and Odunola (2021) also established that over 80% of the Nigerian undergraduate students sampled for their study rated circulation, reference and information retrieval as the most often used information services. Similarly, a study by Thakor (2023) on students in Shrimad Rajchandra Vidyapeeth college in India established that majority of the students used circulation (91.67%) and reference services (95%). However, the moderate usage of indexing, cataloguing, and SDI suggests that students may not fully recognise their value, which calls for AI-powered search enhancements and personalised research assistance.

Meanwhile, accessibility services for visually impaired students remain underutilised (M = 2.49). These results imply that university libraries should enhance awareness of underutilised services through information literacy training (Salimi et al., 2020), while simultaneously improving their information organisation systems. The underutilised services also require redesign to better meet student needs, particularly

through personalised engagement approaches. Furthermore, the resource allocation strategies employed by university libraries should be reevaluated based on service utilisation patterns, with additional staffing or technological upgrades directed toward high-engagement services like reference and retrieval.

The undergraduate students were further presented with a list of information services and were asked to indicate by ticking their level of agreement or disagreement that the listed information services could benefit from AI technologies. The rating scale was from 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. The responses analysis combined "Strongly Agree" and "Agree" as a measure of agreement, "Disagree" and "Strongly Disagree" as a measure of disagreement, while neutral responses were analysed separately. The results are summarised in Table 4.12

Table 4.12

Undergraduate Students' Responses Regarding Information Services that Could Benefit from AI Technologies

Information Services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Circulation service	109(30.4%)	138(38.4%)	84(23.4%)	16(4.5%)	12(3.3%)	3.88	1.003
(ii). Reference service	148(41.2%)	121(33.7%)	65(18.1%)	18(5.0%)	7(1.9%)	4.07	.983
(iii). Information retrieval	137(38.2%)	124(34.5%)	64(17.8%)	18(5.0%)	16(4.5%)	3.97	1.079
(iv). Indexing	100(27.9%)	143(39.8%)	85(23.7%)	22(6.1%)	9(2.5%)	3.84	.982
(v). Cataloguing	98(27.3%)	126(35.1%)	96(26.7%)	21(5.8%)	18(5.0%)	3.74	1.077
(vi). Classification	125(34.8%)	125(34.8%)	78(21.2%)	19(5.3%)	14(3.9%)	3.91	1.057
(vii). Selective Dissemination of Information	97(27.0%)	135(37.6%)	94(26.2%)	19(5.3%)	14(3.9%)	3.79	1.025
(viii) Service for the visually impaired	100(27.9%)	139(38.7%)	85(23.7%)	22(6.1%)	13(3.6%)	3.81	1.026

The results demonstrate substantial endorsement for the integration of AI in fundamental library services, with reference services garnering the most significant level of consensus. Specifically, 148 students (41.2%) expressed strong agreement and 121 students (33.7%) indicated agreement regarding the potential benefits of AI for reference services, culminating in a collective approval from 269 students (74.9%). A total of 18 students (5.0%) expressed disagreement, and seven students (1.9%) strongly disagreed, resulting in a combined total of 6.9% who were not in favour. Additionally, 65 students (18.1%) maintained a "Neutral" stance (M = 4.07, SD = 0.983). Conversely, the perceived benefits of AI in information retrieval services were widely acknowledged, with 137 students (38.2%) strongly agreeing and 124 students (34.5%) agreeing, culminating in a total of 261 students (72.7%) supporting this view. In the meantime, 18 students (5.0%) expressed disagreement, and 16 students (4.5%) indicated strong disagreement, collectively representing 9.5%. Additionally, 64 students (17.8%) maintained a "Neutral" stance (M = 3.97, SD = 1.079). These results imply that students acknowledge AI's potential to enhance reference and retrieval services, presumably through the utilisation of AI-powered chatbots, virtual assistants, and sophisticated search algorithms.

The adoption of AI in classification services was endorsed by 250 students, representing 69.6% of the sample. Of these, 125 students (34.8%) expressed strong agreement, while an additional 125 students (34.8%) also agreed. A total of 19 students (5.3%) expressed disagreement, and 14 students (3.9%) strongly disagreed, resulting in a combined total of 9.2% who were not in favour. Additionally, 78 students (21.2%) adopted a "Neutral" stance (M = 3.91, SD = 1.057). Conversely, 243 students (67.7%) perceived indexing services as benefiting from AI, with 100 students (27.9%) strongly

agreeing and 143 students (39.8%) agreeing. A total of 22 students (6.1%) expressed disagreement, and nine students (2.5%) indicated strong disagreement, collectively representing 8.6% of the respondents. Additionally, 85 students (23.7%) were “Neutral” (M = 3.84, SD = 0.982). These results imply that students perceive AI as a beneficial tool for automating classification and indexing processes, potentially improving resource discoverability and organisation.

A total of 247 students, representing 68.8% of the sample, concurred that AI could enhance circulation services. Among these, 109 students, or 30.4%, expressed strong agreement, while 138 students, equating to 38.4%, indicated agreement. In the meantime, 16 students (4.5%) expressed disagreement, and 12 students (3.3%) indicated strong disagreement, collectively representing 7.8%. Additionally, 84 students (23.4%) maintained a “Neutral” stance (M = 3.88, SD = 1.003). Cataloguing services garnered slightly lower approval, with 224 students (62.4%) expressing agreement, including 98 students (27.3%) who strongly agreed and 126 students (35.1%) who agreed. In the meantime, 21 students (5.8%) expressed disagreement, and 18 students (5.0%) indicated strong disagreement, collectively representing 10.8% of the respondents. Additionally, 96 students (26.7%) maintained a “Neutral” stance (M = 3.74, SD = 1.077). The marginally reduced support for AI in cataloguing may suggest that students perceive it as a service that is already operational but could potentially be enhanced through automation to achieve greater accuracy and efficiency.

In relation to Selective Dissemination of Information (SDI) services, 64.6% of the 359 students surveyed expressed support for the adoption of AI, with 27.0% indicating “Strongly Agree” (97 students) and 37.6% indicating “Agree” (135 students). A total of

19 students (5.3%) expressed disagreement, and 14 students (3.9%) indicated strong disagreement, collectively representing 9.2% of the respondents. Additionally, 94 students (26.2%) were "Neutral" (M = 3.79, SD = 1.025). This indicates that while students recognise the potential of AI in delivering personalised content, a considerable number remain uncertain, likely due to their unfamiliarity with AI-driven SDI services.

In the context of library services for visually impaired individuals, 239 students (66.6%) expressed support for the integration of AI, with 100 students (27.9%) indicating "Strongly Agree" and 139 students (38.7%) indicating "Agree". In the survey, 22 students (6.1%) expressed disagreement, and 13 students (3.6%) strongly disagreed, collectively representing 9.7% of the respondents. Additionally, 85 students (23.7%) indicated a "Neutral" stance (M = 3.81, SD = 1.026). The results underscore that students acknowledge AI's potential to improve accessibility through tools such as text-to-speech, screen readers, and automated transcription services. However, the significant proportion of neutral responses implies that some students may not fully comprehend AI's capabilities in this area.

The findings reveal that undergraduate students regard AI as a valuable asset for enhancing various library services, with the highest support observed for reference services (74.9%) and information retrieval (72.7%). Classification (69.6%), indexing (67.7%), and circulation services (68.8%) also garnered substantial approval. In contrast, cataloguing (62.4%) and SDI services (64.6%) received comparatively lower levels of support. These findings are in line with a study conducted by Rabatseta et al. (2024) in South African university libraries that established that majority of the students identified circulation and reference services as the primary areas where AI could improve efficiency.

Another study by Wang et al. (2023) also established that information retrieval and personalised recommendations could benefit most from AI integration. Further, Masinde et al. (2024) established that university libraries in Kenya had adopted AI for circulation (44%) and reference service (77%). The findings indicate that AI-driven accessibility tools were widely recognised as beneficial, though some students appeared uncertain about their impact. These findings underscore the need for targeted AI implementation strategies, awareness initiatives, and investments in intelligent automation to maximise the benefits of AI in university libraries (Huang, 2024).

This therefore means that the university libraries should prioritise AI implementation in high-agreement areas like reference and retrieval services (74.9% and 72.7%), by deploying chatbots and Natural Language Processing tools to reduce response times and improve search accuracy. AI-driven classification and indexing systems (69.6% and 67.7%) warrant investment alongside automation in circulation and cataloguing (68.8% and 62.4%) through self-checkout systems and real-time inventory management. The moderate support for AI in Selective Dissemination of Information (SDI) services (64.6%) indicates an opportunity for personalised recommendation systems, while the recognition of AI's benefits for visually impaired users (66.6%) calls for investment in assistive technologies like speech recognition and voice-controlled interfaces.

However, the relatively high percentage of neutral responses across services highlights a knowledge gap regarding AI's potential in library settings. University libraries should address this through AI literacy programs that educate students about technological benefits while simultaneously implementing practical applications (Alam et al., 2024). By strategically focusing resources on both high-agreement areas and addressing awareness

gaps, university libraries can effectively leverage AI to enhance service delivery, improve accessibility, and provide more personalised information experiences that meet evolving student needs.

4.6.3 Qualitative Findings on Information Services Where Artificial Intelligence can be Adopted in the Library

The University Librarians and Systems Librarians were asked to comment on existing information services within the library that could benefit most from the implementation of AI technologies. Several key themes emerged from their responses, highlighting areas where AI can optimise operations, improve efficiency, and enhance user experience. The common themes derived from the responses are discussed below.

1. Application of AI in cataloguing and classification

A dominant theme among the responses was the application of AI in cataloguing and classification. Multiple librarians emphasised that automated cataloguing could lead to faster *"processing times"*, *"improved accuracy"*, and *"reduced human error"*.

2. AI-powered information retrieval and discovery

Another recurring theme was AI-powered information retrieval and discovery. Both University Librarians and Systems Librarians recognise that AI can enhance search functionalities by *"providing personalised and intelligent search results"* and "*helping users discover resources they might not have found using traditional search methods"*.

3. Reference services and research assistance

It also emerged that AI has the potential to revolutionise reference services and research assistance, as highlighted by both university and systems librarians. One respondent noted that *"virtual assistants and chatbots can provide 24/7 reference*

support" while another one noted that AI can *"ensure efficient and effective research processes reducing the time users use to locate resources"*.

4. Plagiarism detection and content analysis

The integration of AI into plagiarism detection and content analysis was another notable theme. One respondent indicated that AI could be used in *"plagiarism detection"*, while another one noted that AI is useful in *"content analysis and summarisation"*.

5. Data analytics and resource management.

University Librarians and Systems Librarians also identified AI's potential in data analytics and resource management. One Systems Librarian noted that AI can result in *"more data-driven, proactive collection development that aligns with evolving academic needs"* while another respondent noted that "*AI can enhance data-driven decisions about acquiring new materials".*

6. Enhancement of online services and accessibility

Another emerging theme was the enhancement of online services and accessibility. The librarians indicated that AI can "*improve access to digital resources"*, *"facilitate seamless remote interactions"* and *"enhance user experience in online library environments"*.

7. Security management

A few University Librarians and Systems Librarians also mentioned AI's role in security management, indicating its potential for monitoring library resources, preventing theft, and ensuring compliance with institutional policies. One librarian noted that AI can be used in *"securing the library resources"*, while one Systems Librarian *mentioned "the use of RFID technology to track library resources".*

The responses from University Librarians and Systems Librarians reveal a strong recognition of AI's transformative potential in library information services. The key areas identified, cataloguing and classification, information retrieval, reference services, plagiarism detection, data analysis, online services, and security management, highlight the broad scope of AI applications in modern libraries. Ogwo et al. (2023) opines that AI has a great potential of transforming information services in university libraries by enhancing the efficiency, effectiveness and accessibility of their resources and services.

These findings agree with the findings of studies by Isiaka (2023, Jha (2023) and Vijayakumar and Sheshadri (2019) that reported that AI is utilised in university libraries for bibliographic description of information sources, including cataloguing, classification, and indexing. Existing research by Ali et al. (2024) and Asim et al. (2023) also established that AI was used in Pakistani university libraries for provision of reference services. Further, the findings also align with the findings of the studies by Asim et al. (2023), Jha (2023) and Vijayakumar and Sheshadri (2019) which found out that university libraries utilise data analytics in making decisions on the information resources to acquire.

The Systems Librarians were asked to comment on AI technologies that would be most beneficial for enhancing library services. Several key themes emerged from their responses. The common themes derived from the responses are discussed below.

1. Machine learning (ML)

A predominant theme in the responses was the significance of machine learning in enhancing library services. Several Systems Librarians mentioned ML, highlighting its potential to streamline various library functions such as *"cataloguing, information*

retrieval, content summarisation, and collection management". Another Systems Librarian indicated that *"libraries can use ML to predict trends or user needs".*

2. AI-driven recommendation systems

Another key theme was the use of AI-driven recommendation systems to personalise user experiences. One Systems Librarian noted "*personalises book and article recommendations based on user preferences"*, while another one noted that "*AI could lead to more personalised and accurate search results".*

3. Predictive analytics

The role of predictive analytics in library services was also emphasised. One Systems Librarian noted that libraries can use predictive analytics to *"identify which books might become more popular based on current demand",* while another one mentioned that AI could help in *"predicting trends that could inform collection development".*

4. Plagiarism detection

Another emerging theme was AI-based plagiarism detection, which supports academic integrity by ensuring originality in research and coursework. Systems Librarian number 01 noted that *"AI could help in plagiarism detection".*

5. Uncertainty about how AI technologies work

One response from Systems Librarian number 03 indicated uncertainty about how AI technologies work, by noting *"not very sure because I don't know how these technologies work"*. This suggested that there may be a gap in awareness and training among library staff.

The responses from Systems Librarians suggest that AI technologies, particularly machine learning, recommendation systems, predictive analytics, and plagiarism

detection, have the potential to transform library services. These technologies can enhance efficiency, improve user engagement, and support data-driven decision-making (Ogwo et al., 2023). In line with these findings, the librarians in a study by Seonghun et al. (2022) were in agreement that AI-related educational content recommendation system would improve the user experience. However, the study also found that budget and content quality issues were the major hindrances to its implementation. Jakati and Kumar (2022) also established that ML and data analytics are used in libraries for provision of services such as cataloguing, information retrieval, content summarisation, and collection management. However, given that one of the respondents indicated uncertainty about how AI technologies work, it indicates a need for greater awareness and training to ensure librarians can effectively implement and leverage AI solutions in academic and research libraries.

In focus group discussions, the HODs were asked to indicate the library services that were considered time-consuming or challenging and could benefit from AI automation. The common themes derived from the discussion are discussed below.

1. Information retrieval and search optimisation

The most prominent theme was information retrieval and search optimisation. The HODs specifically mentioned challenge with *"manually searching for relevant journal articles and filtering through large volumes of research papers"* and "*searching for books from the catalogue and the shelves."*

2. Resource status and access management

A second theme focused on resource status and access management. Respondent 06 noted difficulties in "*knowing the status of the physical books in the library, whether*

the books are on loan, or are on the library shelves," suggesting a need for real-time inventory tracking and availability information.

3. Content Summarisation

Content summarisation and analysis also emerged as another significant theme. The HODs specifically mentioned the value of "*summarisation of the contents of information resources,"* indicating that AI could help condense large volumes of information into manageable insights.

4. Research support

Research support functions constituted a fourth theme, with respondent 01 noting that *"AI automation could significantly enhance research support and library services by streamlining literature reviews, research data management, citation analysis, information retrieval, academic integrity checks, and grant discovery."*

5. Curriculum support

At the same time, curriculum support was identified as an area that could leverage AI assistance, with reference to *"during curriculum development and review,"* suggesting potential applications for AI in educational content curation and alignment.

These themes collectively indicate that HODs see considerable potential for AI in transforming library services from traditional manual processes to more efficient, intelligent systems that better support the academic enterprise. These findings align with the findings of a study by Fraidan (2024) where majority (90%) of the faculty members indicated that AI systems significantly improved research and learning by enhancing access to library resources through research efficiency and provision of personalised recommendations. Confirming the findings on the use of AI in curriculum development,

a study by Chiu et al. (2021) established that the Chinese University of Hong Kong used AI to create a curriculum for pre-tertiary education.

Members in focus group discussions were asked to state how it would feel about using AI technologies, such as chatbots or automated reference services in the library. The common themes derived from the discussions are discussed below.

1. Enthusiasm for adoption of AI

The most prevalent theme from their discussion was enthusiasm for AI adoption, with numerous respondents expressing strong support. As one HOD (05) directly stated, "*This is a welcome idea". "It's an idea whose time has come, and we do not need to rebel it."* Others used affirmative terms like "*Wonderful*" and "*Nice,*" indicating general receptiveness. This enthusiasm appears to stem from recognition that, as another HOD (02) respondent noted, *"its benefits outweigh [the disadvantages]."*

2. Efficiency and productivity gains

A second significant theme was about efficiency and productivity gains. Respondents specifically mentioned time savings, with HOD 06 stating *"I would prefer them if they saved time."* Another HOD (03) noted that AI tools could "*reduce manual effort"* in citation management, suggesting appreciation for automation of labor-intensive tasks.

3. Enhanced research support and access

Enhanced research support and access emerged was the third theme. HODs recognised AI's potential to "*enhance research support, streamline information retrieval, and provide 24/7 assistance"* (02) and "*enhance access and use of library resources and services" (*01). One HOD (respondent 04) specifically highlighted potential benefits "*to*

both students and faculty especially in retrieval of relevant content," indicating awareness of cross-constituency advantages.

4. Awareness of limitations and concerns of AI

Despite the predominantly positive responses, a fourth theme introduces awareness of limitations and concerns. HOD respondent 05 mentioned that "*AI-generated answers may sometimes be incorrect or biased, requiring human oversight*," while another one (HOD, 03) raised concerns that *"copyright infringement is not factored."* These comments suggest that while supportive, some HODs maintain a nuanced view of AI implementation that acknowledges potential challenges.

In a nutshell, the analysis indicates that the HODs were generally receptive to AI technologies in library settings, particularly when these technologies promise to enhance efficiency, improve access, and support research activities, but with awareness that proper implementation will require addressing accuracy, bias, and copyright concerns. These findings concur with the findings of a study by Fraidan (2024) where the 90% of the faculty had a positive perception towards AI systems in the library, especially since they contributed to the improvement of research efficiency and provided personalised content recommendations. However, 60% of the faculty members in the study by Fraidan (2024) also had concerns about the ethical use of AI and the accuracy of AI generated information.

In an open-ended question in the questionnaire, the HOSs in libraries were asked to state how they envision AI being used in provision of information services in university libraries. Their responses revealed several prominent themes reflecting their perspectives

on future library services. The common themes derived from the responses are discussed below.

1. Efficiency and productivity

Enhanced efficiency and productivity emerged as a primary theme, with numerous respondents highlighting AI's potential to streamline operations. As HOS 23 succinctly stated, *"It reduces cost and time when it comes to work,"* while another one emphasised that AI "*Promotes accuracy, increase efficiency of operations and easy information access in university Libraries"* (HOS, 08). The HOSs respondents specifically identified routine tasks like cataloguing as prime candidates for AI automation, noting that "*AI can streamline the process of cataloguing new materials, generating metadata, and tagging resources in a more intelligent and consistent way*" (HOS, 17).

2. Improved information organisation and retrieval

Improved information organisation and retrieval constitute another significant theme. Multiple HOSs respondents envisioned AI facilitating better access to resources, with HOS respondent 05 stating that "*With the [AI] in future there will be easy and quick retrieval of information resources."* Another HOS respondent 08 anticipated libraries being "*depicted as a global village in terms of information organisation, retrieval & utilisation in order to satisfy individual user information needs,*" suggesting a transformation in how information was structured and accessed.

3. Personalised user experiences

Personalised user experiences represent a third theme, with HOS recognising AI's capacity to tailor services to individual needs. HOS respondents 09 mentioned "*offering personalised research recommendations*" and further noted that "*By analysing user*

[patterns], libraries can tailor resource suggestions to individual needs," indicating an appreciation for customised approaches to information delivery.

4. User assistance and support

User assistance and support services form another prominent theme, with respondents particularly interested in AI-powered chatbots. One, HOS respondent 21 explained that "*AI-powered chatbots can provide real-time assistance to library users, helping them find resources, check the availability of books, or answer general queries*," while another one, HOS 29 mentioned that "*AI-driven chatbots provide instant responses to frequently asked questions about library hours, policies, or research guidance*."

5. Strategic transformation of library services

Strategic transformation of library services constitutes a final theme, with respondents viewing AI as catalysing broader institutional evolution. One HOS number 16 noted that "*Most university libraries are aiming at redesigning their services to become what is known as the Smart libraries,"* while another HOS number 27 asserted that "*universities should embrace use [of] AI as fast as possible. near future it will be a determinant of progress."* One HOS respondent 0aSD1 summarily described AI implementation as "*An idea whose time has come*," reflecting the perceived inevitability and necessity of this technological transition.

The above themes collectively demonstrate that HOSs envision AI as a transformative force in university libraries, enhancing operational efficiency, improving information access, personalising user experiences, providing automated assistance, and ultimately reimagining library services for the digital age. These findings align with Ali et al.'s (2022) study which highlights AI’s potential to transform the information services

in university libraries through automation of acquisition, classification, reference, information retrieval, and circulation, thus, making university libraries to be user centred Ogwo et al. (2023) opines libraries can enhance the efficiency and effectiveness of their services by adopting AI.

Despite the potential, opportunities and enthusiasm of using AI in libraries, the undergraduate students gave 394 responses regarding challenges and limitations in current library information services that could be resolved by AI. The analysis summarised them into five prominent themes that AI could potentially address as discussed hereunto.

1. Information retrieval and search efficiency

Information retrieval and search efficiency emerge as the most frequently mentioned challenge. Students repeatedly cited "*time wastage"* and "*hectic retrieval processes of information resources*" as significant concerns. Student number 79 specifically noted that "*Finding books takes sometime but through the use of AI, it will help point clearly where books are found*," while number 186 mentioned the challenge of "*having very important information scattered across different books."* Students envision AI streamlining these processes, with number 103 stating that AI could provide "*extensive and consistent information that can be retrieved in a matter of seconds*."

2. Information overload and content management

Information overload and content management constitutes a second major theme. Students expressed difficulty managing large volumes of information, with student 229 noting that "*Users struggle to sift through large volumes of data to find relevant information."* Another student number 66 observed that "*There is so much information out here that it is hard to find one that is truthful and relevant, AI can help with that*."

Several responses indicated that AI's ability to filter, summarise, and organised information would be valuable, with student 81 stating AI could *"analyse large datasets quickly providing relevant insights and filtering out unnecessary information."*

3. Accessibility and convenience

Accessibility and convenience represent another significant theme. Students desire remote access to library resources, with student number 248 explicitly stating, "*We just need to digitise library, I do not have to walk to the library to access information."* Another student, 09 suggested creating "*an AI online library student's portal for access to all this information at all times."* Convenience extends to accessibility for diverse users, with multiple mentions of "*services for the visually impaired*" requiring improvement. Students also highlighted potential AI applications in "*breaking down language barriers through automated translation*."

4. Personalisation and relevance

Personalisation and relevance emerged as the fourth theme from student responses. Several students mentioned the "*limitation of personal information*" and noted that "*usually information services provide generic recommendations.*" They desire AI systems that can "*generate more what the user wants and know his taste*" and "*provide personalised recommendations and filter out irrelevant information using machine learning algorithms*." Student 93 specifically noted that AI could help in "*developing an environment that will give students incentive to want to learn more and use library resources*."

5. Accuracy and information quality

Accuracy and information quality constitutes the final theme, with students expressing concerns about misinformation, data inconsistency, and outdated materials. Student 17 noted the challenge of "*misunderstanding of information*," while student number 113 mentioned "*authenticity*" concerns. Students suggested that "*AI-powered fact-checking and validation tools can help identify and reduce the spread of inaccurate data*" and could assist in ensuring information was "*current and up to date*."

The above five themes collectively indicate that undergraduate students understand the potential AI in transforming library services by enhancing information discovery, managing information overload, improving accessibility, personalising experiences, and ensuring information quality. Their responses reflect both practical concerns with current library operations and awareness of how AI capabilities might address these limitations. These findings are supported by studies conducted by Fraidan (2024), Jha (2023), Seonghun et al. (2022) and Shaheen and Khurshid (2023) who suggest that AI has the potential to enhance information retrieval, summarise content, personalise content for the users based on their research patterns, in addition to providing users with accurate information. Ogwo et al. (2023) opines that AI is one of the emerging technologies that have a great potential of transforming information services in university libraries by enhancing the efficiency, effectiveness and accessibility of their resources and services.

4.6.4 Convergence of Quantitative and Qualitative Findings on Information Services Where Artificial Intelligence can be Adopted in the Library

4.6.4.1 Convergence of Quantitative Findings

A comprehensive analysis of all the quantitative findings, from both undergraduate students and HOSs, reveals notable areas of convergence in perspective regarding the current use of information services and their potential for enhancement through AI technologies. These areas of agreement are summarised below.

1. Priority information services: Reference, information retrieval, and circulation

Both undergraduate students and HOSs identified reference services, information retrieval, and circulation services as among the most used and most likely to benefit from AI technologies. Among students, reference services recorded high usage (41.5% often, 18.7% always; M = 3.60) and the highest AI enhancement rating (74.9% agree/strongly agree; M = 4.07). Similarly, information retrieval had strong student engagement (40.7% often, 20.3% always; M = 3.63) and was highly ranked in terms of AI potential (72.7% agree/strongly agree; M = 3.97). The HOSs also mentioned these same services, reference (M = 4.47), cataloguing, information retrieval (M = 4.57), and circulation (M = 4.50), as key areas where AI can improve speed, accuracy, and personalisation. This reflects a clear alignment between end-users' (students') usage patterns and professionals' (librarians') strategic priorities for AI implementation.

2. Backend information Services: Cataloguing, classification, and indexing

Both groups recognised the foundational role of cataloguing, classification, and indexing, despite these services being more administrative in nature: Students reported moderate engagement with cataloguing (M = 3.35), indexing (M = 3.33), and

classification (M = 3.48), but still saw potential for AI to enhance them (cataloguing: 62.4% agree/strongly agree; classification: 69.6%). The HOSs also mentioned cataloguing (M = 4.60) and classification (M = 4.57) as information services that could be enhanced by AI. This convergence suggests a shared understanding that AI can enhance behind-the-scenes operations that ultimately impact the quality of user services.

3. Low visibility and use of services for special needs

Across the quantitative findings, the service for the visually impaired received the least engagement from students (M = 2.49) and lower perceived benefit from AI (66.6% agree/strongly agree), a pattern echoed by its absence in librarian responses. This implies that both user and provider groups may not prioritise or adequately engage with accessibility services, highlighting a potential gap in inclusivity that future AI efforts could be directed toward addressing.

4.6.4.2 Convergence of Qualitative Findings

A further review of the qualitative findings alone from University Librarians, systems librarians, HODs and the findings from the open-ended questions by the HOSs and undergraduate students reveals several clear areas of convergence regarding the role of AI in enhancing library services. The following were the main converging points derived from their perspectives.

1. Cataloguing and classification

Across all respondent groups, there was broad agreement that cataloguing and classification services could greatly benefit from AI. Both librarians and Systems Librarians specifically highlighted the potential of automated cataloguing and metadata generation using AI to streamline the organisation of resources, reduce errors, and speed

up processing. The HOSs also mentioned cataloguing as one of the most challenging tasks, reinforcing the need for automation in this area.

2. Reference and information retrieval services

Participants consistently emphasised that reference services and information retrieval were among the most important areas where AI can have a significant impact. Systems Librarians suggested virtual reference assistants, while HODs discussed AI's ability to facilitate semantic search, improve information access, and help users retrieve relevant books or articles more efficiently. The HOSs and undergraduate students also indicated that AI would enhance the retrieval of information.

3. Use of E-resources and digital platforms

Librarians and HODs alike pointed to the increasing reliance on e-resources, such as digital journals and databases, and saw opportunities for AI to enhance access through personalised recommendations, search optimisation, and automated indexing. There was also agreement that AI can support remote access and improve user interaction with digital repositories. The HOSs and undergraduate students also indicated that AI would enhance access to library resources through personalised recommendations.

4. Research support and academic assistance

A strong convergence emerged around AI's potential to enhance academic research. Respondents highlighted AI's role in summarising scholarly articles, supporting plagiarism detection, conducting citation analysis, and even assisting in curriculum development. This was especially important to HODs, who noted how AI tools could improve efficiency in both teaching and research. The HOSs also indicated that AI would provide user assistance and support through chatbots.

4.6.4.2 Key Areas of Convergence across Quantitative and Qualitative Results

A detailed review and analysis of both the quantitative findings (from undergraduate students and HOSs in the library) and the qualitative findings (from University Librarians, systems librarians, and HODs reveal several key points of convergence. These shared perspectives shed light on the current use, challenges, and AI potential in enhancing information services within university libraries. The converging areas are summarised and discussed below.

a) Strong demand and AI potential for reference and information retrieval services

The quantitative findings from the undergraduate students an HOSs shows that they rated reference services and information retrieval among the most frequently used library services with high perceived potential for AI enhancement. The qualitative evidence indicates that the university and Systems Librarians consistently emphasised reference services, information discovery, and literature search as key areas where AI, particularly Natural Language Processing (NLP), semantic search, and virtual assistants, could improve accuracy, user engagement, and availability (e.g., 24/7 service). Consequently, there was clear convergence and alignment between students and librarians on the centrality of reference and retrieval services and the need to enhance them through AI tools for faster, more accurate, and personalised information delivery.

b) Cataloguing and classification as key backend services for automation

There was quantitative evidence from students acknowledging moderate use of cataloguing and classification services but still supported their enhancement using AI. The HOSs also mentioned the need for enhancing cataloguing and classification services with AI. Similarly, there was qualitative evidence from library staff, especially Systems

Librarians who cited automated cataloguing and classification as high-priority areas for AI implementation. Therefore, convergence was noted since both data sources underscore strong potential for AI to improve internal library operations, such as cataloguing and classification, which underpin user access and discovery services.

c) Importance of circulation services and need for ai in resource management

Results indicate quantitative evidence that circulation services were frequently used by students and received relatively high support for AI intervention. At the same time, qualitative evidence was noted where both librarians and HODs mentioned resource borrowing, loan tracking, and availability updates as important. This indicates a convergence considering that there was strong consensus that AI-powered automation in circulation can streamline library operations, improve access to materials, and ensure better resource planning.

d) Enhancement of access to e-resources and institutional repositories

There was compelling quantitative evidence in that, students and HODs alike, emphasised frequent use of electronic resources, with AI proposed to improve searchability, citation, and classification. The qualitative evidence was noted when HODs discussed challenges in searching and filtering through digital databases, recommending the integration of AI-driven semantic search and recommendation systems. Systems Librarians echoed this by pointing to the usefulness of AI in managing digital access and personalisation. Hence, there was a convergence considering a strong cross-group agreement on the centrality of e-resources in academic workflows and the need for AI to enhance discoverability, summarisation, and citation automation.

The convergence of both quantitative and qualitative findings demonstrates a strong, shared interest in leveraging AI to improve reference services, information retrieval, cataloguing, circulation, and access to digital resources. Both students and professionals recognise that AI can enhance user experience, operational efficiency, and academic outcomes. At the same time, the findings point to under-addressed areas such as inclusive services and accessibility, highlighting opportunities for more equitable AI deployment in university libraries.

4.7 ICT Infrastructure Readiness for adoption of Artificial Intelligence in University Libraries

The second objective of the study aimed to examine the status of ICT infrastructure in university libraries in Kenya in readiness for adopting AI. These objective assessed aspects that included high performance computing resources for AI applications, AI development tools and platforms, high-speed connectivity and scalable network infrastructure, cybersecurity measures, cybersecurity measures, technical support and expertise, budget allocation and investment in ICT infrastructure, collaboration tools with AI integration, and data backup and recovery systems.

To achieve this objective, quantitative and qualitative data were collected. Quantitative data was collected from HOSs in the library and from the undergraduate students using open and closed-ended questionnaires. The closed-ended questions from questionnaires were analysed using SPSS. Qualitative data collected using open-ended questions from the questionnaires, interview schedules administered to University Librarians and systems librarians, and through focus group discussions with the HODs were analysed thematically. The qualitative responses related to one question or aspect

were coded and analysed thematically and presented in narratives descriptions, themes or theme categories, and using excerpts in few cases.

4.7.1 Findings from Heads of Sections on availability of ICT infrastructure components required for adoption of AI for provision in library services

The first question in this objective used a five-point Likert scale relating to availability of ICT infrastructure components required for adoption of AI for provision of information services. It had choices ranging from strongly disagree to strongly agree. The findings, as presented in Table 4.13, reveal varying levels of agreement among HOSs in university libraries. The responses analysis combines "Strongly Agree" and "Agree" as a measure of agreement, "Disagree" and "Strongly Disagree" as a measure of disagreement, while neutral responses were analysed separately.

Table 4.13

HOSs Responses on Availability of ICT Infrastructure Components Required for Adoption of AI in the Library

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Our library has access to high-speed Internet to support AI-driven services.	8(26.7%)	14(46.7%)	4(13.3%)	3(10.0%)	1(3.3%)	3.83	1.053
(ii). Our library is equipped with advanced computer systems capable of supporting AI applications.	6(20.0%)	10(33.3%)	5(16.7%)	6(20.0%)	3(10.0%)	3.33	1.295

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(iii). Cloud computing services are available in our library for AI-based information services.	3(10.0%)	15(50.0%)	5(16.7%)	3(10.0%)	4(13.3%)	3.33	1.213
(iv). Our library has well-established digital libraries and databases for supporting AI adoption.	7(23.3%)	12(40.0%)	8(26.7%)	2(6.7%)	1(3.3%)	3.73	1.015
(v). Up-to-date security systems are in place to ensure safe implementation of AI technologies.	5(16.7%)	10(33.3%)	6(20.0%)	4(13.3%)	5(16.7%)	3.20	1.349
(vi). Machine learning platforms are available in our library to support AI functionalities.	3(10.0%)	10(33.3%)	8(26.7%)	3(10.0%)	6(20.0%)	3.03	1.299
(vii). Our library has robust server capacity to handle AI-based processes and data.	2(6.7%)	12(40.0%)	7(23.3%)	5(16.7%)	4(13.3%)	3.10	1.185
(viii). There is adequate technical support and expertise available to maintain ICT infrastructure for AI adoption.	5(16.7%)	10(33.3%)	8(26.7%)	4(13.3%)	3(10.0%)	3.33	1.213
(ix). The library has a budget allocation for upgrading ICT infrastructure to integrate AI technologies.	1(3.3%)	9(30.0%)	11(36.7%)	5(16.7%)	4(13.3%)	2.93	1.081
(x). Our library's network infrastructure is scalable to accommodate future AI advancements.	5(16.7%)	17(56.7%)	3(10.0%)	4(13.3%)	1(3.3%)	3.70	1.022

A significant proportion of HOSs, (n = 22, 73.4%), agreed that their libraries have access to high-speed Internet, which is essential for supporting AI-driven services. Conversely, only 4 (13.3%) respondents expressed disagreement, with an equal number remaining neutral (n = 4, 13.3%). This item recorded a high mean score of 3.83 (SD = 1.05), indicating strong consensus on Internet connectivity as a well-established component of ICT infrastructure.

In contrast, only 16 respondents (53.3%) agreed that their libraries were equipped with advanced computer systems capable of supporting AI applications. A substantial proportion (n = 9, 30.0%) expressed disagreement, whereas 5 (16.7%) respondents adopted a neutral stance. The mean score was moderate at 3.33 (SD = 1.30), indicating variability in the availability of hardware infrastructure across institutions. Regarding cloud computing services, 18 respondents (60.0%) reported the availability of these services within their libraries. Conversely, 7 (23.3%) respondents expressed disagreement, while 5 (16.7%) remained neutral. The mean score of 3.33 (SD = 1.21) implies moderate support for cloud-based infrastructure, though disparities still exist.

In regard to digital libraries and databases, a majority of HOSs (n=19, 63.3%) agreed that their libraries were well-established in this area. Conversely, 3 (10.0%) respondents expressed disagreement, and 8 (26.7%) maintained a neutral stance. The mean score was relatively high at 3.73 (SD = 1.020), suggesting that the availability of digital resources was a strength in many university libraries. Regarding security systems, 15 respondents (50.0%) agreed that up-to-date security measures were implemented, whereas 9 (30.0%) respondents expressed disagreement and 6 (20.0%) adopted a neutral

stance. The mean score was 3.20 (SD = 1.35), revealing concerns about cybersecurity readiness, which is a critical component for the secure implementation of AI.

The availability of machine learning platforms received comparatively less support, with 13 respondents (43.3%) expressing agreement, 9 (30.0%) indicating disagreement, and 8 (26.7%) providing neutral responses. The mean score was 3.03 (SD = 1.30), indicating limited access to AI-specific tools and technologies. Similar concerns were raised concerning server capacity, with 14 (46.7%) HOSs affirming that their libraries have a robust server infrastructure, 9 (30.0%) dissenting, and 7 (23.3%) respondents remaining neutral. This item yielded a mean score of 3.10 (SD = 1.19), indicating that the back-end infrastructure for AI implementation may be insufficiently developed in some libraries.

Regarding the matter of technical support, 15 (50.0%) respondents concurred that sufficient expertise was available to maintain ICT infrastructure for AI adoption. Conversely, 7 (23.3%) respondents expressed disagreement, while 8 (26.7%) adopted a neutral stance. The mean score of 3.33 (SD = 1.21) indicates a moderate level of preparedness, yet highlights significant opportunities for enhancement in technical staffing. A particularly weak area identified was the allocation of budget resources for the enhancement of ICT infrastructure. Only 10 respondents (33.3%) agreed that their libraries had dedicated financial support for AI integration, whereas 9 (30.0%) respondents disagreed and 11 (36.7%) remained neutral. The mean score for this item was the lowest among all evaluated categories at 2.93 (SD = 1.08), highlighting budget constraints as a significant barrier to AI readiness.

Finally, the scalability of network infrastructure garnered substantial support from respondents, with 22 (73.4%) HOSs affirming that their libraries' networks are capable of accommodating future advancements in AI. A mere 5 (16.6%) respondents expressed disagreement, while 3 (10.0%) remained neutral. This particular item was associated with a high mean value of 3.70 (SD = 1.02), suggesting that many institutions have made progress in building scalable digital infrastructure.

These findings indicate that while foundational infrastructure elements such as high-speed Internet, digital libraries, and scalable networks were generally available in most university libraries, there were critical gaps in advanced computing systems, security, machine learning tools, and technical expertise. These findings align with the findings of a study conducted by Farag et al. in 2021 in Saudi Arabia, where 100% of the participants indicated that their libraries had insufficient ICT infrastructure and technical expertise for supporting AI- enhanced information services. Other studies by Amoah and Minishi-Majanja (2023) in Ghana, Eiriemiokhale and Sulyman (2023) in Nigeria, Nakaziba and Ngulube (2024) in Uganda and Mwilongo and Mwageni (2022) in Tanzania also established that the university libraries in their respective countries were lagging in adoption of AI due to inadequate ICT infrastructure in addition to lack of technical expertise to maintain the ICT infrastructure necessary for adoption of AI.

Further, the findings of this study indicate that the libraries had high speed Internet and scalable networks, which contradicts the findings of studies by Kibuku et al. (2020) and Murgor (2015) that established that the university libraries in Kenya suffer from poor Internet connectivity and low bandwidth challenges. According to Ajani et al. (2022), the absence of adequate technological infrastructure and expertise in developing countries

affects the effective implementation of AI-driven applications in libraries, thereby limiting their potential impact on information access and user services.

The findings also reveal a major challenge to the sustainable integration of AI technologies in library services is lack of consistent budgetary support for enhancement of the ICT infrastructure. Several studies such as Odeyemi (2019) in Nigeria, Asim et al. (2023) in Pakistan, Huang et al. (2023) in UK and China and Nakaziba and Ngulube (2024) in Uganda also note this challenge. Studies by Otike and Kiszl (2024) and Kibuku et al. (2020) in Kenya also established that university libraries are poorly funded by their parent organisations, hence the need to source for sustainable funding.

According to Hussain (2023) successful implementation of AI in university libraries requires huge financial investment in the infrastructure and technical expertise. Consequently, Echedom and Okuonghae (2021) put forward that there is need sustainable funding models for university libraries to ensure long-term viability of AI implementations in libraries. To ensure successful adoption, it is imperative that universities invest in strengthening hardware and software capabilities, enhance cybersecurity frameworks, build technical capacity, and secure long-term financial support dedicated to AI infrastructure.

The HOSs in the library were also presented with statements on availability of AI-related software or tools that were necessary for adoption of AI for provision of information services and asked to rate each using rating scale of 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. The responses analysis combines "Strongly Agree" and "Agree" as a measure of agreement, "Disagree" and

"Strongly Disagree" as a measure of disagreement, while neutral responses were analysed separately. Their responses were summarised in Table 4.14.

Table 4.14

HOSs Responses on Availability of AI-Related Software or Tools That Are Necessary for Adoption of AI for Provision of Information Services

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Our library has access to machine learning frameworks (e.g., TensorFlow, PyTorch) to support AI applications.	1(3.3%)	4(13.3%)	9(30.0%)	11(36.7%)	5(16.7%)	2.50	1.042
(ii). Our library uses data analytics tools (e.g., MATLAB, R, Python) for analysing information and supporting AI adoption.	2(6.7%)	6(20.0%)	7(23.3%)	9(30.0%)	6(20.0%)	2.63	1.217
(iii). Natural Language Processing (NLP) tools (e.g., spaCy, NLTK) are available in our library to enhance AI-driven services.	1(3.3%)	5(16.7%)	11(36.7%)	9(30.0%)	4(13.3%)	2.67	1.028
(iv). Pattern recognition software is utilised in our library to improve data organisation and user services.	2(6.7%)	7(23.3%)	11(36.7%)	6(20.0%)	4(13.3%)	2.90	1.125
(v). AI model management platforms (e.g., MLflow, Kubeflow) are in place for managing AI workflows in our library.	1(3.3%)	4(13.3%)	10(33.3%)	10(33.3%)	5(16.7%)	2.53	1.042

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(vi). AI-based research tools (e.g., AI-powered search engines) are integrated into our library's systems to improve information retrieval.	3(10.0%)	12(40.0%)	7(23.3%)	6(20.0%)	2(6.7%)	3.27	1.112
(vii). Our library has access to open-source AI tools for experimentation and implementation of AI-based solutions.	4(13.3%)	12(40.0%)	5(16.7%)	3(10.0%)	6(20.0%)	3.17	1.367
(viii). Collaboration tools with AI integration (e.g., Microsoft Teams with AI features) are available for library operations.	5(16.7%)	12(40.0%)	7(23.3%)	5(16.7%)	1(3.3%)	3.50	1.075
(ix). Visualisation software (e.g., Tableau, Power BI) is used in our library to present data insights and trends effectively.	1(3.3%)	7(23.3%)	9(30.0%)	8(26.7%)	5(16.7%)	2.70	1.119

The results, summarised in Table 4.14, reveal varied levels of availability and readiness across institutions, as discussed below. Access to machine learning frameworks such as TensorFlow or PyTorch was perceived to be relatively limited. Only 5(16.6%) respondents agreed that such tools were available in their libraries, while 16 (53.4%) disagreed, and 9 (30.0%) were neutral. The item recorded a low mean score of 2.50 (SD = 1.04), indicating minimal exposure to or integration of machine learning frameworks in library operations.

The use of data analytics tools like MATLAB, R, or Python for analysing information also showed limited adoption. A total of 8 (26.7%) respondents reported agreement, while a notable 15 (50.0%) disagreed, and 7 (23.3%) were neutral. The mean for this item was slightly higher at 2.63 (SD = 1.22) but still reflected low adoption of analytics tools in support of AI.

Similarly, availability of Natural Language Processing (NLP) tools, such as spaCy or NLTK, was confirmed by only 6 (20.0%) respondents, while 13 (43.3%) disagreed and 11 (36.7%) were neutral. This statement had a mean of 2.67 (SD = 1.03), suggesting that NLP technologies were underutilised in the surveyed libraries. Pattern recognition software, used to improve data organisation and user services, was confirmed available by 9 (30.0%) respondents, while 10 (33.3%) disagreed and 11 (36.7%) remained neutral. This resulted in a mean score of 2.90 (SD = 1.13), suggesting moderate uncertainty or partial implementation across institutions.

On availability of AI model management platforms such as MLflow or Kubeflow, only 5 (16.6%) respondents agreed to their availability. A considerable number, 15 (50.0%), disagreed, while 10 (33.3%) were neutral. The mean for this item was 2.53 (SD = 1.04), confirming that AI workflow management platforms were largely absent or unknown in these library environments. AI-based research tools, including AI-powered search engines, had a relatively higher level of agreement. A total of 15 (50.0%) HOSs agreed that such tools were integrated into their libraries' systems, while 8 (26.7%) disagreed and 7 (23.3%) were neutral. This item had a mean score of 3.27 (SD = 1.11), indicating a fair level of availability of AI-enhanced research support tools.

The availability of open-source AI tools also received moderate affirmation, with 16 (53.3%) respondents reporting agreement, 9 (30.0%) disagreeing, and 5 (16.7%) remaining neutral. The mean score was 3.17 (SD = 1.37), indicating relatively higher accessibility to cost-effective, open-source solutions for experimentation and development of AI tools in libraries. Collaboration tools with AI features, such as Microsoft Teams with integrated AI, were among the more widely available technologies. A total of 17 (56.7%) respondents agreed with their presence in their libraries, while only 6 (20.0%) disagreed, and 7 (23.3%) were neutral. This item recorded one of the highest mean scores at 3.50 (SD = 1.08), indicating a favourable level of adoption of AI-supported collaboration tools.

Finally, the use of visualisation software such as Tableau or Power BI to present data insights and trends showed limited adoption. Only 8 (26.6%) respondents agreed that such tools were in use, while 13 (43.4%) disagreed and 9 (30.0%) were neutral. The mean was relatively low at 2.70 (SD = 1.12), pointing to underutilisation of advanced data visualisation in support of AI-driven decision-making in libraries.

The results suggest that most university libraries surveyed were at the very early stages of integrating AI-related software tools into their operations. While there was moderate availability of collaboration tools and AI-based research systems, core tools such as machine learning frameworks, NLP libraries, and model management platforms remain largely inaccessible. A significant proportion of respondents either disagreed with the availability of these tools or remained neutral, indicating either lack of access or limited awareness and training among library staff. These findings are in line with the

findings of a study conducted by Bakiri et al. (2024) in Tanzania, where only 23% of the respondents indicated that their libraries had some AI-based devices.

In Kenya, a study by Masinde et al. (2024) established that libraries were at the initial stage of AI adoption using the Maturity model while Sang (2025) also found that only 22.7% of the participants indicated that their libraries had implemented some AI powered tools or services. These findings, however, contradict the findings of a study on the application of AI in university libraries in Canada and the United States by Hervieux and Wheatley (2021) where majority (77%) of the respondents indicated that their libraries were already using AI to provide information services. This was, however, attributed to the high level of awareness of AI applications in libraries, in addition to adequate ICT infrastructure and expertise.

These findings highlight the need for strategic capacity-building initiatives, particularly in equipping libraries with relevant AI tools and software platforms. Institutions should also prioritise training programs to increase familiarity with emerging AI technologies among staff. According to Barsha and Munshi (2023), such training will ensure that university libraries have a workforce that can effectively use AI tools and systems. Furthermore, investment in both proprietary and open-source solutions may offer scalable options for enhancing information services through AI. Without such interventions, the transformative potential of AI in library services may remain largely unrealised.

The HOSs in the library were further presented with statements on the availability of network connections that were necessary for adoption of AI for provision of information services and asked to rate each using rating scale of 1-5, where Strongly Agree

= 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. The responses analysis combines "Strongly Agree" and "Agree" as a measure of agreement, "Disagree" and "Strongly Disagree" as a measure of disagreement, while neutral responses were analysed separately Their responses were summarised in Table 4.15.

Table 4.15

HOSs Responses on the Availability of Network Connections That are Necessary for Adoption of AI for Provision of Information Services

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Our library uses cable connections that provide stable and reliable network access for AI-based service.	14(46.7%)	11(36.7%)	5(16.7%)	0	0	4.30	.750
(ii). Fibre-optic Internet connections are available in our library, offering high-speed connectivity for AI adoption.	13(43.3%)	8(26.7%)	6(20.0%)	2(6.7%)	1(3.3%)	4.00	1.114
(iii). Wireless (Wi-Fi) networks are accessible throughout the library to support AI-driven information services.	12(40.0%)	15(50.0%)	2(6.7%)	1(3.3%)	0	4.27	.740
(iv). Satellite Internet is utilised in our library to provide connectivity where other options are limited.	1(33.3%)	5(16.7%)	10(33.3%)	8(26.7%)	6(20.0%)	2.57	1.104
(v). The library has Ethernet connections for dedicated and high-bandwidth network access.	8(26.7%)	15(50.0%)	6(20.0%)	0	1(3.3%)	3.97	.890

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(vi). Our library has access to 5G or other advanced cellular network technologies to enhance AI service provision.	7(23.3%)	10(33.3%)	9(30.0%)	3(10.0%)	1(3.3%)	3.63	1.066
(vii). The library employs Virtual Private Network (VPN) technology to ensure secure remote access for AI-based services.	10(33.3%)	12(40.0%)	5(16.7%)	3(10.0%)	0	3.97	.964

A significant majority of respondents affirmed the presence of stable cable connections within their libraries. Notably, 25 out of 30 respondents (83.4%) indicated agreement or strong agreement that cable connections were employed to ensure reliable access for AI-based services. The remaining 5(16.7%) respondents adopted a neutral stance, with no individuals expressing disagreement. The mean score was notably high (M = 4.30, SD = 0.75), indicating widespread and consistent cable infrastructure in place.

In relation to fibre-optic Internet connections, 21 HOSs (70.0%) expressed agreement or strong agreement regarding their availability in facilitating high-speed connectivity for the adoption of AI. However, 3 (10.0%) respondents indicated disagreement, while 6 (20.0%) maintained a neutral stance. The mean value for this particular item was 4.00 (SD = 1.11) indicating a relatively robust presence of high-capacity Internet connections within libraries, although this is not yet universal. The responses regarding the availability of Wi-Fi networks demonstrated the most significant affirmation. Specifically, 27 respondents (90.0%) either agreed or strongly agreed that wireless Internet was accessible throughout the library to facilitate AI-driven services. In

contrast, only 1 (3.3%) respondent expressed disagreement, while 2 (6.7%) remained neutral. The mean value was 4.27 (SD = 0.74) indicating robust wireless coverage across the majority of institutions.

In response to inquiries regarding satellite Internet as a connectivity solution, the findings revealed its limited utilisation. Specifically, 6 (20.0%) respondents expressed agreement or strong agreement with its availability, whereas a significant 14 respondents (46.7%) indicated disagreement, and 10 respondents (33.3%) adopted a neutral stance. The mean score was notably low at 2.57 (SD = 1.10), indicating that satellite connections were not frequently utilised, likely due to the presence of more efficient terrestrial alternatives.

Regarding Ethernet connectivity, 23 respondents (76.7%) expressed agreement or strong agreement that Ethernet connections were available to provide dedicated, high-bandwidth access. A minority, comprising 1(3.3%) of the respondents, disagreed, whereas 6(20.0%) remained neutral. The mean score of 3.97 (SD = 0.89) indicates a relatively high level of access to dedicated wired connections within library settings. Access to 5G or other advanced cellular technologies was affirmed by 17 respondents (56.6%), while 4 (13.3%) expressed disagreement, and 9 (30.0%) remained neutral. The mean score was 3.63 (SD = 1.07, indicating a moderate and emerging presence of mobile network technologies, which have the potential to enhance flexibility in accessing AI services.

Finally, 22 respondents (73.3%) expressed agreement or strong agreement that their libraries utilise Virtual Private Network (VPN) technology to facilitate secure remote access for AI-based services. Conversely, 3 (10.0%) respondents disagreed with this statement, while 5 (16.7%) maintained a neutral stance. The mean score was 3.97 (SD =

0.96), indicating a robust foundation of cybersecurity across the surveyed libraries, which is crucial for the effective implementation of AI technologies.

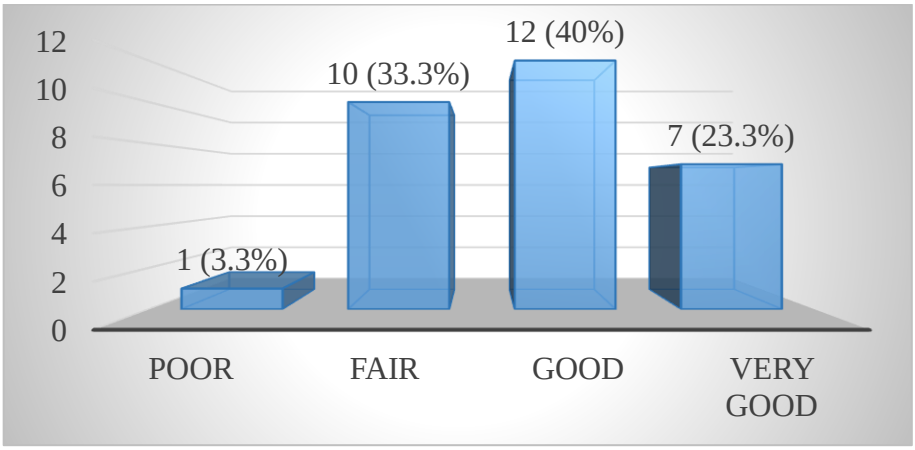
The substantial consensus regarding the availability of cable, Wi-Fi, fiber-optic, and Ethernet connections suggests that the fundamental network infrastructure was predominantly established in the surveyed libraries. This creates a conducive environment for the deployment of AI-powered systems that require high bandwidth and reliable connectivity. The findings contradict the findings of several studies such as Amoah and Minishi-Majanja (2023) in Ghana, Eiriemiokhale and Sulyman (2023) in Nigeria, Nakaziba and Ngulube (2024) in Uganda, and Kibuku et al (2020) and Murgor (2015) that indicated that the Internet connectivity in the university libraries sampled for their studies was inadequate to support AI tools and applications.

The relatively low availability of satellite Internet and moderate adoption of 5G technologies reflect a gap and redundancy in modern mobile access options, particularly for libraries in remote or underserved areas. According to Jan et al. (2024) the adoption of AI in libraries is made possible with the availability of 5G Internet connection. Additionally, while VPN use was promising, continuous investment in secure, remote-access technologies will be important as AI applications increasingly require data sharing across networks and locations.

When asked to rate the quality, speed, and reliability of the current network infrastructure at their library for supporting AI adoption, the majority HOSs 12 (40%) indicated good as shown in Figure 4.4.

Figure 4.4

HOSs Responses on Quality, Speed, and Reliability of the Current Network Infrastructure at Their Library for Supporting AI Adoption



Source: Research Data

All the above results indicate that, to build on this foundation, university libraries should consider strengthening their connectivity infrastructure by expanding access to advanced mobile networks and ensuring consistent implementation of VPN and cybersecurity tools. This will support seamless integration and scaling of AI services, particularly those that rely on real-time data processing, cloud computing, and remote access capabilities.

Another question posed to HOSs was about the availability of cybersecurity measures that were necessary for adoption of AI for provision of information services. The responses analysis combines "Strongly Agree" and "Agree" as a measure of agreement, "Disagree" and "Strongly Disagree" as a measure of disagreement, while neutral responses were analysed separately. Their responses are summarised in Table 4.16.

Table 4.16

HOSs Responses on the Availability of Cybersecurity Measures That are Necessary for Adoption of AI for Provision of Information Services

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Antivirus and malware protection systems are implemented to safeguard library systems against cyber threats.	13(43.3%)	16(53.3%)	0	0	1(3.3%)	4.33	.802
(ii). Firewall systems are in place to prevent unauthorised access to library networks.	15(50.0%)	12(40.0%)	3(10.0%)	0	0	4.40	.675
(iii). Data encryption methods are used to secure sensitive information in library systems.	16(53.3%)	10(33.3%)	4(13.3%)	0	0	4.40	.724
(iv). Multi-factor authentication (MFA) is required for accessing library resources to ensure security.	9(30.0%)	12(40.0%)	7(23.3%)	1(3.3%)	1(3.3%)	3.90	.995
(v). Regular security updates and patches are applied to keep systems protected against vulnerabilities.	9(30.0%)	16(53.3%)	4(13.3%)	1(3.3%)	0	4.10	.759
(vi). User education and awareness programs are conducted to promote cybersecurity best practices among library staff and users.	6(20.0%)	19(63.3%)	3(10.0%)	1(3.3%)	1(3.3%)	3.93	.868

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(vii). Intrusion detection and prevention systems (IDPS) are used to monitor and mitigate network threats in the library.	6(20.0%)	14(46.7%)	6(20.0%)	2(6.7%)	2(6.7%)	3.67	1.093
(viii). Access control policies are implemented to ensure that only authorised personnel can manage AI-related systems.	8(26.7%)	18(60.0%)	3(10.0%)	0	1(3.3%)	4.07	.828
(ix). Data backup and recovery systems are in place to protect against data loss or corruption.	11(36.7%)	17(56.7%)	2(6.7%)	0	0	4.30	.596

A significant proportion of respondents confirmed the presence of antivirus and malware protection systems in their libraries. Specifically, 29 out of 30 respondents (96.6%) agreed that such systems were in place. Only one respondent (3.3%) strongly disagreed. No respondents reported a neutral stance or disagreement. The mean score was high at 4.33 (SD = 0.80), indicating a strong emphasis on foundational cybersecurity practices.

Responses to the availability of firewall systems were similarly positive. A total of 27 respondents (90.0%) agreed that firewalls were in place to prevent unauthorised access to library networks. The remaining 3 (10.0%) respondents were neutral. The mean was 4.40 (SD = 0.68), suggesting robust perimeter security across most libraries. In terms of data encryption methods, 26 respondents (86.6%) agreed that encryption was used to

secure sensitive information in library systems. Four respondents (13.3%) selected neutral, while none disagreed. The mean score was again 4.40 (SD = 0.72), reflecting widespread implementation of data protection protocols.

With respect to multi-factor authentication (MFA), 21 respondents (70.0%) reported agreement on its application in accessing library resources. Seven respondents (23.3%) were neutral, and 2 (6.6%) expressed disagreement. The mean score was 3.90 (SD = 0.99), indicating a generally positive but slightly more varied perception of MFA implementation compared to other measures. Regular application of security updates and patches was affirmed by 25 respondents (83.3%), 4(13.3%) were neutral, while 1 (3.3%) disagreed. The item had a mean of 4.10 (SD = 0.76), reinforcing the importance of proactive system maintenance.

Concerning user education and awareness programs, 25 respondents (83.3%) agreed that such programs were conducted. Three respondents (10.0%) were neutral, while 2 (6.6%) disagreed. The mean score was 3.93 (SD = 0.87), suggesting that most institutions were promoting cybersecurity literacy among staff and users. Intrusion detection and prevention systems (IDPS) received slightly lower but still substantial support. A total of 20 respondents (66.7%) agreed or strongly agreed that IDPS were used in their libraries. Six respondents (20.0%) were neutral, while 4 (13.4%) expressed disagreement. The mean score was 3.67 (SD = 1.09), reflecting moderate adoption of advanced threat monitoring systems.

Regarding access control policies, 26 respondents (86.7%) either strongly agreed or agreed that these policies were implemented. Three respondents (10.0%) were neutral, and 1 (3.3%) strongly disagreed. The item had a mean of 4.07 (SD = 0.83), highlighting a

generally structured approach to access rights and authorisation. Furthermore, data back-up and recovery systems were reported as available by 28 respondents (93.4%). Two respondents (6.7%) selected neutral, and none disagreed. This item had one of the highest mean scores at 4.30 (SD = 0.60), suggesting that most libraries have disaster recovery measures in place to protect against data loss or corruption.

These findings reveal that the majority of libraries have implemented key cybersecurity measures necessary to support AI adoption. High mean scores across statements on antivirus systems, firewalls, encryption, data backups and regular system updates suggest that libraries were well-prepared in terms of securing both infrastructure and data. These elements form the backbone of trust and integrity in any digital or AI-powered service environment. However, areas like multi-factor authentication (MFA) and intrusion detection systems received slightly lower ratings, indicating room for improvement. In line with these findings, a study carried out in by Gujar et al. (2024) established that university libraries in India have adopted cybersecurity measures such as data encryption, intrusion detection systems, firewalls, regular data back-up and antivirus. Ibrahim and Kototoi, (2025) opine that it is important for university libraries to put cybersecurity measures in place so as to safeguard not only the information resources but also the sensitive records of the institutions and patrons.

While adoption of AI is underway, more robust implementation of these measures will be critical in ensuring comprehensive protection, especially as libraries transition into more AI-integrated systems that interact with sensitive user data and remote cloud environments. The results also emphasise the importance of human-centric cybersecurity practices, such as user education and access control, which were also highly rated but

require continuous effort. Promoting cybersecurity awareness and enforcing structured access protocols will further strengthen the security framework necessary for the responsible deployment of AI tools in library settings (Ibrahim & Kototoi, 2025).

4.7.2 Findings from Undergraduate Students on availability of ICT infrastructure components required for adoption of AI for provision in library services

The undergraduate student's questionnaire used a five-point Likert scale to evaluate the availability of ICT infrastructure components required for adoption of AI for provision in library services. The question had ratings ranging from 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. Their responses were summarised in Table 4.17.

Table 4.17

Undergraduate Students' Responses Regarding Availability of ICT Infrastructure Components Required for Adoption of AI for Provision in Library Services

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Our library has access to high-speed Internet to support AI-driven	60(16.7%)	118(32.9%)	119(33.1%)	20(5.6%)	15(4.2%)	3.30	1.347
(ii). Our library is equipped with advanced computer systems capable of supporting AI applications.	90(25.1%)	119(33.1%)	90(25.1%)	28(7.8%)	32(8.9%)	3.58	1.200
(iii). Cloud computing services are available in our library for AI-based information services.	67(18.7%)	129(35.9%)	106(29.5%)	27(7.5%)	30(8.4%)	3.49	1.131

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(iv). Our library has well-established digital libraries and databases for supporting AI adoption.	55(15.3%)	107(29.8%)	134(37.3%)	32(8.9%)	31(8.6%)	3.34	1.110
(v). Up-to-date security systems are in place to ensure safe implementation of AI technologies.	79(22.0%)	109(30.4%)	110(30.6%)	31(8.6%)	30(8.4%)	3.49	1.170
(vi). Machine learning platforms are available in our library to support AI functionalities.	72(20.1%)	124(34.5%)	110(30.6%)	24(6.7%)	29(8.1%)	3.52	1.128
(vii). Our library has robust server capacity to handle AI-based processes and data	61(17.0%)	119(33.1%)	119(33.1%)	27(7.5%)	33(9.2%)	3.41	1.135
(viii). There is adequate technical support and expertise available to maintain ICT infrastructure for AI adoption.	62(17.3%)	107(29.8%)	120(33.4%)	32(8.9%)	38(10.6%)	3.34	1.178
(ix). Our library's network infrastructure is scalable to accommodate future AI advancements.	73(20.3%)	137(38.2%)	94(28.2%)	24(6.7%)	31(8.6%)	3.55	1.144

Regarding the availability of high-speed Internet, 178 students (49.6%) either strongly agreed or agreed that their library provides adequate Internet for AI-driven services. However, 35 students (9.8%) disagreed, while 119 students (33.1%) were neutral. The mean score for this item was 3.30 (SD = 1.35), indicating that while many

students perceive Internet access as sufficient, there was a noticeable group that remained neutral or dissatisfied with the speed or reliability of Internet connections, suggesting that further improvements might be needed.

For the availability of advanced computer systems capable of supporting AI applications, a total of 209 students (58.2%) either strongly agreed or agreed. A smaller portion, 60 students (16.7%), were neutral, while 60 students (16.7%) disagreed or strongly disagreed. The mean score was 3.58 (SD = 1.20), indicating a positive perception overall, but the presence of neutral and disagreeing responses suggests that not all students find the computer systems to be sufficiently advanced or capable of supporting AI applications.

Concerning the availability of cloud computing services, 196 students (54.6%) reported that they strongly agreed or agreed that these services were available. However, 57 students (16.0%) disagreed or strongly disagreed, while 106 students (29.5%) were neutral. The mean score was 3.49 (SD = 1.13), indicating that while cloud services were perceived to be available, a significant portion of students were either neutral or unsatisfied with this component of ICT infrastructure, highlighting a need for greater clarity or improvement in cloud service availability.

Regarding the availability of digital libraries and databases, 162 students (45.1%) either strongly agreed or agreed that their library was well-equipped. However, 134 students (37.3%) were neutral, while 63 (17.5%) strongly disagreed or disagreed. The mean score for this item was 3.34 (SD = 1.11), showing that while many students recognise the availability of digital resources, the large proportion of neutral responses

suggest that students perceive these resources to be adequate but not necessarily outstanding or advanced enough for supporting AI services.

For the presence of up-to-date security systems, a total of 188 students (52.4%) either strongly agreed or agreed that these systems were in place to ensure safe AI implementation. However, 110 students (30.6%) were neutral, and 61 students (17.0%) disagreed or strongly disagreed. The mean score was 3.49 (SD = 1.17), reflecting a generally positive perception but also indicating some concerns over the adequacy or awareness of security measures.

Regarding the availability of machine learning platforms, 196 students (54.6%) either strongly agreed or agreed that such platforms were available. However, 110 students (30.6%) were neutral, while 53 (14.8) strongly disagreed or disagreed. The mean score was 3.52 (SD = 1.13), suggesting a positive view of machine learning platforms, although the significant portion of neutral and dissatisfied responses indicate that machine learning resources may not be fully integrated into the library's infrastructure.

Concerning the availability of server capacity to handle AI-based processes, 180 students (50.1%) either strongly agreed or agreed. However, 119 students (33.1%) were neutral, while 60 students (16.7%) disagreed or strongly disagreed. The mean score of 3.41 (SD = 1.14) suggests a generally positive outlook, but the number of neutral and disagreeing students indicates that server capacity may not be uniformly sufficient across all areas of the library.

For the availability of technical support and expertise, 169 students (47.1%) either strongly agreed or agreed that there was sufficient support. However, 120 students (33.4%) were neutral, while 70 students (19.5%) disagreed or strongly disagreed. The

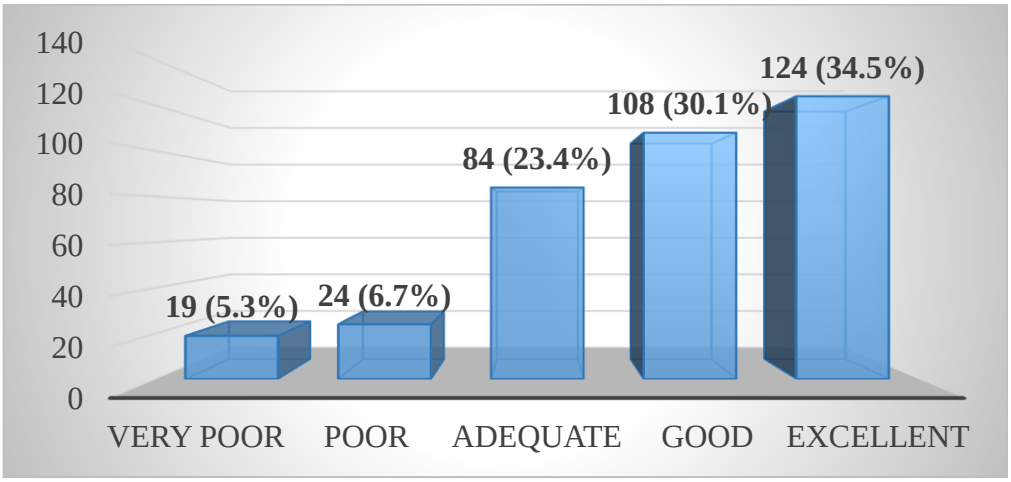
mean score was 3.34 (SD = 1.18), indicating a moderate level of satisfaction with the support infrastructure but highlighting concerns regarding its adequacy and availability.

Regarding scalable network infrastructure, 210 students (58.5%) strongly agreed that their library's network can accommodate future AI advancements. However, 94 students (28.2%) were neutral, while 55 students (15.3%) disagreed or strongly disagreed. The mean score was 3.55 (SD = 1.14), indicating a generally favourable view of the library's network capacity to support future growth in AI technologies, though there remains some uncertainty regarding the infrastructure's ability to scale.

When asked to rate the current network infrastructure of their university library in terms of supporting advanced technologies like AI, the majority undergraduate students 124 (34.5%) indicated excellent as shown in Figure 4.5. Only 43 students (12%) indicated poor or very poor with approximately a quarter, 84 (23.4%) indicating adequate.

Figure 4.5

Undergraduate Students Responses on Quality, Speed, and Reliability of the Current Network Infrastructure at Their Library for Supporting AI Adoption



Source: Research Data

The foregoing results suggest that undergraduate students perceive the availability of key ICT infrastructure components to be generally favourable but not overwhelmingly positive. Areas such as scalable network infrastructure, advanced computer systems, cloud services, and machine learning platforms were seen as available but with significant room for improvement, as reflected in the relatively high percentages of neutral responses. The most positively rated component was the library's network infrastructure, with a mean of 3.55 (SD = 1.14), signaling that many students believe the network can handle future AI needs. However, critical components like advanced computer systems, server capacity, and technical support received somewhat lower ratings, indicating that these may need investment and enhancement to fully support AI services. Hussain (2023) and Orubebe et al. (2024) attribute the poor ICT infrastructure in the university libraries of developing nations to inadequate funding, given that adoption of AI demands significant financial investment.

The findings suggest that while there was a solid foundation in terms of ICT infrastructure, there was a clear opportunity for libraries to invest in improving components such as computer systems, security measures, and technical expertise to ensure that the library can adopt AI technologies more effectively. The wide range of neutral responses in several categories may point to varying levels of awareness or differing student experiences with the infrastructure, which should be considered when planning for future upgrades and training. It was noted that while students acknowledged the availability of essential ICT infrastructure, their responses suggest that further development in infrastructure and support systems was needed to fully support AI-driven library services.

4.7.3 Qualitative Findings on ICT Infrastructure Readiness for adoption of AI in University Libraries

The study analysed the responses from University Librarians and Systems Librarians regarding the assessment of the library's current ICT infrastructure capacity in readiness for supporting AI implementation. Common perspectives and significant concerns expressed by both groups of library professionals included infrastructure adequacy and readiness, technical requirements and upgrades, connectivity and network capacity, human resource and skills capacity, and adaptive ICT infrastructure planning.

1. Infrastructure adequacy and readiness

The responses from both information professionals demonstrate varied perceptions regarding infrastructure adequacy. Some expressed confidence in their current systems: "*We have an adequate and reliable ICT infrastructure*" and "*Our infrastructure is adequate*." The Systems Librarian 05 specifically noted their infrastructure was "*AI ready."* However, this confidence was not universal, with one University Librarian explicitly stating, *"currently we have insufficient computer infrastructure to support AI sufficiently to match the current trends*."

2. Technical requirements and upgrades

Both groups identified specific technical requirements for effective AI implementation. Systems Librarians highlighted the need for infrastructure upgrades, particularly regarding connectivity: "*it needs upgrading from cable to fibre-optic for high-speed, stable broadband with minimal downtime to support real-time operations and large operations*." University Librarians emphasised the importance of comprehensive

technical planning: "*AI implementation requires extensive technology inputs which needs to be fully planned for to manage the workloads."*

3. Internet connectivity and network capacity

Internet connectivity emerged as a critical factor across responses from both groups. As one University Librarian (02) noted, there was *"Availability of 24-hour Internet connectivity both structured and wireless*," while Systems Librarians emphasised bandwidth considerations, recognising that connectivity determines "*how much of the library's Internet bandwidth is being utilised by existing services... AI applications, particularly cloud-based services or real-time interactions, require reliable and fast Internet speeds*."

4. Human resources and skills capacity

Beyond hardware infrastructure, respondents identified human resource capacity as a significant concern for AI implementation. The University Librarian 03 noted: "*currently in terms of human resource capacity to manage AI is limited in relation to skills, and integration of AI to library services and products. I would recommend hiring staff with the required qualifications."* This suggests that technological readiness extends beyond physical infrastructure to include skills development and personnel expertise.

5. Adaptive ICT infrastructure planning

Several responses indicated an understanding that infrastructure needs will evolve with AI implementation. One Systems Librarian (01) noted that "*the ICT infrastructure is upgraded to match the needs*," suggesting ongoing adaptation rather than a one-time upgrade. Similarly, the University Librarian number 5 observed that their "*current ICT*

infrastructure has not factored AI implementation, however, it can accommodate a substantial percentile," indicating partial readiness requiring further development.

The above responses from both groups collectively demonstrate that while some libraries report adequate basic infrastructure components such as computers, Internet connectivity, and automation systems, there remains significant variability in comprehensive AI readiness, with concerns regarding bandwidth capacity, technical specifications, and human resource expertise. These findings are supported by a study by Kibuku et al. (2020) that established that some university libraries in Kenya struggle with Internet connectivity as a result of low bandwidth and Masinde et al. (2024) whose study suggests that there is insufficient staff in Kenyan university libraries with AI skills and competencies . Nyerere (2016) attributes the lack of adequate ICT infrastructure and lack of AI skills and competencies among the library staff to support AI in Kenyan university libraries to the significant expenses involved in purchasing, setting up, and maintaining these systems and training of the library staff.

The Systems Librarians were asked to provide the specific hardware and software upgrades that would be necessary to support AI implementation in their library services. The common themes derived from the responses are discussed below.

1. High-speed network connections for AI adoption.

The Systems Librarians emphasised the importance of high-speed network connections for AI adoption. This includes access to fibre-optic connections, wireless (Wi-Fi) networks, and advanced options like 5G. One respondent (Systems Librarian 04) noted the need for *"stable and reliable network access for AI-based services*."

2. Acquisition of high-performance servers

Other responses were about the acquisition of high-performance servers. Notably a prominent theme across responses was the need for high-performance servers with enhanced processing power, memory, and storage. These servers were critical for running computationally intensive AI tasks locally. As stated by Systems Librarian 02, "*AI applications, especially machine learning models, require powerful processing capabilities."*

3. Integration of AI tools into existing Library Management Systems (LMS)

The system librarians also pointed out the compatibility issue of Library Management Systems (LMS), hence raising the integration of AI tools into existing LMS was a shared concern. Compatibility with features such as recommendation systems, Natural Language Processing (NLP), and predictive analytics was highlighted. The Systems Librarian 05 mentioned, "*Your existing LMS should be capable of integrating with AI tools*."

4. Reliance on third-party software providers

A unique point raised by the Systems Librarians was the reliance on third-party software providers for AI compatibility. The responsibility of integrating AI or offering AI plug-ins lies largely with the system owners, as noted: *"It is up to the owners of the systems to integrate AI.*"

5. Scalability to accommodate future AI advancements

The responses further highlighted the importance of scalability to accommodate future AI advancements. This includes infrastructure readiness for emerging AI technologies. Although not explicitly mentioned in all responses, the implementation of

advanced security protocols for AI systems was inferred as essential for safeguarding sensitive data and ensuring safe AI deployment.

The above responses from the Systems Librarians collectively underscore the need for university libraries in Kenya to invest in scalable ICT infrastructure, including high-speed Internet, that can be integrated with AI tools and systems to accommodate the use of AI in provision of information services. Confirming these findings, a study by Sang (2024) established that technological factors such as compatibility of AI tools and applications with other library systems was a challenge in AI adoption in Kenyan university libraries. Studies by Hussain (2023) and Jha (2023) also suggest that university libraries lack proper ICT infrastructure that encompasses high speed Internet connectivity, scalable data storage systems, modern software and hardware, and technical expertise that is necessary to effectively provide AI-enhanced information services. Barsha and Munshi (2023) recommend that university libraries should be allocated more funds to enable them to invest in robust ICT infrastructure including reliable Internet connectivity and computing facilities.

The system librarians were asked how the current data centre capabilities and cloud infrastructure would support AI workloads to which they responded by mentioning aspects that included procurement of AI-ready servers, scalability of ICT infrastructure, security enhancements, network infrastructure optimisation, and adequacy of the existent systems.

1. Procurement of AI-ready servers

The responses consistently highlighted the necessity for acquiring servers with high processing power, memory, and storage to effectively handle AI workloads. As

Systems Librarian 02 noted, "*AI workloads, especially those involving large datasets, require fast data transfers between servers, storage systems, and AI tools*."

2. Scalability of ICT infrastructure

Another recurring theme was the need to scale infrastructure to accommodate the specific requirements of AI workloads. For example, Systems Librarian 03 stated, "*The infrastructure would have to be scaled up to accommodate this.*" Several responses emphasised that the support provided by data centres and cloud infrastructure depends on the nature and scale of the AI workloads being implemented. Systems Librarian 01noted, "*This will depend on what AI workloads. Again, the scale shall be done if need be*."

3. Security enhancement

The importance of re-evaluating and strengthening security measures was commonly mentioned. Security adjustments were seen as critical to safeguarding data and ensuring robust AI implementation. Systems Librarian 04 respondent noted, "*Security of data would also be re-looked*."

4. Network infrastructure optimisation

Furthermore, fast and reliable network infrastructure is essential for AI workloads, as highlighted in the responses. High bandwidth and low latency were necessary to support seamless data transfers and maintain AI application performance. A response from Systems Librarian 03 mentioned, "*The network infrastructure needs an upgrade*."

5. Adequacy of the existent systems

Moreover, some Systems Librarians believed the current capabilities were already effective for supporting AI workloads. This implied a solid foundation was in place but

may require optimisation for specific tasks. A response from Systems Librarian 02 mentioned, "*Very effective*."

These responses reveal a spectrum of AI readiness among institutions. While some have adequate data centre capabilities and cloud infrastructure that would support AI workloads, others report the need to procure AI-ready servers, enhance the scalability of the ICT infrastructure, enhance security, and optimise the network infrastructure. The adoption of AI in university libraries requires strengthening ICT infrastructure, including high-performance computing capabilities and cloud storage. Consequently, a study by Shahzad et al. (2024) suggested that university libraries make investments in adaptable and scalable systems that can handle the needs of AI technologies for data processing and storage by resolving concerns with cloud infrastructure, network capacity, and data security.

The University Librarians were also asked how the current data management and security infrastructure align with the requirements for AI implementation. Their response narrowed down on aspects that included: gaps in policy and implementation, lack of established AI integration, potential for existing systems to adapt, existing security measures as a foundation, and provided varied perceptions of readiness.

1. Gaps in policy and implementation

A common theme was the need for stronger alignment of data management policies and practices to meet the requirements for AI implementation. The University Librarian 06 mentioned, "*Maybe a little more need to be done relating to policy-related issues.*" This reflects the necessity to establish clear policies that incorporate AI-specific considerations, such as data accessibility, ethical use, and compliance with AI standards.

2. Lack of established AI integration

It was also evident from responses that AI-specific data management and security systems had not yet been fully implemented in many cases. Phrases such as "*not yet implemented*" and "*not sure*" highlighted this gap. This suggests that many institutions were in the early stages of exploring AI adoption.

3. Potential for existing systems to adapt

Some University Librarians' respondents highlighted potential adaptability of current systems for specific AI functionalities, such as antiplagiarism tools. The University Librarian 03 noted, "*The current data management has not aligned so much with AI implementation, but the antiplagiarism can adopt this*." This underscores an opportunity to enhance existing technologies to integrate AI capabilities.

4. Existing security measures as a foundation

Similarly, the presence of foundational security systems like firewalls and antivirus software provides a basis for future AI-related enhancements. The University Librarian 01 shared, "*Have university firewall, antivirus software*," indicating that basic security infrastructure was in place, but additional measures may be required for comprehensive AI adoption.

5. Varied perceptions of readiness

Moreover, responses ranged from acknowledging misalignment to expressing confidence in current systems. For instance, the University Librarian 04 observed that systems were "*very well*" aligned, demonstrating variability in institutional readiness and perspectives on AI implementation.

The above responses from the University Librarians collectively demonstrate that while the university libraries had foundational ICT infrastructure, there was need to enhance it through acquisition of servers with high processing power, memory, and storage, and strengthening security measures. Alignment of data management policies and practices to meet the requirements for AI implementation was also considered necessary for successful implementation of AI in the university libraries.

These findings are supported by the findings of a study by Farag et al. (2021) that suggests that the most crucial technical prerequisites for implementing AI technologies in libraries are setting up the right ICT infrastructure, including a robust communication network, scalable data management systems and contemporary hardware and software. Additionally, a study by Ibrahim and Kototoi (2025) also emphasised the need for robust cybersecurity measures when implementing AI in libraries to secure the patrons data and the organisations confidential records. A study by Sang (2024) also underscored the importance of policy frameworks in adoption of AI in university libraries. Consequently, to effectively adopt AI in university libraries, Moonasar (2024) emphasises the need for university libraries to continuously upgrade their ICT infrastructure to support emerging technologies such as AI.

The study also asked the University Librarians "What budgetary and resource allocation strategies do you have in place to support the necessary ICT infrastructure upgrades for AI adoption?" Their responses were about general ICT budget allocation, library-specific budgetary provisions, external support through donations and partnerships, and lack of AI-specific budgeting.

1. General ICT budget allocation

The University Librarian 01 observed, "*The university budgets for ICT infrastructure."* This indicates that ICT funding was already a recognised priority, serving as a foundation for future upgrades. At the same time, a specific allocation within the library's budget for technological advancement was noted.

2. Library-specific budgetary provisions

The University Librarian 05 referenced the "*library main budget allocation*," and another one, University Librarian 03 emphasised that "*annual library budgetary plans are meant to anticipate advances in technology."* This suggests that libraries were attempting to foresee and plan for technological needs, though AI-specific requirements may not yet be fully integrated.

3. External support through donations and partnerships

The reliance on external funding sources, such as donations from government agencies and international partners, was also mentioned. This was expressed as "*donations from the government agencies and international partners,"* suggesting that external collaborations were seen as a valuable strategy for resource acquisition.

4. Lack of AI-specific budgeting.

A significant theme was the absence of dedicated funding for AI-related upgrades. Responses such as "*The current budget has not factored AI adoption*" and "*We do not have any budgetary allocation towards that yet*" reflect a gap in strategic resource planning for AI implementation. This indicates that AI was not yet fully integrated into financial planning processes.

These responses reveal a spectrum of AI readiness among institutions. While some have general ICT budgets and forward-looking plans, others report no current allocation for AI technologies, demonstrating disparity in institutional readiness. These findings are confirmed by studies conducted in university libraries such as Eiriemiokhale and Sulyman (2023) in Nigeria, Amoah and Minishi-Majanja (2023) in Ghana, Nakaziba and Ngulube (2024) in Uganda and Sang (2025) and Masinde et al. (2024) in Kenya that suggest that inadequate funding is the main obstacle to the adoption of AI in university libraries. According to Orubebe et al. (2024), expenses involved in purchasing, setting up, and maintaining AI systems are high which justifies the need for increased budgetary allocation. Otike and Kiszl (2024) opine that university libraries in Kenya need to source for sustainable funding to ensure successful integration of AI in their services.

During the focus group discussions, the HODs were asked to discuss how they assess the current ICT infrastructure in their university library (e.g., Internet speed, computer systems, access to digital resources) in terms of its readiness to support AI technologies. Their discussion narrowed down on a few themes that included network infrastructure challenges where, frequent downtimes, bandwidth limitations, and unreliable Wi-Fi connections emerge as obstacles to seamless AI adoption.

1. Network infrastructure challenges

One participant noted, "*The Internet connectivity is good for as long as one is using LAN. However, I have experienced challenges with the Wi-Fi since it's not very reliable*." This indicates the need for strategic improvements to network infrastructure, particularly in bandwidth and wireless connectivity.

2. Strength of existing LAN systems

Another theme was the strength of existing LAN systems. While Wi-Fi reliability was criticised, LAN systems received positive feedback for providing stable connectivity. A respondent shared, "*Internet infrastructure is okay for as long as one is using LAN*." This suggests LAN systems can currently serve as the foundation for AI integration, though broader upgrades were necessary.

3. Need for strategic upgrades

A need for strategic upgrades featured as a theme where many participants emphasised the importance of strategic upgrades in Internet speed, hardware, and digital resources. One noted, "*Strategic upgrades in Internet speed, hardware, digital resources, and AI integration are needed to fully support AI-driven library services.*" This highlights the urgency of forward-thinking improvements.

4. Integration of AI with existing systems

The theme of integration with existing systems was also prominent. Some responses stressed the importance of proper integration of AI technologies into existing systems, such as Library Management Systems (LMS). A participant stated, "*The current ICT infrastructure can support AI as long as the integration of AI into the existing systems, such as the management systems, is done properly*."

5. Low Internet bandwidth and insufficient speed

Low Internet bandwidth and insufficient speed were recurring concerns during the discussion. One respondent observed, "*Equipment and Internet bandwidth [are] low*," while another added, "*The Internet speed is wanting*." These limitations could significantly hinder AI-driven services if not addressed. While challenges exist, some

libraries were making strides in adopting modern technologies and digital transformation. A respondent shared, "*Our infrastructure is currently recommendable with modern technologies.*" This reflects optimism regarding readiness for future AI integration.

The responses from the HODs demonstrated some disparities in readiness across universities. For instance, one library was described as "*future-ready*," while another was assessed as "*poor*" or lacking alignment. This variability reflects different stages in ICT infrastructure development across institutions. Confirming these findings, a study conducted by Amoah and Minishi-Majanja (2023) on the ICT infrastructure readiness for 4IR in Ghanaian university libraries also established that there were varying levels of readiness with most of the respondents (33.0%) stating that their libraries were somehow prepared, 13.8% indicated their libraries were adequately prepared, while 22.0% said their libraries were unprepared for these innovative trends.

Further, the HODs were asked to discuss the technical challenges, they were facing when accessing library resources remotely, several challenges were noted. The common themes derived from the discussion are discussed below.

1. Difficulties with Internet connectivity

The HODs noted having difficulties with Internet connectivity owing to frequent disruptions when accessing digital resources due to unstable Internet connections. One respondent observed *"Slow Internet",* while another stated *"Connectivity challenges".*

2. Navigation of remote access platforms

Challenges related to navigation and usability of the remote access platforms, authentication and access restrictions were also pointed out by the HODs. One respondent

stated, *"navigation of the remote access platforms"* while another one indicated *"not being able to get the exact resources that are in line with the question at hand".*

3. User-related challenges

Lastly, user-related challenges such as forgetting passwords were also brought up during the discussion. One of the respondents stated, *"authentication issues",* while another one noted *"challenges like forgetting passwords"*

Other challenges mentioned included limited availability of computers *"Fewer computers"* and other necessary tools and geographic unreliability of specific platforms *"restricted access to certain journals"*

These responses reveal a spectrum of challenges experienced by HODs in remote access to e-resources, ranging from challenges with Internet connectivity, navigation of the e-resources platforms, user-related challenges and inadequate computers. Confirming these findings, a study by Musungu and Maina (2023) established that 25.7% of the faculty sampled for their study cited unreliable network connection as a significant challenge in accessing E-resources. Additionally a study by Tenya et al. (2023) on utilisation of digital resource platforms by academic staff also revealed that 86% of the respondents had challenges accessing the E-resources due to inadequate digital literacy skills resulting in challenges in access and navigation of the E-resources platforms. To enhance access to E-resources, Musungu and Maina (2023) recommend training of faculty to equip them with digital literacy skills, in addition to enhancing the ICT infrastructure such as the Internet speed.

The HODs were finally asked to discuss the specific technological upgrades or changes they believed should happen in the library to support AI adoption. The common themes derived from the discussion are discussed below.

1. AI-powered chatbots

From the discussion, AI-powered chatbots were identified as a critical enhancement for user accessibility and support. These chatbots can provide instant responses to frequently asked questions, assist with research processes, and ensure 24/7 availability for navigating digital resources and resolving technical issues. One response observed, "*The introduction of AI-driven chatbots in the university library can significantly enhance user support and accessibility."*

2. Upgrade of the existent ICT infrastructure

The discussion further noted a need to upgrade equipment such as computers, servers, and Internet bandwidth was a recurrent theme. Respondents mentioned, "*Addition of more computers to make it easy for several students to interact with AI technologies*" and "*Equipment, e.g., computers and Internet bandwidth, should be upgraded."* This ensures sufficient resources for students and faculty to engage with AI technologies effectively.

3. Improvements in storage capacity

The HODs noted that the adoption of AI will generate significant amounts of data, necessitating improvements in storage capacity. A participant noted, "*The improvement would be in terms of the storage capacity, since I envision that the use of AI will result in a lot of data*." They further noted the need for implementation of secure and dedicated servers. Notably, security and independence in operational activities emerged as a priority.

One respondent suggested, "*A separate server because of security and independence in operational activities*." This indicates a need for dedicated servers that were optimised for handling AI workloads securely.

4. Purchase of licenses for AI tools

The purchase of licenses for AI tools was also noted as a necessary step to facilitate effective implementation. One respondent recommended, "*Purchase of licenses for most of the AI tools*," emphasising the importance of acquiring legal and reliable software for AI adoption. Furthermore, the integration of AI-powered discovery tools and expansion of digital resources was seen as essential for "*enhancing research and support services"*.

5. Improvement of authentication systems

The HOD finally narrowed down on the need to improve authentication systems. Streamlined authentication processes were necessary to provide seamless remote access to library resources. As noted, *"Improving authentication systems for seamless remote access and research support*" was an important technological upgrade to ensure user convenience.

A similar question (open-ended) was posed to the HOSs in the library and the undergraduate students. The response received was overwhelming (426 suggestions) which the study scrutinised and narrowed them to 12 thematic areas regarding necessary upgrades and resources for AI adoption in libraries. These were:

1. Computing hardware infrastructure
2. Network connectivity and bandwidth
3. Data management and storage systems
4. Cloud computing capabilities

5. Cybersecurity and data protection
6. Human resource development and training
7. AI-specific software and tools
8. User-oriented AI services
9. Digital content and resources
10. Policy and governance frameworks
11. Integration with existing library systems
12. Collaborative partnerships

These findings resonate with the findings of prior research by Owolabi et al. (2022) that suggest that to adopt AI for provision of information services in university libraries, there is need to enhance the ICT infrastructure including the hardware and software, Internet connectivity, cybersecurity measures, cloud computing technologies and the data storage capacity; training of the library staff, and availability of a policy framework for AI adoption. Similarly, a study by Barsha and Munshi (2023) in Nigeria also established that training of the library staff, collaboration and partnerships with university libraries in the developed world to share lessons and experiences, designing of user oriented AI services, availability of a policy framework and adequate ICT infrastructure including stable Internet connection and high performance computing devices were all necessary for adoption of AI in university libraries. Studies by Masinde et al. (2024) and Sang (2025) on Kenyan university libraries also found that collaboration and partnerships, training of library staff, and investment in the ICT restructure are key in adoption of AI.

4.7.4 Convergence of Quantitative and Qualitative Findings on ICT Infrastructure Readiness for adoption of AI in University Libraries

4.7.4.1 Convergence of Quantitative Findings

The review of the quantitative findings from both the HOSs in the library and undergraduate students revealed several key points of convergence regarding the availability of ICT infrastructure components necessary for the adoption of artificial AI in the provision of library services.

1. Availability of ICT infrastructure components

Both groups demonstrated a moderate to high level of consensus regarding the availability of ICT infrastructure components, including high-speed Internet, advanced computer systems, and server capacity, within the library to facilitate AI adoption. For example, 83.4% of the HOSs agreed or strongly agreed that cable connections ensure stable network access (M = 4.30, SD = 0.750), while 49.6% of undergraduate students concurred with the availability of high-speed Internet (M = 3.30, SD = 1.35). Likewise, 58.2% of students concurred that advanced computer systems were available (M = 3.58, SD = 1.20), aligning with staff perceptions of fiber-optic, Wi-Fi, and Ethernet connectivity being generally accessible and functional. This convergence suggests a mutual acknowledgment of availability of the foundational ICT infrastructure, despite the fact that students' ratings were generally lower and more varied, potentially indicative of discrepancies between actual usage and technical awareness.

2. Library's preparedness for future technological demands

Both groups concurred regarding the library's readiness to meet future technological requirements. Specifically, 58.5% of students expressed agreement that the

network infrastructure was scalable to support future advancements in AI (M = 3.55, SD = 1.14). Similarly, the HOSs demonstrated a high level of consensus regarding the availability of Wi-Fi connections (90%) and Ethernet connections (76.7%). Additionally, there was a notable level of agreement on the availability of 5G and VPN access, with a combined agreement exceeding 50%. This convergence highlights a proactive infrastructure strategy, reflecting both awareness and optimism about the library's capacity to support the evolving of AI technologies.

3. Perception of cybersecurity readiness

A strong point of convergence was noted in the perception of cybersecurity readiness. The HOSs reported high levels of agreement on the availability of antivirus systems (96.6%, M = 4.33, SD = 0.802), firewalls (90%, M = 4.40, SD = 0.675), and data encryption (86.6%, M = 4.40, SD = 0.724). Similarly, undergraduate students expressed moderate agreement that up-to-date security systems were implemented (52.4%, M = 3.49, SD = 1.17). Although students' perceptions were less pronounced, this alignment indicates a shared acknowledgment of security infrastructure as a fundamental and relatively well-established component supporting AI integration.

4. Availability of cloud computing and machine learning platforms

A further convergence was observed in the accessibility of cloud computing and machine learning platforms. Among students, 54.6% concurred that cloud services were available (M = 3.49, SD = 1.13). Additionally, 54.6% confirmed the presence of machine learning platforms (M = 3.52, SD = 1.13). Correspondingly, 50.0% of the HOSs acknowledged the availability of cloud computing (M = 3.33), while (43.3%) indicated the availability of machine learning platforms (M = 3.03). This indicates that both users

and staff are aware of the availability of advanced ICT tools; however, further sensitisation or increased visibility may be required to enhance student confidence and utilisation.

5. Technical support and accessibility

Although both groups largely concurred regarding the availability of infrastructure, they demonstrated mixed or moderate levels of confidence in technical support and accessibility. Specifically, only 47.1% of students expressed agreement that there was sufficient technical support (M = 3.34, SD = 1.18), while the only 50.0% of the HOSs agreed that there was adequate technical support (M = 3.33) This alignment underscores a potential shared gap in operational support, indicating a necessity for investment not only in hardware but also in personnel and support systems.

The quantitative findings from both the library HOSs and undergraduate students converge on several fundamental aspects: acknowledgment of foundational ICT infrastructure, future-oriented scalability, cybersecurity preparedness, and the presence of AI-supportive technologies. However, both groups also express concerns regarding technical support and variability in access to emerging technologies, highlighting areas for institutional enhancement. These convergences provide a robust, multi-perspective validation of the current state of library readiness for AI integration.

4.7.4.2 Convergence of Qualitative Findings

A further examination of the qualitative findings derived from University Librarians, systems librarians, Heads of Departments (HODs), and the responses to open-ended questions by the HOSs and undergraduate students revealed several key areas of convergence concerning the readiness of ICT infrastructure for supporting AI adoption in university libraries.

1. The centrality of reliable and high-speed Internet connectivity in adoption of AI

All respondent groups consistently underscored the critical importance of reliable and high-speed Internet connectivity as a fundamental prerequisite for the implementation of AI. There was a strong consensus that network performance, encompassing bandwidth and stability, was inconsistent and frequently inadequate, particularly for wireless connections. For example, both Systems Librarians and HODs stressed the necessity of transitioning from cable to fiber-optic Internet to achieve enhanced speed and minimal downtime. University Librarians and HODs concurred that while Local Area Network (LAN) connections were generally stable, Wi-Fi remained unreliable and insufficient for supporting AI applications. Additionally, the library HOSs and undergraduate students highlighted the need for stable network connectivity and increased Internet bandwidth.

2. Need for strategic upgrade of existent ICT infrastructure to support AI

The qualitative data collectively highlighted the necessity for strategic upgrades of the existing ICT infrastructure to facilitate the integration of AI technologies. This encompasses the upgrading of servers, augmentation of processing capabilities, expansion of storage capacity, and assurance of compatibility with advanced AI tools. Systems Librarians emphasised the need for high-performance servers and robust data centres to manage AI workloads effectively. Concurrently, University Librarians and Heads of Departments advocated for advancements in computer systems and the increased integration of digital resources. Furthermore, HOSs and undergraduate students underscored the need for the university library to invest in a robust ICT infrastructure, including scalable servers and cloud storage solutions.

3. Insufficiency of current human resource capacities to manage AI systems

A convergence emerged regarding the inadequacy of existing human resource capabilities to manage AI systems effectively. University Librarians and HODs identified a deficiency in personnel possessing the necessary AI and ICT skills, advocating for specialised training and the recruitment of qualified staff. Systems Librarians echoed this concern, acknowledging that successful implementation of AI relies not only on infrastructure but also on skilled personnel to manage, maintain, and integrate AI tools effectively. Furthermore, the HOSs and undergraduate students underscored the importance of human resource development and training to ensure the successful adoption of AI.

4. Integration of AI tools into existing Library Management Systems (LMS)

The issue of integrating AI tools into existing Library Management Systems (LMS) was a recurrent theme across all groups. Systems Librarians particularly emphasised compatibility issues, noting the importance of ensuring LMS platforms can incorporate features such as recommendation engines and Natural Language Processing. HODs and University Librarians similarly recognised that AI technologies must be thoughtfully embedded into current systems to avoid operational disruptions and to maximise the benefits of AI in user services. The HOSs and undergraduate students also emphasised the need for AI tools and systems to integrate with existing library systems.

5. Importance of secure and structured data management

All respondent groups exhibited an understanding of the critical significance of secure and structured data management as a fundamental requirement for the adoption of AI. There was consensus that existent security measures, such as firewalls and antivirus software, offer a foundational layer but may be insufficient for comprehensive AI implementation. University Librarians highlighted policy and implementation gaps, particularly concerning ethical data usage and system scalability. Systems Librarians and HODs also recognised the necessity for dedicated, secure servers to manage the escalating data volumes generated by AI applications. Furthermore, the HOSs and undergraduate students emphasised the need for university libraries to establish cybersecurity and data protection measures during AI implementation.

6. Lack of targeted budgetary allocations for AI adoption.

Participants across all categories noted a lack of targeted budgetary allocations specifically for AI adoption. While ICT infrastructure was generally supported in broader university budgets, AI-specific investments, such as for AI software licenses, high-capacity servers, or AI-skilled personnel, were largely absent. University Librarians and HODs emphasised the need for explicit financial planning, including tapping into external funding and forming strategic partnerships. This convergence underscores institutional unpreparedness in aligning financial strategies with future AI needs.

7. Transformative potential of AI in enhancing library services.

Despite the challenges identified, there was a collective sense of optimism among University Librarians, systems librarians, and HODs regarding the transformative potential of AI in enhancing library services. Several respondents acknowledged a degree

of readiness and expressed confidence that their institutions could integrate AI technologies with adequate planning and incremental upgrades. HODs discussed future-oriented goals, such as AI-driven discovery tools and chatbot assistance, indicative of an aspiration for digital transformation even in the face of infrastructural limitations.

8. Importance of policy frameworks and collaborative partnerships

The participants acknowledged the significance of policy frameworks and collaborative partnerships in facilitating AI adoption. Recommendations included the development of AI-specific policies and governance mechanisms, as well as the utilisation of partnerships with governmental agencies or international entities for resource support. This perspective was uniformly held by librarians and HODs, underscoring the necessity for institutional collaboration and governance reform to ensure ethical and effective AI integration. Additionally, the HOSs and undergraduate students emphasised the importance of policy and governance frameworks, along with collaborative partnerships, to achieve successful AI adoption in the provision of information services.

The convergence observed in the qualitative findings indicates a broad consensus on the primary priorities for AI readiness in university libraries. These priorities encompass enhancing network infrastructure, upgrading computing hardware, addressing skills gaps, integrating AI with existing systems, ensuring data security, planning financially for AI, and promoting collaborative governance. This consensus reflects a shared understanding among institutional stakeholders that AI adoption is both desirable and feasible, contingent upon addressing foundational gaps through coordinated strategic action.

4.7.4.3 Key Areas of Convergence across Quantitative and Qualitative Findings

A comprehensive analysis and evaluation of the quantitative findings from the library HOSs and undergraduate students, alongside the qualitative findings from University Librarians, systems librarians, and HODs revealed several converging themes. These points of convergence indicate a widespread institutional agreement on the essential factors that impact the readiness of university libraries to adopt AI

a) Importance of robust ICT infrastructure

Both quantitative and qualitative data demonstrate a clear consensus regarding the essential role of sufficient computing hardware and infrastructure in enabling AI adoption. Quantitatively, a significant majority of respondents highlighted the necessity for updated computing equipment and robust Internet infrastructure. Qualitative findings corroborated these concerns, with university and Systems Librarians underscoring the need for high-performance servers, enhanced Internet bandwidth, and fiber-optic connectivity.

b) Network connectivity and bandwidth

There was a strong convergence across both datasets on the necessity of reliable and high-speed Internet connectivity. Quantitative results from students and library HOSs highlighted frequent interruptions and insufficient bandwidth as major impediments. Similarly, qualitative data from HODs and librarians confirmed that low Internet speed and unstable Wi-Fi were critical barriers, with LAN networks sometimes outperforming wireless networks in stability and speed.

c) Human resource capacity and training

A further convergence was observed concerning the development of human capital. Both datasets highlighted the inadequacy of existing skills among library staff to

effectively support AI technologies. University Librarians and Systems Librarians identified a deficiency in AI-related competencies and advocated for capacity building and targeted recruitment efforts. Quantitative responses corroborated the necessity for training programs aimed at enhancing AI literacy among both staff and users.

d) Integration with existing systems

Both qualitative and quantitative findings revealed concerns about the integration of AI with existing library systems, such as the Library Management System (LMS). Systems Librarians identified the compatibility challenges of current LMS platforms, while quantitative results emphasised the necessity of seamless integration to ensure efficient AI-driven services.

e) Data management and storage

There was a notable convergence around the importance of efficient data storage and management systems. Quantitative responses indicated the need for cloud computing and data storage capacity, aligning with qualitative feedback from HODs and librarians who projected that AI implementation would lead to increased data volumes, necessitating improved storage and retrieval systems.

f) Cybersecurity and data protection

Security concerns were consistently raised across both datasets. The HOSs and students quantitatively rated cybersecurity as a key consideration, while qualitative respondents stressed the need for strengthened data protection, especially in the context of AI-generated or processed information. Systems Librarians emphasised the importance of re-evaluating and enhancing security protocols before full AI adoption.

g) Policy and governance frameworks

Both datasets indicated the absence of or inadequacy of AI-specific policy frameworks. University Librarians mentioned lack of AI-aligned data policies, while quantitative responses emphasised the need for clear governance structures and institutional policies to guide AI deployment.

h) Budgeting and resource allocation

Funding emerged as a consistent theme. Quantitative responses pointed to the lack of specific AI budgets, aligning with qualitative feedback indicating that AI-related needs had not been prioritised in current budgetary provisions. University Librarians referenced general ICT budgeting but acknowledged that AI had yet to be fully integrated into strategic financial planning.

i) Expansion of digital content and resources

Both datasets emphasised the need for increased digital content to support AI services. Quantitative data showed support for expanded access to e-resources, while qualitative data highlighted the value of digital transformation, including AI-powered discovery tools and recommendation systems, in enhancing research support.

j) Need for AI-specific tools and applications

There was a consensus on the necessity for AI-driven applications, such as chatbots and discovery tools, capable of delivering personalised support to users. Quantitative responses supported the implementation of intelligent user support tools, while HODs and librarians identified chatbots and Natural Language Processing tools as essential for libraries prepared for the future.

The convergence between quantitative and qualitative findings offers a cohesive perspective on the requirements for AI readiness in university libraries. These requirements encompass infrastructure development, bandwidth optimisation, skills enhancement, integration with existing systems, data governance, and strategic budgeting.

4.8 Readiness of Staff's ICT Skills and Competencies to Adopt Artificial Intelligence

The third objective of the study aimed to evaluate the library staff's level of ICT competence in readiness for the adoption of AI in information provision of information services within university libraries in Kenya. This objective assessed various aspects, including the library staff's degree of competence with basic, intermediate, and advanced ICT skills, availability and uptake of AI-focused training programs, such as workshops, courses, and certifications and assessment of the degree of confidence the library staff have in their capacity to utilise AI technologies successfully.

To accomplish this objective, both quantitative and qualitative data were gathered. Quantitative data were collected from the library HOSs and undergraduate students through open and closed-ended questionnaires. The closed-ended questions were analysed using Statistical Package for the Social Sciences (SPSS). Qualitative data were obtained through open-ended questions, interview schedules administered to University Librarians and systems librarians, and focus group discussions with HODs. These qualitative data were analysed thematically. Responses related to a specific question or aspect were coded, analysed thematically, and presented in narrative descriptions, themes or theme categories, and occasionally with excerpts.

4.8.1 Findings from Heads of Sections on Library Staff Level of ICT Competence in Readiness for AI Adoption in Information Provision

The first question in this objective employed a five-point Likert scale to assess the level of basic ICT skills required for adoption of AI in information provision. The response options were rated on a scale from 1 to 5, where Very High = 5, High = 4, Moderate= 3, Low = 2, Very Low =1. The analysis integrates responses on a five-point Likert scale ranging from "Very Low" (1) to "Very High" (5). For interpretative purposes, responses categorised as "Very High" and "High" were combined to indicate a high level of competence, while those rated as "Low" and "Very Low" were combined to denote a low level of competence. "Moderate" ratings were analysed independently. Key findings and interpretations are outlined in Table 4.18.

Table 4.18

HOSs Responses on the Level of Basic ICT Skills Necessary for Adoption of AI in Information Provision

Basic ICT skills	Very high	High	Moderate	Low	Very low	Mean	Std. dev.
(a). Proficiency in basic computing tasks, such as word processing (e.g., Microsoft Word).	16(53.3%)	11(36.7%)	3(10.0%)	0	0	4.43	.679
(ii). Ability to create and make PowerPoint presentations effectively	17(56.7%)	10(33.3%)	3(10.0%)	0	0	4.47	.681
(iii). Skills in copying, saving, and organising documents in digital formats.	20(66.7%)	9(30.0%)	1(3.3%)	0	0	4.63	.556
(iv). Competence in retrieving documents from storage devices (e.g., USB drives, cloud storage).	23(76.7%)	7(23.3%)	0	0	0	4.77	.430

Basic ICT skills	Very high	High	Moderate	Low	Very low	Mean	Std. dev.
(v). Ability to use statistical tools like Excel for data analysis and reporting.	15(50.0%)	12(40.0%)	3(10.0%)	0	0	4.40	.675
(vi). Skills in digitising documents, including scanning, and creating digital archives.	19(63.3%)	10(33.3%)	0	1(3.3%)	0	4.57	.679
(vii). Proficiency in using email and online communication tools for collaboration and information sharing.	24(80.0%)	6(20.0%)	0	0	0	4.80	.407
(viii). Ability to navigate and utilise digital library management systems or databases.	18(60.0%)	11(36.7%)	1(3.3%)	0	0	4.57	.568
(ix). Familiarity with troubleshooting basic technical issues, such as resolving printer or connectivity problems.	15(50.0%)	12(40.0%)	3(10.0%)	0	0	4.40	.675

In terms of proficiency in basic computing tasks, 27 respondents (90.0%) rated library staff as possessing a high level of competence in basic computing tasks, such as word processing. In contrast, 3 (10.0%) respondents rated the competence level as moderate, with no respondents rating this skill as low. The mean score was 4.43 (SD = 0.679), indicating a high level of competence. This suggests that library staff were well-prepared in fundamental computer usage, which lays the foundation for AI adoption. Additionally, 27 HOSs (90.0%) rated the staff as highly competent in creating PowerPoint presentations, while 3 (10.0%) rated them as moderately competent. There were no low ratings. The mean score of 4.47 (SD = 0.681) highlights the staff's strong presentation skills, which may be crucial for effectively communicating AI-generated information.

Regarding document management in digital formats, a significant majority of 29 HOSs (96.7%) rated library staff as highly competent in tasks such as copying, saving, and organising documents in digital formats. Only one HOS (3.3%) indicated moderate competence, with no respondents selecting the low categories. The mean score was 4.63 (SD = 0.556), indicating consistent proficiency in digital content management, which is a crucial requirement for AI-based systems that depend on structured data. Additionally, all 30 respondents (100%) rated the staff as highly competent in retrieving documents from storage devices, such as USB drives or cloud storage. The mean score was 4.77 (SD = 0.430), indicating a high level of competence, which was essential for accessing AI-integrated systems and tools.

A total of 29 respondents (96.6%) rated library staff as highly competent in digitising documents, such as scanning and archiving, while 1 (3.3%) respondent provided a low rating. No moderate ratings were given. The mean score of 4.57 (SD = 0.679) indicates readiness in digital preservation, which is a crucial component in the integration of AI for automated information retrieval and archiving. Additionally, all respondents (100%) rated the staff as highly competent in utilising email and other online communication tools. The highest mean score of 4.80 (SD = 0.407) among all items suggests strong communication abilities, which are essential for collaborative AI applications and virtual information services.

Additionally, a high rating was observed in the navigation of digital library systems, with 29 respondents (96.7%) rating library staff as highly competent in managing digital library systems and databases, while 1 (3.3%) respondent indicated moderate

competence. The mean score was 4.57 (SD = 0.568), which highlights the staff's readiness in managing digital information environments, which were often enhanced by AI functionalities. Lastly, 27 respondents (90.0%) rated library staff as highly competent in basic technical troubleshooting, while 3 (10.0%) respondents rated them as moderately competent. No low ratings were recorded. The mean score of 4.40 (SD = 0.675) suggests that staff are capable of independently resolving minor technical disruptions, thereby supporting the maintenance of AI systems.

These findings demonstrate a consistently high level of basic ICT skills and competencies among university library staff, as assessed by the HOSs. For all assessed ICT skills, at least 90.0% of respondents reported high competence levels, with most items exhibiting no low ratings whatsoever. Moderate ratings were minimal and largely consistent across various items, not exceeding 10.0%. These findings are in line with the findings a study conducted by Agava and Underwood (2020) in Tangaza University that established that 80% of the librarians had very high, while 16.7% had high basic ICT skills. The findings of other studies conducted in Nigeria by Adedara et al. (2022) and Oyedokun et al. (2018) also established that majority of the librarians possessed basic ICT skills with a mean of 3.89. David-West and Ig-worlu (2023) opine that possession of basic ICT skills by library staff is a precondition for effective adoption of AI for provision of information services. Consequently, the high level of basic ICT skills indicates that the library staff in Kenyan university libraries are well-placed for the transition to AI-powered systems in information provision.

The implications of these findings are substantial. Firstly, the robust ICT foundation among staff suggests that minimal training may be necessary to facilitate AI adoption. Secondly, their proficiency in document management, data analysis, and system navigation corresponds well with the requirements of AI tools that depend on structured digital content and analytics. Lastly, their strong competence in communication and troubleshooting indicates that staff can effectively support users, even in more complex AI-integrated service environments.

The second question pertained to the level of intermediate ICT skills necessary for the adoption of AI in information provision. Key findings and interpretations are detailed in Table 4.19.

Table 4.19

HOSs Responses on the Level of Intermediate ICT Skills Necessary for Adoption of AI in Information Provision

Intermediate ICT skills	Very high	High	Moderate	Low	Very low	Mean	Std. dev.
(i). Proficiency in browsing the Internet to locate and access information effectively.	22(73.3%)	8(26.7%)	0	0	0	4.73	.450
(ii). Ability to create and manage web content using tools like content management systems (e.g., WordPress).	13(43.3%)	11(36.7%)	5(16.7%)	0	1(3.3%)	4.17	.950
(iii). Skills in utilising Web 2.0 technologies (e.g., blogs, wikis, and social media) for information sharing and collaboration.	13(43.3%)	13(43.3%)	2(6.7%)	1(3.3%)	1(3.3%)	4.20	.961

Intermediate ICT skills	Very high	High	Moderate	Low	Very low	Mean	Std. dev.
(iv). Competence in using search engines effectively for advanced searches and research.	21(70.0%)	8(26.7%)	1(3.3%)	0	0	4.67	.547
(v). Proficiency in using email for communication, including attaching files and organising messages.	24(80.0%)	6(20.0%)	0	0	0	4.80	.407
(vi). Ability to navigate and utilise subject gateways to access specialised resources.	15(50.0%)	12(40.0%)	3(10.0%)	0	0	4.40	.675
(vii). Familiarity with managing cloud-based storage platforms (e.g., Google Drive, OneDrive) for collaborative work.	14(46.7%)	10(33.3%)	4(13.3%)	1(3.3%)	1(3.3%)	4.17	1.020
(viii). Competence in basic data visualisation techniques using tools like Excel or Google Charts.	14(46.7%)	9(30.0%)	5(16.7%)	2(6.7%)	0	4.17	.950
(ix). Proficiency in integrating multimedia tools (e.g., video editing or audio recording software) to create engaging digital content.	10(33.3%)	12(40.0%)	6(20.0%)	1(3.3%)	1(3.3%)	3.97	.999

As indicated in Table 4.19, the proficiency in effective Internet browsing and conducting advanced searches using search engines was rated highly. Notably, all 30 respondents (100%) rated the staff as highly competent in general Internet browsing for locating and accessing information, with no moderate or low ratings. This criterion

achieved a high mean score of 4.73 (SD = 0.450), indicating a very strong skill set in basic digital navigation. Additionally, 29 respondents (96.7%) indicated high competence in utilising search engines for advanced searches and research, whereas only one respondent (3.3%) rated the skill as moderate. There were no reports of low competence. The mean score was 4.67 (SD = 0.547) suggesting that library staff possess essential search skills that are crucial for engaging with AI tools that depend on data sourcing and retrieval from digital platforms.

In terms of the capability to develop and oversee web content using content management systems like WordPress, 24 respondents (80.0%) rated the staff as highly competent, 5 (16.7%) as moderately competent, and only 1 (3.3%) respondent as having a low level of competence. The mean score was 4.17 (SD = 0.950), indicating a moderate to strong level of familiarity with web publishing tools, which is becoming increasingly significant in AI-supported digital information services.

Collaboration and communication skills through digital platforms were evaluated across several items. Regarding proficiency in email usage, which encompasses attaching files and organising messages, all 30 respondents (100%) rated the library staff as highly competent. This particular item achieved the highest mean score of 4.80 (SD = 0.407), indicating that email communication was a fully integrated skill among staff. The skills in utilising Web 2.0 technologies, such as blogs, wikis, and social media platforms for collaboration and information sharing, were also rated favourably. A total of 26 respondents (86.6%) rated these skills as high, 2 (6.7%) respondents provided moderate ratings, while 2 (6.6%) rated them as low. The mean score was 4.20 (SD = 0.961),

indicating fairly strong competence in engaging with interactive and user-generated content, an area that supports the participatory nature of AI tools in information services.

On data management and visualisation, proficiency in utilising and navigating subject gateways to access specialised resources was rated as high by 27 respondents (90.0%), moderate by 3 (10.0%) respondents, and did not receive any low ratings. The mean score of 4.40 (SD = 0.675) indicates a satisfactory level of familiarity with subject-specific resources, thereby enhancing the capacity to utilise AI tools for the retrieval of discipline-specific information. Additionally, 24 respondents (80.0%) rated the staff as highly competent in managing cloud-based storage platforms such as Google Drive and OneDrive. Four respondents (13.3%) provided a moderate rating, while 2 (6.6%) reported low competence. The mean was 4.17 (SD = 1.020), indicating a moderate level of comfort with cloud collaboration, which is essential for applications based on cloud-based AI.

In the context of data visualisation using tools such as Excel and Google Charts, 23 respondents (76.7%) indicated a high level of competence, 5 (16.7%) respondents rated it as moderate, and 2 (6.7%) rated it as low. The mean score was 4.17 (SD = 0.950). These competencies were crucial for interpreting and presenting AI-generated insights in visually understandable formats. In terms of multimedia integration skills, the capacity to utilise multimedia tools (such as video and audio editing software) received slightly lower ratings compared to other competencies. Twenty-two respondents (73.3%) rated staff as highly competent, while 6 (20.0%) rated them as moderately competent, and 2 (6.6%) provided low ratings. The mean score was 3.97 (SD = 0.999), the lowest among the intermediate ICT skills assessed, suggesting that multimedia content creation was a relatively weaker area, though still moderately strong overall.

The findings suggest that university library staff exhibit significant proficiency in intermediate ICT skills, especially in areas pertinent to digital communication, Internet research, and data management. The highest competencies were observed in email usage (M = 4.80), general Internet browsing (M = 4.73) and proficient use of advanced search engines (M = 4.67) highlighting the staff's readiness to interact with AI systems that rely on digital interaction and information retrieval. Moderate competencies in areas such as web content creation web content creation (M = 4.17), use of Web 2.0 tools (M = 4.20), cloud storage (M = 4.17), and data visualisation (M = 4.17) further demonstrate preparedness, although they may benefit from capacity-building initiatives to ensure the optimal utilisation of AI-enabled tools. Multimedia integration, while rated lowest, (M = 3.97), remains a critical area for improvement, as multimedia formats increasingly used in AI-generated and AI-enhanced information delivery.

In line with these findings, a study by Antidius (2018) in Tanzania established that 73.3% of the librarians possessed intermediate ICT skills. Further, the findings of this study also indicate that the library staff had the highest proficiency in the use of Internet (M = 4.73) and email communication (M = 4.80) which concurs with the findings of Oyedokun et al. (2018) that suggested that the library staff were very proficient in the use of the Internet (67.9%) than any other intermediate ICT skills.

The implications of these findings are that first, university libraries can leverage the existing ICT skill base of their staff as a foundation for AI adoption. However, targeted training in areas such as multimedia content creation and the more advanced use of collaborative technologies would enhance overall readiness. Strategic investments in staff professional development will be crucial for ensuring that library staff can fully utilise AI

to improve efficiency, user engagement, and the quality of information services (Oyovwe-Tinuoye et al., 2021).

The third question was about the level of advanced ICT skills necessary for adoption of AI in information provision. Key findings and interpretations are outlined in Table 4.20.

Table 4.20

HOSs Responses on Level of Advanced ICT Skills Necessary for Adoption of AI in Information Provision

Advanced ICT skills	Very high	High	Moderate	Low	Very low	Mean	Std. dev.
(i). Proficiency in designing and integrating software to enhance library services.	4(13.3%)	10(33.3%)	8(26.7%)	5(16.7%)	3(10.0%)	3.23	1.194
(ii). Ability to install and configure operating systems for optimal functionality.	9(30.0%)	7(23.3%)	10(33.3%)	1(3.3%)	3(10.0%)	3.60	1.248
(iii). Skills in the development of information systems tailored to library needs.	5(16.7%)	13(43.3%)	5(16.7%)	5(16.7%)	2(6.7%)	3.47	1.167
(iv). Competence in designing user interfaces (UI) for library applications and systems.	7(23.3%)	7(23.3%)	7(23.3%)	8(26.7%)	1(3.3%)	3.37	1.217
(v). Ability to perform minor computer repairs, such as troubleshooting hardware issues.	9(30.0%)	9(30.0%)	8(26.7%)	3(10.0%)	1(3.3%)	3.73	1.112
(vi). Expertise in data mining techniques to extract meaningful insights from large datasets.	6(20.0%)	9(30.0%)	9(30.0%)	5(16.7%)	1(3.3%)	3.47	1.106

Advanced ICT skills	Very high	High	Moderate	Low	Very low	Mean	Std. dev.
(vii). Proficiency in data analysis and developing algorithms for AI and library services.	3(10.0%)	8(26.7%)	9(30.0%)	8(26.7%)	2(6.7%)	3.07	1.112
(viii). Knowledge of cybersecurity measures and network management to secure library systems.	5(16.7%)	11(36.7%)	7(23.3%)	5(16.7%)	2(6.7%)	3.40	1.163
(ix). Competence in managing database management systems to organise and retrieve data efficiently.	5(16.7%)	13(43.3%)	7(23.3%)	5(16.7%)	0	3.60	.968
(x). Skills in setting up and maintaining network infrastructure to support AI-driven services.	6(20.0%)	8(26.7%)	7(23.3%)	7(23.3%)	2(6.7%)	3.30	1.236
(xi). Proficiency in programming languages (e.g., Python, Java) for developing AI applications.	3(10.0%)	7(23.3%)	4(13.3%)	12(40.0%)	4(13.3%)	2.77	1.251
(xii). Knowledge of cloud computing platforms (e.g., AWS, Azure) for deploying AI solutions.	3(10.0%)	8(26.7%)	6(20.0%)	11(36.7%)	2(6.7%)	2.97	1.159
(xiii). Ability to train and fine-tune machine learning models to support AI applications in libraries.	5(16.7%)	8(26.7%)	4(13.3%)	8(26.7%)	5(16.7%)	3.00	1.390

From the above table, the responses on software and system development skills reveal a mixed level of competence in software and system development. For designing

and integrating software to enhance library services, only 14 respondents (46.6%) rated staff as highly competent, while 8 (26.7%) rated them as moderately competent, and another 8 (26.7%) rated them as having low competence. The mean was 3.23 (SD = 1.194). Similarly, for developing information systems tailored to library needs, 18 respondents (60.0%) indicated high competence, 5 (16.7%) rated it as moderate, and 7 (23.4%) gave low ratings. This area recorded a mean of 3.47 (SD = 1.167). The findings suggest that while a slight majority of library staff may possess foundational abilities in system development, a significant portion lacks confidence or exposure to these advanced technical domains.

The proficiency in data science skills related to AI was predominantly at a basic level. Regarding data mining techniques, 15 respondents (50.0%) rated the staff's competence as high, 9 (30.0%) rated them as moderate, and 6 (20%) rated them low. The mean was 3.47 (SD = 1.106). In the context of data analysis and algorithm development for AI, a mere 11 respondents (36.7%) indicated a high level of competence, whereas 9 (30.0%) rated it as moderate, and 10 (33.4%) rated it as low. This skill had one of the lower mean scores at 3.07 (SD = 1.112).

Regarding the training and fine-tuning of machine learning models, 13 respondents (43.4%) rated the staff as highly competent, 4 (13.3%) as moderate, and a concerning 13 (43.4%) as low. The mean here was 3.00 (SD = 1.390). These findings indicate a substantial deficiency in the specialised data skills required for the comprehensive integration of AI in library services. This gap may constrain libraries to employing only basic AI applications unless external expertise is acquired or in-house capacity is built through professional training.

In the domain of cybersecurity and network management, 16 respondents (53.4%) rated staff highly in knowledge of cybersecurity measures, while 7 (23.3%) gave a moderate score and 7 (23.4%) rated it low. The mean was 3.40 (SD = 1.163). In the context of setting up and maintaining network infrastructure, only 14 respondents (46.7%) rated the staff's competence as high, whereas 7 (23.3%) rated it as moderate, and 9 (30.0%) reported low competence. The mean was 3.30 (SD = 1.236). These findings indicate moderate levels of preparedness in managing the security and network aspects of AI infrastructure, which are essential for ensuring the safety and reliability of AI-driven library services.

The proficiency in database management emerged as one of the relatively more robust domains within the advanced skill set. A total of 18 respondents (60.0%) rated library staff as highly competent in managing database management systems, 7 (23.3%) rated them as moderately competent, and 5 (16.7%) rated them as having low competence. The mean score was 3.60 (SD = 0.968), indicating a slightly above-average proficiency in organising and efficiently retrieving data, a crucial skill for managing AI-enhanced systems that depend significantly on structured data. Additionally, the capacity to conduct minor computer repairs, including hardware troubleshooting, was evaluated favourably. A total of 18 respondents (60.0%) provided high ratings, 8 (26.7%) rated them as moderate, and only 4 (13.3%) gave low ratings. This item had a mean of 3.73 (SD = 1.112), suggesting a solid base in basic technical support, which is essential for maintaining infrastructure that supports AI tools.

The domains of programming and cloud computing registered the lowest scores overall. Regarding proficiency in programming languages such as Python or Java, only

10 respondents (33.3%) rated the staff as highly competent, 4 (13.3%) as moderately competent, and a concerning 16 (53.4%) as having low competence. This was the lowest-rated criterion in the entire assessment, with a mean of 2.77 (SD = 1.251). Similarly, regarding proficiency with cloud computing platforms such as AWS or Azure, 11 respondents (36.7%) rated the staff's competence as high, 6 (20.0%) as moderate, and 13 (43.4%) as low. The mean was 2.97 (SD = 1.159). These findings indicate a substantial deficiency in programming and cloud computing skills, which are essential for the development, deployment, and scalability of AI applications within libraries. In the absence of these competencies, libraries may encounter difficulties in implementing AI solutions that extend beyond basic pre-packaged tools.

The aforementioned findings regarding the level of advanced ICT skills necessary for the adoption of AI in information provision suggest that university library staff generally possess moderate proficiency in these skills with stronger capabilities in database management and technical troubleshooting, and weaker skills in programming, cloud computing, and AI-specific tasks such as machine learning. The findings indicate that while foundational skills such as minor computer repairs (M = 3.73) and database management (M = 3.60) show promise, key competencies for advanced AI implementation, such as programming (M = 2.77), cloud computing (M = 2.97), and training AI models (M = 3.00), were significantly lacking.

These findings are supported by the findings of studies conducted in Nigerian university libraries by Adedara et al. (2022) and Oyedokun et al. (2018) which established that programming skills had the least number of respondents with proficiency with 62.0% and 65.0% respectively. In line with the study's findings, these studies also recorded a

drop in the number of respondents with advanced ICT skills, in comparison to the basic and intermediate ICT skills. This implies that although staff may be able to support and interact with user-end AI tools, they may lack the expertise required for developing, customising, and scaling AI systems independently.

The implications of these findings underscore the urgent need for structured training and upskilling programs focused on programming languages, cloud platforms, machine learning, and cybersecurity. In the absence of these competencies, university libraries may become excessively reliant on external vendors or restricted to basic AI applications. It is recommended that strategic investments be made in advanced ICT training, potentially through partnerships with IT departments or external institutions, to build in-house AI capabilities that can drive innovation within academic libraries.

The HOSs in libraries were presented with various types of training programs designed to equip library staff for adoption of AI in university libraries. They were tasked with rating each program, indicating their level of agreement or disagreement with the necessity of these trainings. The rating scale was 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. For interpretative purposes, the percentages and frequencies for “Strongly Agree” and “Agree” were combined to represent agreement, while those for “Disagree” and “Strongly Disagree” were similarly combined to reflect disagreement. “Neutral” responses were discussed independently. The findings are summarised in Table 4.21.

Table 4.21

HOSs Responses on Types of Training Required to Prepare Library Staff for Adoption of AI in University Libraries

Types of Training	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Training on basic AI concepts to understand AI fundamentals and applications in libraries.	26(86.7%)	4(13.3%)	0	0	0	4.87	.346
(ii). Workshops on data analytics to enhance decision-making and information management skills.	25(83.3%)	5(16.7%)	0	0	0	4.83	.379
(iii). Training on machine learning applications specific to library operations and services.	22(73.3%)	7(23.3%)	1(3.3%)	0	0	4.70	.535
(iv). Digital literacy training to ensure staff can effectively use digital tools and platforms.	24(80.0%)	6(20.0%)	0	0	0	4.80	.407
(v). Cybersecurity and data privacy training to safeguard library systems and user information.	22(73.3%)	8(26.7%)	0	0	0	4.73	.450
(vi). Hands-on training on AI tools and software (e.g., TensorFlow, PyTorch) used in library services.	23(76.7%)	6(20.0%)	0	1(3.3%)	0	4.70	.651
(vii). Training on managing and integrating cloud computing platforms for library operations.	20(66.7%)	10(33.3%)	0	0	0	4.67	.479
(viii). Workshops on ethical considerations and responsible use of AI in library environments.	24(80.0%)	6(20.0%)	0	0	0	4.80	.407

The findings indicate that all 30 respondents (100%) either strongly agreed (n = 26, 86.7%) or agreed (n = 4, 13.3%) that training on basic AI concepts was essential to

assist library staff in comprehending AI fundamentals and their applications. None of the respondents selected “Neutral,” “Disagree,” or “Strongly Disagree.” This item demonstrated the highest possible consensus, with a mean score of 4.87 (SD = 0.346), reflecting very low variability in responses. This result highlights the universal acknowledgment among HOSs of the significance of foundational AI literacy as a prerequisite for the adoption and integration of AI in library settings.

Likewise, all 30 respondents (100%) concurred on the importance of workshops in data analytics, with 25 (83.3%) expressing strong agreement and 5 (16.7%) agreeing. This training area had a mean of 4.83 (SD = 0.379). The results indicate a significant appreciation for the role of data analytics in enhancing evidence-based decision-making and information management, both of which are critical components in data-driven AI environments. There was also strong support for training on machine learning applications specific to library operations, with 29 respondents (96.6%) in agreement. Only one respondent (3.3%) selected “Neutral,” and none disagreed. The mean was 4.70 (SD = 0.535), indicating a high level of endorsement with slight variation. These findings suggest an increasing interest in equipping staff with specialised AI competencies that extend beyond theoretical knowledge to include applied, domain-specific skills.

In relation to cybersecurity and data privacy training, all 30 respondents (100%) affirmed its importance, with 22 (73.3%) expressing strong agreement and 8 (26.7%) indicating agreement. The mean was 4.73 (SD = 0.450). The unanimous agreement in this domain indicates that the HOSs were cognisant of the potential risks associated with AI-driven systems, including data breaches and ethical challenges, and recognised the need to safeguard library infrastructure and user information. Furthermore, regarding training

on cloud computing platforms, all 30 respondents (100%) endorsed its necessity, with 20 (66.7%) strongly agreeing and 10 (33.3%) agreeing. The mean was 4.67 (SD = 0.479). The findings indicate a recognition of cloud technologies as fundamental to scalable, remote, and collaborative AI applications, underscoring the necessity of training in this domain for contemporary library operations.

Regarding practical training on AI tools and software, 29 respondents (96.7%) expressed strong support, with 23 (76.7%) strongly agreeing, 6 (20.0%) agreeing, and 1 respondent (3.3%) disagreeing. This type of training had a mean score of 4.70 and a slightly higher standard deviation of 0.651, suggesting some minor variation in levels of agreement. This implies that practical, skills-based training is regarded nearly as crucial as theoretical instruction, especially for the implementation of AI applications in real-world library environments.

Finally, workshops on ethical considerations and responsible AI use received unanimous support, with 24 participants (80.0%) strongly agreeing and 6 (20.0%) agreeing, resulting in a mean of 4.80 (SD = 0.407). The level of consensus observed underscores the awareness among HOSs regarding the potential social and ethical implications of AI in libraries, such as algorithmic bias, data privacy, and the responsible use of automated decision-making tools. There was universal support for digital literacy training, with all 30 respondents (100%) in agreement—24 (80.0%) strongly agreed and 6 (20.0%) agreed (4.80, SD = 0.407). This result suggests that, although many staff members already have general digital skills, there is a necessity to enhance these competencies to remain aligned with the rapidly evolving technological landscape associated with AI.

The results indicate overwhelming support across all proposed training categories, with 96.7% to 100% of respondents agreeing on the necessity of each type. Notably, there were no “Strongly Disagree” responses across the board, and only two instances of disagreement (both in the AI tools category). These findings concur with the findings of a study by Abiolu and Akinyemi (2025) where all the participants indicated a high need of training in various aspects of AI such as AI fundamentals, AI programming and coding, how to evaluate and assess AI, the ethical considerations of AI use in libraries, data handling and data privacy and AI design and user experience. This strong consensus implies that the HOSs perceive a multi-faceted training approach as essential for building the capacity of library staff to effectively adopt and apply AI in their operations.

The university libraries therefore need to invest in comprehensive and structured training programs that address both the theoretical and practical aspects of AI. Foundational knowledge (e.g., basic AI concepts and digital literacy), applied skills (e.g., hands-on AI tools, machine learning), and ethical awareness (e.g., responsible AI use and cybersecurity) must be integrated into continuous professional development plans. Partnerships with academic departments, IT units, and external trainers could enhance the implementation of such initiatives, ensuring that library staff were well-prepared to lead in the digital transformation of information services (Agava & Underwood, 2020).

Another critical question posed to HOSs in libraries was methods of training on new technologies such as AI. The HOSs respondents were required to provide a rating on each provided sentiment indicating the extent to which they would prefer each of the suggested methods. The rating scale was 1-5, where Strongly Prefer = 5, Prefer = 4, Neutral = 3, Do not Prefer= 2, Strongly Do Not Prefer =1. The frequencies and percentages

of “Strongly Prefer” and “Prefer” responses were combined to represent high preference, while “Do Not Prefer” and “Strongly Do Not Prefer” were also combined to indicate rejection of the training method. Responses marked as “Neutral” were discussed separately. The findings are summarised in Table 4.22.

Table 4.22

HOSs Responses on Methods of Training on New Technologies Such as AI

Methods of Training	Strongly prefer	Prefer	Neutral	Do Not prefer	Strongly do not prefer	Mean	Std. dev.
(i). Workshops and conferences for hands-on experience and knowledge sharing.	23(76.7%)	7(23.3%)	0	0	0	4.77	.430
(ii). Seminars to gain insights and updates on AI and related technologies.	20(66.7%)	10(33.3%)	0	0	0	4.67	.479
(iii). Further studies in Library and Information Science (LIS) with a focus on emerging technologies.	16(53.3%)	12(40.0%)	2(6.7%)	0	0	4.47	.629
(iv). Web tutorials for flexible and self-paced learning.	16(53.3%)	12(40.0%)	2(6.7%)	0	0	4.47	.629
(v). Online courses offering in-depth knowledge on AI and its applications.	20(66.7%)	8(26.7%)	2(6.7%)	0	0	4.60	.621
(vi). On-the-job training for practical application of new skills in real-time.	24(80.0%)	6(20.0%)	0	0	0	4.80	.407
(vii). Personal training sessions tailored to individual staff needs.	18(60.0%)	9(30.0%)	3(10.0%)	0	0	4.50	.682
(viii). Learning from friends and colleagues with expertise in AI technologies.	15(50.0%)	10(33.3%)	4(13.3%)	1(3.3%)	0	4.23	1.073

Methods of Training	Strongly prefer	Prefer	Neutral	Do Not prefer	Strongly do not prefer	Mean	Std. dev.
(ix). Training provided by software suppliers to ensure proper usage of AI tools and systems.	16(53.3%)	11(36.7%)	2(6.7%)	0	1(3.3%)	4.37	.890
(x). Professional certifications in AI and ICT, such as courses offered by Coursera or edX.	20(66.7%)	8(26.7%)	1(3,3%)	0	1(3.3%)	4.53	.860
(xi). Internships or attachments in organisations already leveraging AI in library services.	11(36.7%)	15(50.0%)	4(13.3%)	0	0	4.23	.679
(xii). Blended learning programs combining face-to-face and online training for a comprehensive approach.	17(56.7%)	13(43,3%)	0	0	0	4.57	.504

The results indicate that an overwhelming majority of respondents, 30 (100%), either strongly preferred (n = 23, or 76.7%) or preferred (n = 7, 23.3%) workshops and conferences as an effective training method. None expressed neutrality or a negative preference. This method resulted in one of the highest mean scores at M = 4.77 (SD = 0.430), indicating a strong and uniform endorsement. This finding suggests that hands-on, participatory learning environments that facilitate knowledge exchange were particularly valued by the HOSs in libraries.

Likewise, all participants (n = 30, 100%) expressed a preference for on-the-job training, with 24 participants (80.0%) strongly preferring it and 6 (20.0%) simply preferring it. This method achieved the highest overall mean at M = 4.80 (SD = 0.407). The findings demonstrate a significant consensus, indicating a strong preference for the

immediate and real-time application and acquisition of skills within practical library environments. This suggests that training strategies should be integrated into daily operations to enhance relevance and retention.

The seminars garnered complete support from all 30 respondents, with 20 (66.7%) expressing a strong preference and 10 (33.3%) indicating a preference, resulting in a mean of 4.67 (SD = 0.479). Similarly, online courses were also highly favoured, with 28 respondents (93.4%) in agreement—20 (66.7%) strongly preferred and 8 (26.7%) preferred, while 2 (6.7%) remained neutral (M = 4.60, SD = 0.621). The strong preference for these methods underscores the importance of accessible, structured knowledge delivery formats that provide both depth and flexibility. Another highly favoured approach was blended learning, which integrates online and in-person components. All respondents endorsed this method, with 17 (56.7%) expressing a strong preference and 13 (43.3%) a preference, resulting in a mean score of 4.57 (SD = 0.504). This preference indicates that a hybrid model may offer a balanced approach to accommodate diverse learning styles and logistical realities in university libraries.

Both web tutorials and further studies in Library and Information Science (LIS) were supported by 28 respondents (93.3%), with 2 (6.7%) respondents remaining neutral in both instances. Regarding web tutorials, 16 respondents (53.3%) strongly preferred them, while 12 respondents (40.0%) simply preferred them. Similarly, for further studies in LIS, 16 respondents (53.3%) strongly preferred them, and 12 respondents (40.0%) simply preferred them. Each method had a mean score of 4.47 (SD = 0.629). This indicates that, although both formal academic advancement and flexible self-paced learning are

esteemed, they may be ranked slightly lower in preference compared to interactive and hands-on methods.

Notably, 27 respondents (90.0%) expressed a preference for personal training sessions customised to individual staff needs, with 18 (60.0%) indicating a strong preference and 9 (30.0%) a general preference. Conversely, 3 (10.0%) respondents selected a neutral stance, resulting in a mean score of 4.50 (SD = 0.682). This suggests that personalised attention and customisation were valued, although their implementation may be constrained by available resources and time. In related findings, 25 respondents (83.3%) preferred learning from colleagues, with 15 (50.0%) expressing a strong preference and 10 (33.3%) a general preference. Four respondents (13.3%) were neutral, and one (3.3%) did not prefer this method. The mean score was 4.23 (SD = 1.073), indicating greater variability in responses. Similarly, internships in AI-enabled organisations were preferred by 26 respondents (86.7%), with 11 (36.7%) strongly preferring and 15 (50.0%) preferring, while 4 (13.3%) remained neutral. This method had a mean of 4.23 (SD = 0.679). These findings underscore the perceived importance of peer networks and experiential learning beyond the conventional academic framework, although they were marginally less preferred compared to formal training methods.

The staff expressed a preference for professional certifications in AI and ICT (e.g., through platforms such as Coursera or edX). Specifically, 28 respondents (93.4%) preferred these certifications, 20 (66.7%) strongly preferred them, and 8 (26.7%) indicated a preference. Additionally, 1 (3.3%) respondent was neutral, and 1 (3.3%) did not prefer such certifications. The mean score was 4.53 (SD = 0.860). These findings emphasise the

acknowledgment of formal credentials as a pathway to career progression and technical proficiency, notwithstanding the relatively greater variability in preference levels.

The majority of respondents, 27 (90.0%), expressed a preference for training provided by software suppliers. Of these, 16 respondents (53.3%) indicated a strong preference, while 11 respondents (36.7%) simply preferred this method. Two respondents (6.7%) remained neutral, and 1 (3.3%) strongly disliked this approach. The method received an average score of 4.37 (SD = 0.890), suggesting a moderate yet positive consensus. Although supplier-led training is acknowledged as crucial for comprehending AI tools effectively, there may be a slight reluctance due to perceived commercial bias or insufficient contextualisation.

The findings reveal that interactive, applied, and flexible training methods were the most strongly preferred by HOSs in university libraries. Methods such as on-the-job training, workshops, seminars, and online courses, which received near-universal support, were the most preferred. This suggests a clear preference for experiential and multimodal learning, which accommodates varied learning styles and allows immediate application of skills in real-world library settings. These findings align with the findings from other studies conducted in developing countries such as Adedara et al. (2022), Agava and Underwood (2020), Baro et al. (2019), Chanetsa and Ngulube (2017), and Manzo (2020). For instance, a study by Agava and Underwood (2020) in Tangaza University established that 100% of the librarians preferred seminars and workshops, while 70.0% preferred on-the-job training. Similarly, a study by Adedara et al. (2022) also established that the librarians preferred on-the-job training and workshops and seminars with means of 4.04 and 3.76 respectively. However, the findings on the high preference of online courses

contradict the findings of the studies by Baro et al. (2019) and Manzo (2020) where this training method was the least preferred method of training with 36.4% and 40.7 % respectively. According to Agava and Underwood (2020), seminars, conferences and workshops are preferred since they run for a short time and are mostly financed.

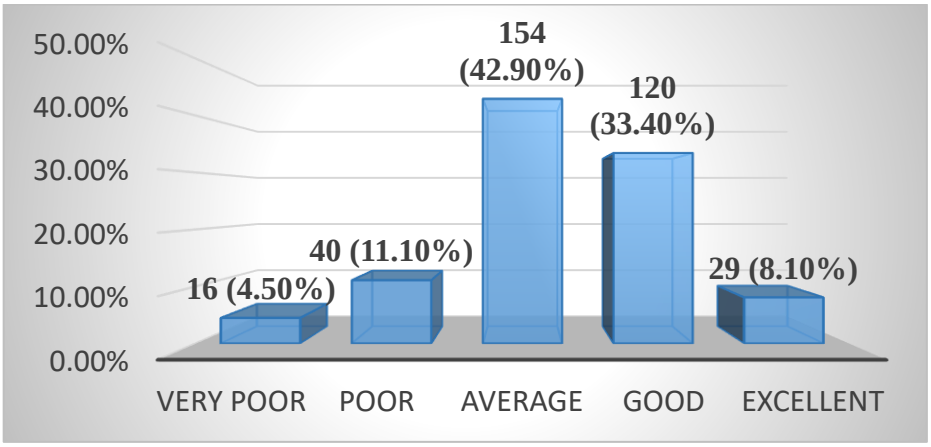
The implications of these findings are significant for university administrators. They highlight the necessity for institutions to prioritise diverse, accessible, and continuous training strategies that integrate formal, informal, and peer-driven learning models. Workshops, internships, certifications, and on-the-job training opportunities should be actively incorporated into professional development plans. Furthermore, collaborations with AI vendors and external platforms such as Coursera or edX could facilitate the scaling of training delivery without overextending in-house resources. The training preferences expressed by the library HOSs also underscore the importance of flexibility, practicality, and relevance in AI capacity-building initiatives. A comprehensive training framework that incorporates the most preferred methods could substantially enhance the readiness of library staff to adopt and utilise AI technologies for improved information service delivery.

4.8.2 Findings from Undergraduate Students on Library Staff Level of ICT Competence in Readiness for AI Adoption in Information Provision

The undergraduate students were posed a single question that required them to assess the library staff's ICT competencies in preparation for providing AI-based information services using a five-point Likert scale. Their responses are summarised in Figure 4.6.

Figure 4.6

Undergraduate Students' Rating of Library Staff's Level of ICT Competence in Readiness for AI Adoption in Information Provision



Source: Research Data

The findings reveal that majority of students, 154 (42.9%), assessed the ICT competence of library staff as average. Furthermore, a considerable number, 120 students (33.4%), rated the staff's competence as good, while 29 students (8.1%) rated it excellent. Conversely, 40 students (11.1%) and 16 students (4.5%) perceived the staff's ICT skills as poor or very poor, respectively. The findings suggest that a majority of students, 82.3% (n = 303), rated the ICT competence of library staff as average or better. Specifically, 42.9% rated it as "average", 33.4% as "good", and 8.1% as "excellent". This suggests a prevailing perception among students that library staff exhibit a foundational to moderately advanced level of ICT proficiency, which may be adequate for the basic to intermediate integration of AI in information delivery.

These findings are consistent with those from the library HOSs regarding basic and intermediate levels of ICT skills. However, the fact that 56 students (15.6%) rated staff competence as "poor" or "very poor" underscores a significant concern regarding

potential competency gaps that may impede the integration of more sophisticated AI tools and services. This cohort likely represents students who have experienced limitations in staff support for digital or AI-related inquiries or who anticipate a higher degree of technological proficiency from library personnel within the dynamic academic landscape.

The findings of this study concur with the findings of a study conducted by Oyedokun et al. (2018) on the library staff at selected universities in Nigeria's Kwara State, where majority of the respondents rated their basic and intermediate skills as high, while a small percentage (25.0%) indicated they had high advanced ICT skills. Similarly, a study by Maina and Muthee (2020) on Kenyan academic libraries' readiness to adopt cloud computing technologies also established that except for Microsoft Office Packages, where most respondents (70.0%) were experts, nearly three-quarters of the respondents had only basic skills in practically all categories. According to Nzioki (2021), University Librarians need to be proficient in ICT skills to embrace the disruptive technologies of this era, such as AI.

The above results have several implications for academic library administration and staff development. The large proportion of "average" ratings (42.9%) indicates that while staff may be equipped with basic ICT skills, there may be a lack of advanced capabilities required for full-scale AI adoption. Libraries need to bridge this gap through targeted upskilling programs that specifically focus on AI technologies, machine learning basics, and AI-driven information services. The combined 41.5% of students rating staff as "good" or "excellent" suggests a favourable perception that can be further strengthened. Enhancing visibility of ongoing training and AI initiatives among staff could help raise student confidence in the library's technological advancement.

However, a minority, 15.6% of students who perceive staff ICT competence negatively must not be overlooked. These perceptions can affect library credibility and user trust. It is crucial to engage in continuous assessment, feedback mechanisms, and transparency in training to assure users that staff are being equipped to meet technological demands. Moreover, the findings reinforce the necessity for libraries to integrate AI-focused ICT training into their staff development programs. Institutions must invest not only in tools but also in human capital to ensure a smooth transition into AI-driven library services.

4.8.3 Qualitative Findings on Readiness of Staff's ICT Skills and Competencies to Adopt Artificial Intelligence

During individual interviews, both University Librarians and Systems Librarians were asked to assess the current ICT competencies of library staff in relation to the integration of AI-based tools for information services. Several salient themes emerged from their responses. These included basic ICT literacy with limited AI skills, the need for training and capacity building, and a supportive environment for technological experimentation. These themes underscore a pivotal transitional phase wherein library staff possess basic ICT skills but require substantial upskilling to proficiently engage with AI-driven tools and systems.

1. Basic ICT literacy with limited AI skills

The responses from University Librarians predominantly mentioned basic ICT literacy among library staff. For instance, University Librarians' respondent number 02 noted, *"most of the staff have basic ICT literacy skills,"* suggesting a foundational understanding of digital tools. However, this foundational literacy was not sufficient for

adopting advanced AI-based technologies in information service delivery. This was further supported by the sentiment "*very few of the library staff have AI skills*," by Systems Librarian 04, indicating a substantial skills gap in this emerging area. The implication is that while ICT competencies may exist, they do not currently extend to the domain of AI, which demands a higher level of technical proficiency.

2. Need for training and capacity building

Another salient theme was the critical need for training, retooling, and professional development. Several respondents emphasised the necessity for structured learning opportunities, with Systems Librarian 01 asserting that there was a *"definite need for trainings*" and another one, University Librarian 05 noting "*the need for retooling in compliance with AI based tools."* These responses reflect an awareness among University Librarians of the evolving nature of digital librarianship and the importance of continuous professional development. Based on the study's findings, it was evident that without deliberate investments in training, library staff will remain ill-equipped to integrate AI tools into library operations effectively.

3. Supportive environment for technological experimentation

A third theme that emerged from the responses was the importance of fostering a supportive environment that encourages learning and experimentation. This was highlighted by the suggestion to *"encourage a supportive environment that allows experimentation of the new technologies within the library environments."* by Systems Librarian 03. Such an environment is essential for staff to build confidence, adapt to technological change, and innovate in service delivery. This implies that beyond formal

training, libraries must also cultivate institutional cultures that are open to change and technological advancement.

The responses from University Librarians and Systems Librarians reveal a strong recognition of the importance of the library staff's ICT skills and competencies in the adoption of AI for provision of information services. The key areas identified were basic ICT literacy with limited AI skills among the library staff, the need for training and capacity building, and a supportive environment for technological experimentation. The findings on basic ICT literacy concur with the findings from the HOSs and undergraduate students who indicated that the library staff have both basic and intermediate ICT skills but were lacking in advanced ICT skills. Additionally, a study conducted by Oyedokun et al. (2018) in Nigerian university libraries also established that while the staff were proficient in basic and intermediate ICT skills, their proficiency in advanced ICT skills such as programming was low.

The findings on the need for training are supported by a study by Oyedokun et al. (2018) that recommended that professional bodies should hold seminars and workshops where librarians can be trained on ICT competencies required for the dynamic information services of today's information society. On supportive environment for technological experimentation, a study by Lee (2021) also recommended that to survive the dynamic technological environment, university libraries should provide an innovative environment where the views of staff, users, suppliers, and other libraries can be incorporated in innovations in order to respond to new demands faster and to invent and provide new user services.

Considering that academic libraries play a key role in supporting research, teaching and learning, the HODs were asked to discuss during the focus group discussions the kind of training or support that was needed to help library staff to effectively provide AI enhanced services. Several prominent themes emerged from the responses, including the need for foundational AI literacy, practical and application-based training, technical and IT support, data analytics skills, and user-centred interface navigation. Collectively, these themes highlight a holistic view of AI readiness that balances technical knowledge with practical utility in service delivery.

1. The need for foundational AI literacy

One of the themes was the necessity of foundational AI literacy for all library staff. Multiple respondents emphasised that staff require an understanding of how AI works within the library environment. For instance, one participant in FGD stated that "*library staff would require comprehensive training and ongoing support in… how AI-driven tools such as chatbots, automated search assistants, and recommendation systems function.*" This suggests that for staff to confidently adopt AI, they must grasp not only the theoretical principles, but also how such tools integrate with and support library services. Another participant echoed this by calling for "*training on the basics of AI,"* reinforcing the idea that foundational competence is critical for broader AI literacy and acceptance.

2. Practical and application-based training

The other theme was the importance of practical, application-based training tailored to library functions. Participants proposed *"training on AI applications in libraries, advanced search and retrieval techniques, AI-driven reference management tools, data analytics for user insights, automation of routine library tasks, and*

cybersecurity for AI". This comprehensive list demonstrates a recognition that AI intersects with multiple facets of library operations, from technical services to public services and user interaction. It also implies that training should be both broad and deep, offering skillsets applicable to different library units and roles.

3. Technical and IT support

Closely tied to this was the call for technical and IT support. Some respondents highlighted that library staff may not need in-depth technical expertise but would benefit from institutional support structures. For example, *"a dedicated ICT person to help with the technical issues that the library staff may not be able to handle".* This underscores the importance of a collaborative environment where AI implementation is not solely the responsibility of frontline librarians but is supported by a multidisciplinary team that includes IT professionals. It also implies that capacity-building efforts must be coupled with organisational support systems.

4. Data analytics skills

Another emergent theme was training in data management and analytics. FGD participants called for *"training in AI & data analytics and data management and analytics training"*. This reflects the growing demand for data-literate professionals who can leverage AI-generated insights to inform library decision-making, user engagement strategies, and personalised service provision.

5. User-centred interface navigation

Notably, there was a recurring sentiment that staff do not necessarily need to learn AI development, but rather how to use AI tools effectively. The discussion noted that the *"staff do not need to learn the AI for them to be able to use the system. That [they] just*

need to be taught how to navigate the interfaces". The discussion also emphasised *"training on how to interact with the AI tools to make their work easy".* These perspectives highlight a user-centric approach to training that prioritises tool interface familiarity and functionality over in-depth technical programming knowledge. This pragmatic view suggests that AI tools should be accessible and intuitive, with training focused on improving service delivery and efficiency.

The focus group discussions with the HODs indicate a multiple approach to preparing library staff for AI-enhanced services. Essential areas include foundational AI knowledge, practical application training, ongoing IT support, data analytics, and intuitive system interaction. Institutions must therefore invest in well-rounded, role-sensitive professional development programs that equip library staff with both the confidence and competence to navigate AI-integrated library environments effectively. These findings concur with the findings from the HOSs where the majority indicated the need for training in AI aspects including AI applications, data analytics, machine learning, cybersecurity, digital literacy, AI tools and systems and ethical use of AI.

A study by Abiolu and Akinyemi (2025) also established that majority of the respondents indicated a high need of training in various aspects of AI such as AI fundamentals, AI programming and coding, how to evaluate and assess AI, the ethical considerations of AI use in libraries, data handling and data privacy and AI design and user experience. The findings on practical, application-based training concur with the findings of the HOSs who all preferred on-the-job training as a method of acquiring ICT skills and competencies as it provides practical experience. Further, the findings are affirmed by the findings of a study by Agava and Underwood (2020) where lack of

practical lessons was pointed out as one of the challenges in acquisition of ICT skills. Adedara et al. (2022) also recommended that university libraries should hire ICT experts to help with the maintenance of ICT tools and systems, in addition to training the library staff.

Some employees have a tendency to resist change, hence, introducing AI services and staff training may face. Consequently, University Librarians were asked to explain how they planned to address potential resistance or concerns from staff regarding AI implementation while ensuring their active participation in the transition. Several themes were noted from their responses ranging from inclusive engagement and participation, creation of supportive environments, leveraging AI champions, motivational talks, to perceived minimal resistance. These themes reflect a mixture of proactive and reactive strategies aimed at facilitating a smoother transition to AI integration in library services, while also revealing certain gaps in preparedness and strategic communication.

1. Inclusive engagement and participation

A central theme that emerged was the importance of inclusive engagement and participatory implementation. University Librarian 06 emphasised the value of *"involving them in implementation of the whole program,"* which suggests a collaborative approach aimed at building ownership and reducing apprehension. By giving staff, a voice in the AI adoption process, institutions can foster a sense of agency and reduce fears associated with job displacement or unfamiliarity with technology.

2. Creation of supportive environments

The responses also underscore the necessity of creating a supportive and psychologically safe environment for staff. University Librarian 02 proposed to "*create a*

supportive environment for them" and "*allow them to respond regularly and [receive] continuous training.*" This highlights the need for two-way communication channels and ongoing skill development as essential tools in managing change.

3. Leveraging AI champions

Another insightful strategy mentioned was the use of AI champions or early adopters to influence peers positively. University Librarian 01 noted the importance of "*getting a few staff who can act as champions to convince others to buy in*." This peer-driven approach can be effective in addressing skepticism and promoting acceptance, especially when staff observe their colleagues successfully engaging with new tools. AI champions serve as both role models and informal trainers, fostering a culture of innovation from within.

4. Motivational talks

The motivational efforts and access to online training were also suggested, with one respondent noting the use of "*motivational talks and exposing them to freely available online trainings"* (University Librarian 03).

5. Perceived minimal resistance

Interestingly, some respondents exhibited a perceived minimal risk of resistance, as reflected in the comment: "*With the current situation in technological development, I don't foresee resistance"* (University Librarian 04). While the findings may indicate a degree of optimism or institutional readiness, it also raises concerns about underestimating the complexities of change management.

The above five themes collectively indicate that University Librarians understand the need to manage staff resistance to successfully implement AI in the provision of

information services. The key themes identified were inclusive engagement and participation, creation of supportive environments, leveraging AI champions, provision of continuous training, to perceived minimal resistance. Confirming these findings, Harisanty et al. (2025) put forward that for successful adoption of AI in academic libraries, there is need for inclusive implementation, where the library staff are involved in the adoption process.

Additionally, Mallikarjuna (2024) puts forward that a supportive environment that tackles issues like ethics, privacy, staff training, and a user-centred approach is required to guarantee the effective adoption of AI in libraries. On the use of AI champions, a study conducted in Toronto university by Gupta (2024) established that the library was using AI champions to encourage the use of AI in the library. The findings on the need for motivational talks concur with the findings of studies by Adedara et al. (2022), Agava and Underwood (2020) and Manzo (2020) that recommend staff motivation having found lack of interest as one of the major challenges experienced by librarians in acquisition of ICT skills.

4.8.4 Convergence of Quantitative and Qualitative Findings on Readiness of Staff's ICT Skills and Competencies to Adopt Artificial Intelligence

4.8.4.1 Convergence of Quantitative Findings

An analysis of the quantitative findings from both the HOSs in the library and undergraduate students demonstrates a significant convergence in perspective concerning the readiness of library staff and the training requirements essential for the effective implementation of AI-enhanced services. Although these groups occupy distinct roles and perspectives, they collectively express a shared concern regarding the current skills gap

among library staff and the necessity for structured professional development to address this gap.

1. Inadequate preparedness among library staff to adopt AI

One of the most prominent areas of convergence was the recognition of inadequate preparedness among library staff to adopt and implement AI-based systems. Both library HOSs and undergraduate students noted that many staff lack sufficient ICT competencies. For instance, the library HOSs reported high competency levels in basic ICT skills (90%), and intermediate ICT skills with the lowest rated skill having a mean of 3.97. However, they were found to be lacking in advanced ICT skills with highest rated skill having a mean of 3.73. Similarly, 42.9% of the undergraduate students perceived the library staff's ICT skills as average while 15.6% of the students rated staff competence as "poor" or "very poor". This agreement across respondent groups suggests a perceived disconnect between current staff capabilities and the technological demands of modern library environments.

2. Need for training and ongoing support

A second area of alignment was the call for training and ongoing support. The HOSs indicated overwhelming support across all proposed training categories, with 96.7% to 100% of respondents agreeing on the necessity of each category, emphasising both foundational and practical applications. Likewise, students expressed that effective AI service delivery would require staff to be well trained on AI tools and their usage. This convergence highlights a shared understanding that successful AI adoption was contingent not merely on the presence of technology, but on the capacity of staff to use it effectively.

3. Need for structured training programs

A third area of alignment was the necessity for structured training programs. The findings from the HOSs indicated their preferred training methods as on-the-job training (100%), workshops (100%), seminars (100%), and online courses (93.4%), which received near-universal endorsement. These findings underscore the need for institutions to prioritise diverse, accessible, and continuous training strategies that integrate formal, informal, and peer-driven learning models.

The study observes that the convergence in the quantitative data from library HOSs and undergraduate students revolves around three key themes: the insufficient preparedness of staff for AI adoption, the necessity for training and ongoing support, and the critical need for structured training programs. These findings collectively emphasise the urgency for academic libraries to invest in targeted staff development initiatives that align with both operational demands and user expectations.

4.8.4.2 Convergence of Qualitative Findings

From the analysis of the qualitative findings from University Librarians, systems librarians, Heads of Departments (HODs), and the responses to open-ended questions by the HOSs and undergraduate students, several areas of convergence were identified.

1. Inadequate preparedness among library staff to adopt AI

A dominant theme across all groups was the acknowledgment of limited preparedness among library staff to adopt AI technologies. University Librarians and Systems Librarians consistently noted that staff possess basic ICT skills but lack the specific competencies needed to handle AI tools. Similarly, HODs and HOSs described staff as not fully prepared, indicating that a majority lack the technical depth necessary for

effective AI adoption. Undergraduate students echoed this concern, perceiving staff as inadequately trained to support AI-enhanced services. This widespread agreement highlights a critical readiness gap that cuts across all stakeholder perspectives.

2. Need for structured training programs and ongoing professional development

Another significant area of consensus was the pressing need for structured training programs and continuous professional development. University Librarians advocated for seminars, workshops, and webinars as crucial instruments for enhancing staff competencies. Systems Librarians highlighted the importance of ongoing capacity building, while HODs specifically identified topics such as AI applications in libraries, data analytics, and technical troubleshooting. Likewise, library HOSs proposed that practical training, in conjunction with support for interface navigation, would more effectively prepare staff. Undergraduate students also supported staff training as a fundamental requirement for improving service quality. This convergence emphasises a collective call for institutions to invest in targeted, relevant, and continuous learning initiatives to address the existing skills gap.

3. Need for practical, role-specific, and user-friendly approaches to AI adoption

In addition, there was shared support for practical, role-specific, and user-friendly approaches to AI adoption. Stakeholders agreed that library staff do not need to become AI developers but should be capable of using AI tools to enhance their work, a sentiment similarly shared by systems librarians, HODs and students. This points to a collective preference for practical training that emphasises AI tools usage, interface interaction, and problem-solving over theoretical or technical depth.

4. Importance of institutional support and an inclusive learning environment

Lastly, there was a consensus on the significance of institutional support and an inclusive, encouraging learning environment. Participants highlighted the importance of motivational speeches, supportive leadership, engagement in implementation processes, and the appointment of AI champions to cultivate a culture of openness and mitigate resistance. These collective recommendations demonstrate a comprehensive understanding that successful AI integration relies equally on change management and organisational culture as it does on technical training.

In summary, the qualitative findings indicate a strong consensus across all respondent groups on four critical themes: Inadequate preparedness of staff for AI adoption, the need for structured and continuous training, a preference for practical, user-centred learning approaches, and the value of institutional support and inclusive leadership.

4.8.4.3 Key Areas of Convergence across Quantitative and Qualitative Findings

A comprehensive analysis of both the quantitative and qualitative findings from the study, including findings from HOSs in the library, undergraduate students, University Librarians, systems librarians, and HODs, reveals several clear converging points. As highlighted below, these areas of agreement indicate a shared understanding among different stakeholders on the current state of preparedness and the needs surrounding the adoption of AI-enhanced services in university libraries.

a) General unpreparedness of library staff to adopt AI technologies

A central point of convergence across both the quantitative and qualitative data was the acknowledgment that library staff were not fully prepared to adopt AI

technologies. Quantitative findings showed that most respondents indicate that most staff lacked the ICT skills necessary for AI adoption. Similarly, qualitative responses reinforced this view. These results demonstrate a widespread recognition that while some foundational ICT skills may be present, AI-specific competencies remain largely underdeveloped.

b) Need for structured and continuous training programs

Another strong point of convergence was the shared call for structured, role-specific, and continuous training. Quantitative data from both HOS and students indicated that staff need further training to effectively support AI services. This was echoed in qualitative findings, where University Librarians and HODs emphasised the importance of workshops, seminars, webinars, and ongoing capacity-building initiatives. This alignment reflects a collective view that capacity-building is the most critical enabler of AI adoption in academic libraries.

c) Value of user- centred and applied approaches to training

The analysis of both quantitative and qualitative data revealed a consensus that library personnel are not required to achieve technical mastery of AI technologies; however, they must develop proficiency in utilising AI tools to enhance library services. Quantitative findings highlighted the significance of usability and practical engagement with AI systems, while qualitative insights from Heads of Departments and librarians emphasised the necessity for training that concentrates on interface navigation and tool interaction. This convergence underscores the critical importance of training models that are both role-appropriate and task-oriented, designed to empower staff to assist users and improve service delivery, rather than transforming them into AI specialists.

d) Institutional support and motivation as key drivers of change

Both quantitative and qualitative data underscore that the successful integration of AI necessitates more than mere training; it also requires institutional support and positive motivation. Quantitative findings highlighted the importance of awareness creation, exposure to AI tools, and leadership-driven encouragement. Qualitative insights from University Librarians and library HOSs emphasised the creation of a supportive environment, the involvement of staff in the change process, and the appointment of champions to advocate for AI adoption within the institution. These strategies reflect a consensus that technological transformation in libraries must be accompanied by inclusive leadership, encouragement, and staff involvement to mitigate resistance and ensure sustainability.

4.9 Users' Perception Readiness in Adopting Artificial Intelligence

The fourth objective of the study aimed to evaluate library users' perception readiness towards adopting AI in university libraries in Kenya. This objective examined various aspects, including users' perceptions of the benefits of AI, the ease of its use, and the challenges associated with employing AI in the provision of information services. To accomplish this objective, both quantitative and qualitative data were gathered. Quantitative data were collected from Heads of Sections (HOSs) in the library and undergraduate students through open-ended and closed-ended questionnaires. The closed-ended questions were analysed using SPSS. Qualitative data were obtained through open-ended questions, interview schedules administered to University Librarians and systems librarians, and focus group discussions with Heads of Departments (HODs). These

qualitative responses were coded and analysed thematically, presented in narrative descriptions, themes or theme categories, and occasionally supplemented with excerpts.

4.9.1 Findings from Heads of Sections on the Concerns Users Might Have Regarding AI in Libraries

The first question in this objective used a five-point Likert scale to assess the concerns that users might have regarding AI in libraries. It had choices whose rating scale was 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree. The interpretation combines agreement responses (Strongly Agree + Agree), disagreement responses (Disagree + Strongly Disagree), and considers Neutral responses separately. The descriptive statistics, including frequencies, percentages, means, and standard deviations are outlined in Table 4.23.

Table 4.23

HOSs Responses on Concerns That Users Might Have Regarding AI in Libraries

Users concerns towards AI	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Poor ICT infrastructure that may limit the effective use of AI-based services in the library.	14(46.7%)	9(30.0%)	4(13.350	2(6.7%)	1(3.3%)	4.10	1.094
(ii). Intermittent power supply affecting the reliability of AI systems and the accessibility of library resources.	13(43.3%)	8(26.7%)	1(3.3%)	5(16.7%)	3(10.0%)	3.77	1.431

Users concerns towards AI	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(iii). Technophobia, or fear of new technologies, hindering the adoption of AI by library users.	7(23.3%)	15(50.0%)	1(3.3%)	4(13.3%)	3(10.0%)	3.63	1.273
(iv). Concerns regarding privacy and security of personal and academic data stored or processed by AI systems.	8(26.7%)	13(43.3%)	1(3.3%)	4(13.3%)	4(13.3%)	3.57	1.382
(v). Lack of adequate training for library staff and users to navigate AI-driven systems effectively.	13(43.3%)	13(43.3%)	1(3.3%)	1(3.3%)	2(6.7%)	4.13	1.106
(vi). Resistance to change among library users, leading to reluctance in embracing AI technologies.	7(23.3%)	13(43.3%)	2(6.7%)	5(16.7%)	3(10.0%)	3.53	1.306
(vii). Over-reliance on technology that might diminish personal interaction with library staff or lead to reduced critical thinking.	7(23.3%)	13(43.3%)	4(13.3%)	5(16.7%)	1(3.3%)	3.67	1.124
(viii). Inaccuracy of AI tools in delivering precise, relevant, or useful results, diminishing trust in AI systems.	9(30.0%)	9(30.0%)	3(10.0%)	7(23.3%)	2(6.7%)	3.53	1.332
(ix). Lack of sufficient AI expertise among library staff, resulting in a lack of support for users in AI-related tasks.	12(40.0%)	16(53.3%)	0	1(3.3%)	1(3.3%)	4.23	.898

Users concerns towards AI	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(x). Failure to establish clear policy guidelines for the ethical and practical use of AI in the library environment.	10(33.3%)	18(60.0%)	0	1(3.3%)	1(3.3%)	4.17	.874
(xi). Fear that AI may lead to the replacement of human library staff, contributing to job insecurity.	11(36.7%)	13(43.3%)	2(6.7%)	3(10.0%)	1(3.3%)	4.00	1.083
(xii). The ethical implications of AI, including the risk of biased algorithms affecting information access or decision-making.	10(33.3%)	14(46.7%)	2(6.7%)	3(10.0%)	1(3.3%)	3.97	1.066
(xiii). Concerns about the cost of AI implementation and the allocation of resources, which might divert funds from other library services.	13(43.3%)	11(36.7%)	2(6.7%)	2(6.7%)	2(6.7%)	4.03	1.189
(xiv). Lack of transparency in AI decision-making, leading to users questioning how AI-driven recommendations or results are generated.	7(23.3%)	10(33.3%)	7(23.3%)	5(16.7%)	1(3.3%)	3.57	1.135

A significant concern identified was the inadequacy of ICT infrastructure, with 23 respondents (76.7%) agreeing, 3 (10%) disagreeing, and 4 (13.3%) remaining neutral. The mean score for this issue was 4.10, and a standard deviation (SD) of 1.09. The relatively

low SD indicates a strong consensus among respondents that insufficient ICT infrastructure was a significant barrier to the effective utilisation of AI in libraries. Regarding intermittent power supply, 21 respondents (70%) agreed, while 8 (26.7%) disagreed, and 1 (3.3%) was neutral. This concern recorded a mean of 3.77 and a higher SD of 1.43, suggesting greater variability in respondents' perceptions of its severity, potentially due to differing infrastructural conditions across libraries.

Technophobia, or the fear of new technologies, was acknowledged by 22 respondents (73.3%), with 7 (23.3%) disagreeing and 1 (3.3%) taking a neutral stance. The mean score was 3.63, with an SD of 1.27, reflecting moderate variability. This suggests that while the majority recognised technophobia as a challenge, there was some disagreement or varied perceptions of its prevalence. Concerns regarding the privacy and security of personal and academic data processed by AI were supported by 21 respondents (70%), 8 (26.6%) disagreed, and 1 (3.3%) remained neutral. The mean score was 3.57, with an SD of 1.38, again indicating moderate variability, which may reflect mixed levels of concern or varying levels of user awareness and sensitivity toward data privacy issues.

A significant concern was the lack of adequate training for both library staff and users. A total of 26 respondents (86.6%) agreed, only 3 (10%) disagreed, and 1 (3.3%) was neutral. This concern had a mean of 4.13 and an SD of 1.11, demonstrating strong agreement with minimal variation, indicating a consensus on the urgent need for training initiatives. The issue of resistance to change garnered agreement from 20 respondents (66.6%), disagreement from 8 (26.7%), and neutrality from 2 (6.7%). The mean score was 3.53, with an SD of 1.31, reflecting moderate variability. This suggests that resistance to change was a concern, but perceptions of its intensity vary among library HOSs.

Regarding the concern that AI may replace human library staff, 24 respondents (80%) agreed, while 4 (13.3%) disagreed, and 2 (6.7%) were neutral. The mean score was 4.00, with an SD of 1.08. The low SD suggests a strong consensus, indicating that job insecurity was widely acknowledged as a concern among library staff. The item concerning the lack of AI expertise among library staff had the highest mean of 4.23 and the lowest SD of 0.90. Twenty-eight individuals (93.3%) agreed, with only 2 (6.6%) in disagreement. The very low SD reflects high agreement and minimal variability, underscoring a shared recognition that skill gaps were a pressing issue.

Regarding failure to establish clear AI policy guidelines, 28 respondents (93.3%) agreed, and only 2 (6.6%) disagreed. This concern had a high mean of 4.17 and the lowest SD overall at 0.87, again indicating very strong consensus on the necessity of institutional AI governance frameworks. Concerning ethical concerns such as biased algorithms, 24 respondents (80%) expressed agreement, 4 (13.3%) disagreed, and 2 (6.7%) were neutral. The mean was 3.97, with an SD of 1.07, indicating relatively low variability, reflecting broad but slightly less uniform agreement. The concern about AI implementation costs received agreement from 24 respondents (80%), while 4 (13.3%) disagreed and 2 (6.7%) were neutral. The mean was 4.03 with an SD of 1.19. The moderate SD suggests general agreement, with some variability likely influenced by budgetary constraints in different institutions.

Over-reliance on AI, which could reduce personal interaction or critical thinking, was agreed upon by 20 respondents (66.6%), disagreed by 6 (20%), and seen as neutral by 4 (13.3%). The mean was 3.67, with an SD of 1.12, indicating moderate variability, suggesting mixed perspectives on the balance between AI automation and human

engagement. Lastly, the lack of transparency in AI decision-making drew agreement from 17 respondents (56.6%), disagreement from 6 (20%), and neutrality from 7 (23.3%). The mean was 3.57, with an SD of 1.13, reflecting a balanced variation of opinions, with some respondents less convinced of this being a major concern.

The analysis indicates that HOSs generally concur on several user concerns regarding the integration of AI in libraries, as evidenced by high mean scores and low to moderate standard deviations across the majority of items. Concerns such as the lack of expertise, absence of policy frameworks, and a lack of training exhibited both high agreement and low standard deviations, underscoring a strong consensus and suggesting these as priority areas for intervention. In contrast, items with higher standard deviations, such as intermittent power supply (SD = 1.43) and privacy concerns (SD = 1.38) indicate the presence of divergent experiences or perceptions, potentially arising from institutional or contextual variations. These areas may necessitate the implementation of context-specific strategies instead of broad, uniform interventions.

These findings concur with the findings of a study by Owolabi et al. (2019) that established lack of expertise, absence of policy frameworks, training deficiencies and intermittent power supply as the perceived challenges of using AI in university libraries by the users. On privacy concerns, several studies such as Gajbhiye (2024) and Mallikarjuna (2024) have supported these findings. The results indicate that efforts to address AI-related concerns in libraries will require a multi-dimensional strategy that aims to improve infrastructure, ensure robust training, establish ethical and operational policies.

Further findings from the library HOSs regarding users' perception and readiness for adopting AI-powered services revealed mixed but generally positive sentiments as shown in Table 4.24.

Table 4.24

HOSs Responses on Users' Perception and Readiness for Adoption of AI-Powered Services

How often do library users inquire about AI-based services (e.g., chatbots, virtual assistants)?	Frequency	Percent	Based on your observations, how willing do you think library users are to adopt AI-powered services?	Frequency	Percent
Never	2	6.7	Very Unwilling	2	6.7
Rarely	11	36.7	Neutral	7	23.3
Sometimes	10	33.3	Willing	14	46.7
Often	5	16.7	Very Willing	7	23.3
Always	2	6.7	Total	30	100.0
Total	30	100.0			

In response to inquiries regarding AI-based services such as chatbots and virtual assistants, the majority of respondents expressed low to moderate interest. Specifically, 11 respondents (36.7%) indicated that users "rarely" inquire about these services, while 10 (33.3%) reported that such inquiries occur "sometimes." Only 5 (16.7%) respondents noted that inquiries happen "often," and 2 (6.7%) respondents each reported both "never" and "always." These findings suggest that while a minority of users consistently demonstrated curiosity about AI applications, a substantial number were either unaware or only occasionally interested.

Regarding the perceived willingness of users to adopt AI-powered services, the majority of HOSs respondents offered a more optimistic assessment. A total of 14

respondents (46.7%) believed users were “willing” to adopt such technologies, while 7 (23.3%) considered users to be “very willing.” Collectively, this represents a significant 70% of respondents who viewed users as open to AI adoption. Only 2 (6.7%) respondents regarded users as “very unwilling,” while 7 (23.3%) maintained a “neutral” stance in their assessment.

These findings contradict the findings of a study by Shaheen and Khurshid (2023) on the perception of Pakistani library users towards AI-powered virtual assistants where majority of participants (60.6%) indicated they were unlikely to use an AI-powered virtual assistants for research-related questions. According to Shaheen and Khurshid (2023), the low likelihood of using an AI-powered virtual assistant could be attributed to individual preferences and needs since not all users may be equally receptive or interested in such technologies.

These findings suggest that although user inquiries about AI were not yet frequent, there was a clear underlying readiness and willingness to adopt AI technologies in the library environment. The discrepancy between low inquiry rates and high willingness may imply a gap in awareness or exposure, where users may not yet fully understand what AI tools were available or how they could benefit from them. This calls for proactive strategies such as user sensitisation, demonstrations, and awareness campaigns to bridge the gap between interest and action.

The implication of these findings on library management is that there is an opportunity to scale up AI services and integrate user-centred AI tools. Given the high perceived willingness, libraries should focus on enhancing visibility, training users, and embedding AI literacy programs into their services. By doing so, they can turn passive

willingness into active engagement, ensuring a smoother and more inclusive transition to AI-enhanced service delivery.

4.9.2 Findings from Undergraduate Students Relating to Perceived Benefits of Using AI in Provision of Information Services

The undergraduate student's questionnaire used a five-point Likert scale to evaluate statements relating to perceived benefits of using AI in provision of information services. The question had rating ranging from 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. Their responses were summarised in Table 4.25.

Table 4.25

Undergraduate Students' Responses Relating to Perceived Benefits of Using AI in Provision of Information Services in Libraries

Statement relating to perceived benefits of using AI in provision of information services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). AI-powered virtual assistants improve the speed of reference query responses	170(47.4%)	124(34.5%)	47(13.1%)	11(3.1%)	7(1.9%)	4.22	.925
(ii). AI systems effectively reduce wait times for basic information services	175(48.7%)	125(34.8%)	46(12.8%)	9(2.5%)	4(1.1%)	4.28	.861
(iii). Natural Language Processing capabilities make library searches more intuitive for users	136(37.9%)	137(38.2%)	70(19.5%)	7(1.9%)	9(2.5%)	4.07	.935

Statement relating to perceived benefits of using AI in provision of information services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(iv). AI-powered recommendation systems help in discovering relevant resources more effectively	161(44.8%)	128(35.1%)	58(16.2%)	7(1,9%)	7(1.9%)	4.19	.911
(v). AI-enhanced search capabilities make it easier to find specific information within digital collections	172(47.9%)	128(35.1%)	48(13.4%)	9(2.5%)	5(1.4%)	4.27	.857
(vi). AI tools improve the discovery of inter-library resources and connections	167(46.5%)	121(33.7%)	57(15.9%)	5(1.4%)	9(2.5%)	4.20	.931
(vii). 24/7 AI assistance enhances the library's accessibility	171(47.6%)	115(32.0%)	56(15.6%)	7(1.9%)	10(2.8%)	4.20	.961
(viii). AI systems help create more inclusive library services	160(44.6%)	131(36.5%)	46(12.8%)	6(1.7%)	16(4.5%)	4.15	1.011
(ix). Personalised AI recommendations improve the research experience	173(48.2%)	113(31.5%)	54(15.0%)	8(2.2%)	11(3.1%)	4.19	.981
(x). AI-powered translation services make resources more accessible to international students	171(47.6%)	122(34.0%)	52(14.5%)	10(2.8%)	4(1.1%)	4.24	.881

The research findings indicate that a significant majority of undergraduate students perceive AI as highly beneficial in enhancing library services. Specifically, more than 80% of students concurred that AI-driven tools enhance the speed of reference query

responses (81.9%), decrease wait times (83.5%), and improve search capabilities (83.6%), with mean scores exceeding 4.20 and low standard deviations (SDs below 0.93), reflecting a robust consensus. Similarly, over 79% agreed that AI facilitates resource discovery, 24/7 access, personalised recommendations, and translation services, demonstrating consistently high levels of agreement. Although slightly lower, perceptions of AI in fostering inclusivity (78.0%) and supporting inter-library discovery (80.2%) remained strong. However, these items exhibited slightly higher standard deviations (above 0.98), indicating a broader spectrum of opinions.

Across all items, the combined agreement levels ranged from 76.1% to 83.6%, clearly demonstrating that most undergraduate students strongly perceive AI as beneficial in enhancing library information services. The mean scores for all items were above 4.00, affirming a generally high level of positive sentiment toward AI tools. These findings are corroborated by the findings from a study by Shaheen and Khurshid (2023) in Pakistani libraries where 60.0% of the students indicated they found AI-powered recommendation systems helpful in discovering new resources. Another study by Fraidan (2024) also affirms these findings, with 85.0% of students agreeing that AI-powered library systems significantly enhance research efficiency. However, standard deviations ranged from 0.857 to 1.011, suggesting that while overall agreement was strong, some variations exist in how students experience or understand AI applications, especially in areas like inclusivity and personalisation.

These findings have significant implications on library planning and policy. Libraries should invest in user-centred AI tools, such as chatbots, natural language search, personalised recommendations, and translation services, to align with students' positive

perceptions. The results also suggest a need to standardise AI implementation to minimise disparities in user experience and to provide targeted training and sensitisation that ensure all users benefit equitably from AI advancements. The findings reflect an optimistic outlook among undergraduates toward AI, positioning it as a valuable asset in the future of university libraries; meaning, libraries should leverage this momentum to expand, refine, and promote AI-enabled services.

The undergraduate students' views on perceived ease of using AI in the provision of information services were also sought. As such, statements meant to measure this aspect were presented to users requiring them to provide a rating ranging from 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree. The interpretation combines agreement responses (Strongly Agree + Agree), disagreement responses (Disagree + Strongly Disagree), and considers Neutral responses separately. The descriptive statistics, including frequencies, percentages, means, and standard deviations, are outlined in Table 4.26.

Table 4.26

Undergraduate Students' Views on Perceived Ease of Using AI in the Provision of Information Services in Libraries

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Overall, I believe AI powered information services are easy to use	141(39.3%)	147(40.9%)	52(14.5)	7(1.9%)	12(3.3%)	4.11	.952
(ii). I believe I can easily learn how to use AI powered information services	161(44.8%)	135(37.6%)	48(13.4%)	7(1.9%)	8(2.2%)	4.21	.905

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(iii). Utilising information services enabled by AI doesn't take a lot of mental effort	112(31.2%)	154(42.9%)	75(20.9%)	9(2.5%)	9(2.5%)	3.98	.921
(iv). Making use of AI-powered information services doesn't take a lot of effort	118(32.9%)	147(40.9%)	70(19.5%)	9(2.5%)	15(4.2%)	3.96	1.001
(v). With AI, I could easily accomplish my goals	149(41.5%)	133(37.0%)	55(15.3%)	5(1.4%)	17(4.7%)	4.09	1.022
(vi). Communicate with AI library systems would be easy for me	138(38.4%)	137(38.2%)	66(18.4%)	7(1.9%)	11(3.1%)	4.07	.959
(vii). Using AI for provision of information services takes too much time	84(23.4%)	95(26.5%)	71(19.8%)	58(15.6%)	53(14.8%)	3.28	1.369

The results presented in Table 4.26 demonstrate a significant overall perception of ease of use among undergraduate students regarding AI in library services. The majority of statements garnered more than 75% agreement, reflecting a favourable attitude towards the usability of AI tools. For instance; A combined 80.2% of respondents (n = 288) agreed or strongly agreed that AI-powered information services were easy to use, with a mean score of M = 4.11(SD = 0.952), indicating a substantial level of consensus with moderate variation. It was also evident that 82.4% (n = 296) believed they could easily learn how to use AI-based services (M = 4.21, SD = 0.905), indicating confidence in skill acquisition with a relatively low standard deviation reflecting consistency.

The assertion “With AI, I could easily accomplish my goals” also garnered significant agreement from 78.5% (n = 282) of students (M = 4.09, SD = 1.022). Notably, the perception that “Using AI for provision of information services takes too much time” had only 49.9% agreement (n = 179), with 30.4% disagreement (n = 111) and a relatively high neutral response of 19.8% (n = 71). The mean was lower at M = 3.28, with the highest variability (SD = 1.369), indicating diverse opinions on time-efficiency.

Notably, undergraduate students perceive AI services in libraries as easy to use, efficient, and not mentally taxing. These findings align with the findings of a study by Owolabi et al. (2022) on the readiness of Nigerian polytechnic students to adopt AI in libraries, where Effort Expectancy (EE) was ranked second (RII=0.764) amongst the factors influencing adoption of AI behind Performance Expectancy (PE) (RII=0.862). The consistently high agreement across statements, particularly regarding the ability to learn AI systems and accomplish goals using AI, reflects an environment where students were likely to embrace AI innovations, given adequate access and support. However, the mixed response regarding the time demands of AI tools (with the lowest mean (M = 3.28) and highest standard deviation (SD = 1.369) suggest uncertainty or varied experiences. Some students may be unfamiliar with specific systems or find certain AI tasks more time-consuming, highlighting a need for usability improvements or further orientation.

These findings suggest that university libraries were well-positioned to integrate AI into information services, given that students generally find these systems intuitive and supportive of their goals. Training and communication strategies should be reinforced to support students who may perceive AI tools as time-consuming or complex. Additionally,

efforts should be made to streamline AI tools to enhance efficiency, particularly for first-time users.

Further undergraduate students' views on perceived challenges of using AI in provision of information services were also sought. As such, statements meant to measure this aspect were presented to users requiring them to provide a rating ranging from1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree. The interpretation combines agreement responses (Strongly Agree + Agree), disagreement responses (Disagree + Strongly Disagree), and considers Neutral responses separately. The descriptive statistics, including frequencies, percentages, means, and standard deviations are outlined in Table 4.27.

Table 4.27

Undergraduate Students' Views on Perceived Challenges of Using AI in the Provision of Information Services in Libraries

Statement on perceived challenges of using AI in the provision of information services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). Poor ICT infrastructure that may limit the effective use of AI-based services in the library.	148(41.2%)	139(38.7%)	51(14.2%)	13(3.6%)	8(2.2%)	4.13	.941
(ii). Intermittent power supply affecting the reliability of AI systems and the accessibility of library resources.	124(34.5%)	142(39.6%)	66(18.4%)	14(3.9%)	13(3.6%)	3.97	1.007
(iii). Technophobia, or fear of new technologies, hindering the adoption of AI by library users.	117(32.6%)	125(34.8%)	75(20.9%)	24(6.7%)	18(5.0%)	3.83	1.109

Statement on perceived challenges of using AI in the provision of information services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(iv). Concerns regarding privacy and security of personal and academic data stored or processed by AI systems.	109(30.4%)	150(41.8%)	73(20.3%)	14(3.9%)	13(3.6%)	3.91	.992
(v). Lack of adequate training for library staff and users to navigate AI-driven systems effectively.	120(33.4%)	140(39.0%)	74(20.6%)	13(3.6%)	12(3.3%)	3.96	.993
(vi). Resistance to change among library users, leading to reluctance in embracing AI technologies.	104(29.0%)	151(42.1%)	69(19.2%)	16(4.5%)	19(5.3%)	3.85	1.057
(vii). Over-reliance on technology that might diminish personal interaction with library staff or lead to reduced critical thinking.	116(32.3%)	136(37.9%)	80(22.3%)	13(3.6%)	14(3.9%)	3.91	1.018
(vii). Inaccuracy of AI tools in delivering precise, relevant, or useful results, diminishing trust in AI systems.	107(29.8%)	134(37.3%)	85(23.7%)	17(4.7%)	16(4.5%)	3.83	1.049
(viii). Lack of sufficient AI expertise among library staff, resulting in a lack of support for users in AI-related tasks.	111(30.9%)	153(42.6%)	69(19.2%)	13(3.6%)	13(3.6%)	3.94	.985
(ix). Failure to establish clear policy guidelines for the ethical and practical use of AI in the library environment.	110(30.6%)	149(41.5%)	70(19.5%)	11(3.1%)	19(5.3%)	3.89	1.045
(x). Fear that AI may lead to the replacement of human library staff, contributing to job insecurity.	125(34.8%)	136(37.9%)	66(18.4%)	16(4.5%)	16(4.5%)	3.94	1.054

Statement on perceived challenges of using AI in the provision of information services	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(xi). The ethical implications of AI, including the risk of biased algorithms affecting information access or decision-making.	114(31.8%)	133(37.0%)	81(22.6%)	15(4.2%)	16(4.5%)	3.87	1.048
(xiii). Concerns about the cost of AI implementation and the allocation of resources, which might divert funds from other library services.	113(31.5%)	146(40.7%)	70(19.5%)	16(4.5%)	14(3.9%)	3.91	1.017
(xiv). Lack of transparency in AI decision-making, leading to users questioning how AI-driven recommendations or results are generated.	109(30.4%)	137(38.2%)	77(21.4%)	18(5.0%)	18(5.0%)	3.84	1.071

The results presented in Table 4.27 indicate that undergraduate students identified several significant challenges associated with the use of AI in the provision of information services in libraries. A predominant concern was the inadequacy of ICT infrastructure, with a substantial majority of students, 287 respondents (79.9%), either agreeing or strongly agreeing that poor infrastructure impedes the effective utilisation of AI. This was evidenced by a high mean score of 4.13 and a relatively low standard deviation of 0.941, suggesting a strong consensus among the students on this matter. The implication is that without considerable investment in infrastructure, efforts to incorporate AI into library services may encounter fundamental technical limitations.

Another significant concern was the insufficient AI expertise among library staff. A total of 264 students (73.5%) agreed or strongly agreed that this deficiency hinders the successful implementation of AI services, with the item recording a mean of 3.94 and a standard deviation of 0.985. This finding underscores the critical need for capacity-building initiatives targeting at library personnel to enhance their ability to assist users in AI-related tasks. A closely related issue was the lack of training opportunities for both staff and users, identified by 260 students (72.4%) as a substantial barrier. This concern was supported by a mean of 3.96 and a standard deviation of 0.993, emphasising the importance of targeted training interventions to equip stakeholders with the necessary skills to effectively navigate AI-enabled systems.

Privacy and data security were also highlighted as serious concerns, with 259 respondents (72.2%) expressing agreement that these issues present challenges in the adoption of AI technologies. The statement had a mean score of 3.91 and a standard deviation of 0.992, indicating moderate agreement and suggesting that trust in AI systems was closely linked to the handling of personal and academic data. Students also expressed apprehensions about the potential costs associated with AI implementation, with 259 students (72.2%) agreeing that resource allocation toward AI may divert funding from other essential library services. This was accompanied by a mean of 3.91 and a standard deviation of 1.017, pointing to concerns over the financial sustainability of AI initiatives in libraries.

Additional findings revealed that 260 students (72.8%) feared that the adoption of AI might lead to the replacement of human library staff, resulting in job insecurity. This concern had a mean of 3.94 and a standard deviation of 1.054, reflecting not only student

sympathy toward library personnel but also a broader unease about automation's role in reshaping professional landscapes. Similarly, the lack of clear policy guidelines on the ethical use of AI in libraries was raised by 259 students (72.1%), who agreed or strongly agreed that this gap could hinder effective implementation. The mean score was 3.89, with a standard deviation of 1.045, underscoring the importance of regulatory frameworks to ensure transparency and accountability in AI use.

Other concerns such as resistance to change (71.1%), technophobia (67.4%), and fears about reduced personal interaction and critical thinking due to AI (70.2%) were also noteworthy. These concerns had mean scores ranging from 3.83 to 3.91 and standard deviations above 1.00, indicating a broader range of responses and reflecting varied levels of exposure to and confidence in digital technologies among students. Furthermore, 67.1% of respondents reported concerns over the accuracy of AI tools in providing relevant or useful information. With a mean of 3.83 and a standard deviation of 1.049, this finding implies that trust in AI systems depends significantly on the reliability of the information they produce.

The aforementioned findings suggest that the most commonly identified obstacles to AI adoption in libraries are infrastructural limitations (M = 4.13), intermittent power supply (M = 3.97) and inadequate human capacity (skills, training, and expertise) (M = 3.96). A significant majority of students believe that the infrastructure is insufficiently robust, which could greatly limit the effectiveness of AI. This concern is statistically supported by a mean exceeding 4.00 and a low standard deviation, indicating consistency in opinion. These findings concur with the findings of a study by Owolabi et al. (2019) on Nigerian polytechnic students that also established lack of expertise, training

deficiencies, weak telecommunication infrastructure and intermittent power supply as the perceived challenges of using AI in libraries.

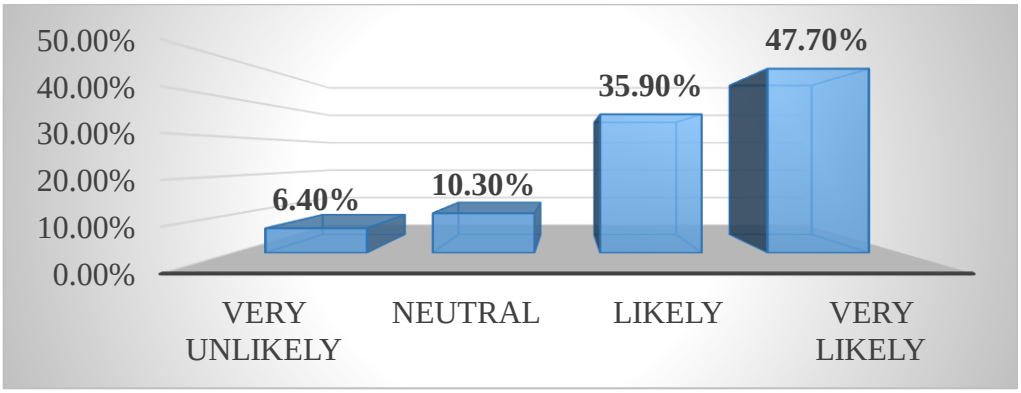
Privacy and ethical concerns also emerged strongly, reflecting a growing awareness among students regarding data protection and transparency. The findings on privacy concerns are supported by the findings of several studies such as Gajbhiye (2024) and Mallikarjuna (2024). The mean scores near or above 3.90 for privacy, ethical concerns, cost, and fear of staff displacement imply that students were not only focused on usability but also on the long-term implications of AI in institutional settings. The relatively higher standard deviations ($\geq$1.00) across several statements, particularly technophobia, resistance to change, and ethical implications, suggest that student experiences and perceptions vary, possibly influenced by prior exposure to technology or confidence in digital literacy.

These findings suggest that while students may acknowledge the potential benefits of AI in library services, they also identify practical, social, and ethical obstacles that must be addressed for successful implementation. To library management, the findings indicate a need for investment in ICT infrastructure and reliable power solutions, training programs for both library staff and users to ensure effective and confident engagement with AI; establishment of clear ethical policies and data protection guidelines to build trust in AI systems. They also indicate a need for strategies to manage change and address technophobia, possibly through user-centred AI system design and participatory feedback mechanisms.

The undergraduate students were separately asked to indicate their likelihood of using AI-powered services if introduced in their university library. Their responses were summarised in Figure 4.7.

Figure 4.7

The Likelihood of Undergraduate Students Using AI-powered Services if Introduced in the Library



Source: Research Data

The responses of undergraduate students generally indicated positive expectations. A significant majority of students exhibited a favourable attitude towards such services, with 170 students (47.4%) expressing that they would be very likely to utilise AI-powered services, and an additional 129 students (35.9%) stating they would be likely to do so. Collectively, this means that 299 out of 359 respondents (83.3%) held a positive view regarding the potential use of AI in the university library context.

In contrast, only a small fraction of respondents demonstrated resistance to the adoption of AI-powered library services. Specifically, 23 students (6.4%) indicated they would be very unlikely to use such services, and none reported them as simply unlikely. Furthermore, 37 students (10.3%) remained neutral, neither expressing clear interest nor disinterest in AI-based library services. These findings suggest that the majority of

undergraduate students were open to or enthusiastic about the integration of AI technologies in their academic information environment. The high rate of positive responses implies a readiness among students to engage with innovative, technology-driven services that potentially enhance information access, efficiency, and convenience.

These findings concur with the findings from the HOSs where 70% of the respondents viewed their users as open to AI adoption. However, contrary to these findings are the findings from a study by Shaheen and Khurshid (2023) on the perception of Pakistani library users towards AI-powered virtual assistants where majority of participants (60.6%) indicated they were unlikely to use an AI-powered virtual assistants for research-related questions. This contrast in the likelihood to adopt AI can be attributed to individual preferences and needs since not all users may be equally receptive or interested in such technologies (Shaheen & Khurshid, 2023).

4.9.3 Qualitative Findings on Users' Perception Readiness in Adopting Artificial Intelligence

During the interviews with University Librarians and Systems Librarians as well as during focus group discussions with the HODS, concerns or reservations that library users had expressed regarding the introduction of AI in library services were sought. An analysis of the responses from University Librarians, systems librarians, and HODs reveals several recurring and significant themes regarding concerns about AI adoption in libraries. These themes were consistent across the various respondent groups and provided a cohesive understanding of the apprehensions related to integrating AI in library services. The following are the major themes identified from their responses.

1. Protection of user data

One of the most prominent and consistently expressed concerns was the protection of user data. Respondents from all three groups highlighted the potential risks to personal and academic information stored or processed by AI systems. The HODs explicitly mentioned in their discussion that *"user data, such as personal details and research history, must be handled with the highest level of security*," and warned of the risk of data breaches or misuse if appropriate safeguards were not established. Similarly, Systems Librarian 01 noted that users were often unaware that their activities "*are being analysed by a machine,"* emphasising the need for ethical transparency and data governance. University Librarians also acknowledged that while no extensive studies have been conducted, "*data security and privacy will be a going concern"* as AI becomes more integrated.

2. Reliability of AI tools in providing accurate and trustworthy information

Another recurring theme relates to the reliability of AI tools in providing accurate and trustworthy information. Respondents raised concerns about the possibility of AI systems generating "*inaccurate or incomplete information*," which could mislead users or compromise academic work. This concern was emphasised by HODs who pointed out that "*AI is not infallible*" and must be trained on high-quality data to ensure consistent performance. Systems Librarians echoed this concern by identifying *"usability and reliability of AI recommendations"* as a potential issue.

3. Fear of diminishing human engagement in library services

The third major theme was the fear of diminishing human engagement in library services. There was widespread concern that over-reliance on AI might *"replace the*

human touch" that users value, particularly in academic settings where nuanced support and critical thinking was essential. As one Head of Department remarked, "*we are losing a critical skill when we use AI… if we let AI decide for us what is right, we lose the skill of decision making."* This sentiment was also reflected in concerns from Systems Librarians about "*loss of librarian engagement with users*."

4. User resistance to change

Several respondents pointed to user resistance to change, with a Systems Librarian stating that *"resistance to change*" and *"complexity of AI technologies*" were notable concerns. This theme underscores the broader challenge of digital transformation in academic environments, particularly when users were not adequately trained or familiar with emerging technologies.

5. Ethical use of AI

A recurring but nuanced concern involves the ethical use of AI. Respondents raised the possibility of algorithmic bias, particularly in information retrieval, recommendations, or resource allocation. The HODs and Systems Librarians alike pointed out the potential for AI tools to "*affect information access or decision-making*" through hidden biases in algorithms. This concern relates closely to the need for transparency, fairness, and inclusiveness in AI design and deployment.

6. High costs associated with acquiring and maintaining AI technologies.

From a practical standpoint, several respondents, particularly HODs, noted the high costs associated with acquiring and maintaining AI technologies. University Librarian 03 specifically stated, "*they are expensive to maintain… for instance in terms of*

subscription," highlighting the need for sustainable budgeting and resource allocation in institutions considering AI integration.

These responses from the University Librarians, Systems Librarians and HODs reveal a spectrum of concerns users may have concerning the introduction of AI in university libraries. The key areas identified were data concerns about data protection, reliability of AI tools, diminishing human engagement, user resistance and ethical concerns. These findings concur with the findings from the HOSs where 70.0% indicated privacy and security of personal data as some of the concerns users have on adoption of AI. Also supporting these findings are findings from the studies by Gajbhiye (2024) and Mallikarjuna (2024) where users indicated privacy and ethical concerns with the integration of AI in library services. Gajbhiye (2024) claims that because AI systems frequently utilise vast volumes of user data to train algorithms and customise services, privacy and data security issues may surface, especially about how libraries and third-party AI providers gather, store, and use patron data.

Additionally, a study by Fraidan (2024) established that some of the concerns users had with adoption of AI in the library were reliability of AI tools (30.0%) and over reliance on technology which diminishes human engagement (50.0%). Further, the findings on resistance to technology are supported by the findings of a study by Owolabi et al. (2022) where the majority of the respondents (60.6%) indicated that they were unlikely to use AI-powered virtual assistants for their research questions. According to Hussain (2023), to facilitate AI integration in university libraries, targeted professional development programs, AI literacy initiatives, and pilot projects should be introduced to demonstrate the practical applications of AI in enhancing library services.

The HODs were asked to discuss the barriers to adoption of AI in Kenyan university libraries. Their responses revealed a comprehensive understanding of the challenges institutions face. Several consistent and interrelated themes emerged from the discussion, indicating both structural and human factors impeding progress toward AI integration. The common themes derived from the discussion are discussed below.

1. Infrastructure inadequacy

One of the most prominent barriers was infrastructure inadequacy. Respondents repeatedly cited issues such as *"low Internet bandwidth," "poor infrastructure*," and *"outdated computer systems*," highlighting that many libraries lack the basic technological foundation required for implementing AI tools. This deficiency affects not only the capacity to host AI platforms, particularly those that were cloud-based, but also impacts the user experience and limits the reliability of AI functions once deployed.

2. Limited funding

Closely related to infrastructure was the challenge of limited funding. Many participants observed that university libraries face "*financial challenges*" and "*high costs*" associated with acquiring, maintaining, and training for AI technologies. Budget constraints, they explained, make it difficult for libraries to prioritise AI over other immediate academic needs. One respondent noted that *"the cost of AI tools, training, and ongoing maintenance can be a substantial barrier,"* pointing to the long-term investment required beyond initial procurement.

3. Inadequate Human capacity and expertise

Inadequate human capacity and expertise also emerged as significant obstacles. Multiple participants emphasised a "*lack of AI expertise*," "*personnel with inadequate*

skills," and the *"need for substantial training".* This gap implies that even where AI tools were available, libraries may struggle to operationalise them effectively. Respondents also highlighted a *"lack of awareness and understanding among staff and users",* which may reduce motivation for adoption and increase the risk of underutilisation.

4. Resistance to change

Another key theme was resistance to change. The introduction of AI technologies in academic settings often disrupts traditional workflows and relationships. Some respondents expressed concern over "*fear of the unknown*" and "*fear of loss of jobs*," with library staff potentially perceiving AI as a threat to their roles. This psychological and cultural barrier reflects a broader concern about how AI might alter the human-centred ethos of librarianship.

5. Privacy and ethical concerns

Privacy and ethical concerns were also noted, with apprehensions around *"data security*," "*user tracking,"* and "*algorithmic bias."* These worries align with global discussions about responsible AI and reflect anxieties about the use and potential misuse of sensitive data in academic environments. As one participant aptly remarked, *"there may be concerns about the protection of sensitive information, particularly given the absence of comprehensive data protection laws."*

6. System integration challenges

Additionally, respondents pointed to system integration challenges. Effective adoption of AI requires that new tools interface seamlessly with existing library systems such as digital catalogs and databases. However, participants flagged the difficulty of

integrating AI with legacy systems that may be "*outdated or incompatible*," which can prolong implementation timelines or lead to project failure.

Based on these findings, it was clear that the HODs identified a complex interplay of infrastructural, financial, technical, cultural, and ethical barriers to AI adoption in university libraries. Mitigating these obstacles will require not only investment in digital infrastructure and human capital, but also clear communication, change management strategies, and ethical frameworks to guide implementation. Concurring with these findings, studies by Masinde et al. (2024), Sang (2024) and Sang (2025) stablished that the challenges experienced by Kenyan university libraries in adoption of AI include poor ICT infrastructure, inadequate funding, lack of technical expertise, privacy and ethical concerns, lack of awareness and training of library staff , challenges with integrating AI with the existent library systems, and resistance to change. The responses underscore that while there is an awareness of AI's potential, a coordinated and well-resourced approach is necessary to transform readiness into reality. According to Sang (2024), for AI adoption in Kenyan libraries to be successful, a comprehensive approach that takes into account ethical concerns, financial concerns, and training needs is required.

4.9.4 Convergence of Quantitative and Qualitative Findings on Users' Perception Readiness in Adopting Artificial Intelligence

4.9.4.1 Convergence of Quantitative Findings

Analysis of the quantitative findings from both the HOSs in the university libraries and the undergraduate students reveals a notable convergence in attitudes and readiness regarding AI adoption in library services. Across both respondent groups, there was a

shared sense of openness and a generally positive disposition toward the use of AI technologies, albeit tempered by caution and awareness of potential risks.

1. Willingness to use AI-powered library services

Among undergraduate students, the likelihood of using AI-powered library services was high, with 47.4% indicating they would be very likely to use such services and 35.9% reporting they would be likely to use them. This indicates that over 83.0% of students were positively inclined toward the integration of AI in library operations. Similarly, findings from library HOSs suggest recognition of this interest, with 70.0% of the respondents indicating that library users were willing to adopt AI-based services. These findings indicate the willingness of users to use AI-based library services.

2. Perceived barriers and concerns

Convergence was also observed in perceived barriers and concerns. The findings from the students indicated that most widely recognised barriers to AI adoption in libraries were infrastructural limitations (M = 4.13), intermittent power supply (M = 3.97) and insufficient human capacity (skills, training, and expertise) (M = 3.96). Similarly, the findings from HOSs emphasised anticipated user concerns such as inaccuracy (M = 3.53), data privacy (M = 3.57), and system reliability (M = 3.57). These findings suggest practical, social, and ethical obstacles that must be addressed for successful implementation.

3. Need for user preparedness

Another strong point of convergence was acknowledgement of the need for user preparedness. While students appear enthusiastic about AI integration, with a high likelihood of using AI-based services (83.3%), responses from library staff underscore

that successful adoption will depend on user education (86.6%), to ensure users understand and are comfortable with new technologies.

4.9.4.2 Convergence of Qualitative Findings

A further analysis of the qualitative findings from University Librarians, systems librarians, HODs and the findings from the open-ended questions by the HOSs and undergraduate students reveals several significant areas of convergence concerning the adoption of AI in university libraries in Kenya. Despite coming from different professional perspectives, all the groups express similar concerns, expectations, and recommendations regarding AI integration.

1. Recognition of data privacy and security as critical issues

One prominent area of convergence was the recognition of data privacy and security as critical issues. Across all categories of respondents, participants emphasised concerns that AI tools may pose risks to user privacy. HODs noted that *"user data, such as personal details and research history, must be handled with the highest level of security,"* while Systems Librarians echoed this sentiment, stressing that *"users are unaware if their activities are being analysed by a machine,"* highlighting the covert nature of AI operations. University Librarians similarly acknowledged that *"issues of data security and privacy will be a going concern,"* even where formal user concerns had not yet been recorded.

2. Concern about reliability and accuracy of AI tools

Another theme consistently reported was the concern about reliability and accuracy of AI tools. Respondents from all groups mentioned the possibility of AI generating inaccurate or misleading results, especially if not properly maintained. One

HOD stated that *"AI systems may sometimes provide inaccurate or incomplete information,"* and system librarians raised related usability concerns, including the "*complexity of AI-enhanced search systems and the inconsistency of AI recommendations*."

3. Fear of over-reliance on AI and loss of human expertise

There also was convergence around the fear of over-reliance on AI and loss of human expertise. Participants worried that AI could undermine human judgment or reduce critical thinking skills. As one HOD put it, "*if we let AI decide for us… we lose the skill of decision making."* This concern was mirrored in the responses of librarians who emphasise the need for balance between AI tools and human interaction to retain the *"human touch"* in library services.

4. Barriers to adoption of AI

In terms the barriers to adoption of AI, all three groups agreed that infrastructure limitations, financial constraints, and lack of staff capacity were major impediments. Infrastructure, particularly Internet connectivity and outdated systems, was repeatedly mentioned as a core challenge. The high cost of AI tools and ongoing maintenance was also highlighted, with one respondent stating, *"AI tools that could help in the use of information are also available online, so there is doubt if the AI should be provided by the library,"* reflecting a broader hesitation rooted in cost-benefit considerations.

5. Importance of training, sensitisation, and user awareness

Finally, a unified perspective emerged around the importance of training, sensitisation, and user awareness. All groups recognised that training was essential, not only for users but also for staff, to demystify AI and build confidence in its application.

For example, University Librarians suggested using *"training, workshops and seminars,"* while system librarians proposed *"awareness campaigns"* and *"educational materials and guides."* HODs also acknowledged the importance of training to bridge the skill gap among library staff.

4.9.4.3 Key Areas of Convergence across Quantitative and Qualitative Findings

An in-depth analysis of both the quantitative and qualitative findings reveals several notable areas of convergence from responses gathered from all respondents, including undergraduate students, library HOSs, systems librarians, University Librarians, and HODs. These converging points highlight shared perspectives on the adoption of AI in university libraries in Kenya.

a) User openness to AI adoption

Quantitative data from undergraduate students and HOSs showed that a majority of the users were positively inclined toward the use of AI in library services. This openness was mirrored in qualitative responses, particularly from systems and University Librarians, who observed that younger users tend to be more receptive to AI technologies. The HODs also expressed openness in the use of AI-enhanced information services.

b) Concerns about privacy, data security, and the reliability of AI tools

Both quantitative findings from HOSs and undergraduate students and qualitative insights from all professional groups emphasised apprehensions about how user data will be managed. For example, HOSs emphasised anticipated user concerns such as inaccuracy, data privacy, and system reliability, HODs expressed fears about the risk of data breaches and algorithmic bias, while librarians stressed users' skepticism about

reliability of AI tools. These concerns reflect a consistent awareness that successful AI adoption must be accompanied by robust ethical and security frameworks.

c) Infrastructural and financial barriers

Another strong point of convergence was inadequate ICT infrastructure and finances to support AI adoption. The quantitative findings from the HOSs and undergraduate students acknowledged that without proper infrastructure or budget allocations, adoption of AI would be difficult to actualise. This was consistent with qualitative findings from all groups that pointed to poor Internet connectivity, outdated technology, and limited financial support as major obstacles to effective AI implementation

d) Importance of training and user awareness

Both quantitative and qualitative data underscore that training and user awareness was necessary for successful implementation of AI in university libraries. Quantitative responses indicated plans to address resistance through workshops, sensitisation, and the use of AI champions, while qualitative responses further emphasised the role of training, educational materials, and direct engagement to enhance user understanding and mitigate skepticism. This convergence underscores a shared recognition that capacity building was central to successful AI integration.

Overall, the convergence of findings across both quantitative and qualitative data points to a cohesive narrative around user readiness, ethical concerns, infrastructural constraints, and the critical need for training and support. These alignments provide a strong foundation for informed policy and implementation strategies in AI-driven library transformation.

4.10 Readiness of University Libraries in Kenya to Adopt Artificial Intelligence

The primary dependent variable in this study was the readiness of university libraries in Kenya to provision of information services. This variable was assessed through various dimensions, including ICT infrastructure and technological readiness, staff skills and AI literacy, user acceptance and readiness, financial resources and budget adequacy, leadership and institutional support, and challenges and strategic planning matters. To accomplish this objective, both quantitative and qualitative data were gathered. Quantitative data were collected from Heads of Sections (HOSs) in the library and undergraduate students through open-ended and closed-ended questionnaires. The closed-ended questions were analysed using SPSS. Qualitative data were obtained through open-ended questions, interview schedules administered to University Librarians and systems librarians, and focus group discussions with Heads of Departments (HODs). These qualitative responses were coded and analysed thematically, presented in narrative descriptions, themes or theme categories, and occasionally supplemented with excerpts.

4.10.1 Findings from Heads of Sections on the Readiness of University Libraries in Kenya to Adopt AI

The first question in this variable used a five-point Likert scale to assess the readiness of university libraries in Kenya to adopt AI for provision of information services. It had choices whose rating scale was 1-5, where Very Adequate = 5, Adequate = 4, Neutral = 3, Inadequate = 2, Very Inadequate = 1. The interpretation combines adequate responses (Very Adequate + Adequate), disagreement responses (Inadequate + Very Inadequate), and considers Neutral responses separately. The descriptive statistics,

including frequencies, percentages, means, and standard deviations are outlined in Table 4.28.

Table 4.28

HOSs Responses on the Readiness of University Libraries in Kenya to Adopt AI

Statements on the readiness of university libraries in Kenya to adopt AI	Very adequate	Adequate	Neutral	Inadequate	Very inadequate
(i). How would you rate your library's current ICT infrastructure in terms of its ability to support AI technologies?	3(10.0%)	11(36.7%	3(10.0%)	7(23.3%)	6(20.0%)
(ii). To what extent does the library staff have the necessary skills and knowledge to support AI adoption and use in the library	2(6.7%)	10(33.3%	5(16.7%)	9(30.0%)	4(13.3%)
(iii). How equipped is your library with the necessary hardware and software to implement AI technologies effectively?	1(3.3%)	10(33.3%)	7(23.3%)	7(23.3%)	5(16.7%)
(iv). How adequate is the library's budget to support the implementation and maintenance of AI technologies in the long term?	2(6.7%)	2(6.7%)	8(26.7%)	9(30.0%	9(30.0%)
(v). What level of support do you think library leadership provides for the adoption of AI technologies	2(6.7%)	12(40.0%)	6(20.0%)	9(30.0%)	1(3.3%)

Regarding the current ICT infrastructure's capacity to support AI technologies, 46.7% of the HOSs respondents indicated that the infrastructure was either "adequate" (36.7%) or "very adequate" (10.0%). In contrast, 43.3% collectively assessed it as "inadequate" (23.3%) or "very inadequate" (20.0%). A smaller percentage (10.0%) expressed neutrality. These results imply a moderately favourable evaluation of ICT infrastructure, with a slight majority of respondents believing their existing systems are capable of supporting AI. Nonetheless, the relatively significant proportion of respondents

citing inadequacy suggests that a considerable number of university libraries continue to encounter infrastructural challenges. This implies the need for targeted investment in technological infrastructure to create an enabling environment for AI adoption.

In assessing the skills and knowledge of library staff in facilitating AI adoption, a mere 40.0% evaluated this capacity as either "adequate" (33.3%) or "very adequate" (6.7%). Conversely, a larger percentage, 43.3%, reported that staff capacity was either "inadequate" (30.0%) or "very inadequate" (13.3%), with 16.7% opting for "neutral." This distribution indicates a significant concern regarding human resource capacity within university libraries. The implication is that while a portion of the workforce may be prepared for AI integration, a substantial segment lacks the requisite competencies. Therefore, staff development programs focused on AI-related skills and digital literacy were essential to ensure effective implementation of AI.

In response to inquiries regarding the adequacy of their libraries in terms of the essential hardware and software necessary for AI implementation, 36.6% of respondents indicated sufficiency, with 33.3% describing their libraries as "adequate" and 3.3% as "very adequate." Conversely, 40.0% of respondents perceived their libraries as either "inadequate" (23.3%) or "very inadequate" (16.7%), while 23.3% remained neutral. This data indicates that, although a segment of university libraries is equipped with appropriate tools for AI implementation, a greater proportion either lacks the requisite technology or is uncertain about their readiness. The neutral responses suggest a potential absence of awareness or evaluation of technological capacity. The implication is that there is a pressing need for libraries to evaluate and upgrade their systems to support AI

functionalities, which could include acquiring AI-ready servers, cloud-based platforms, or smart cataloguing systems.

In assessing the adequacy of their library budgets to support AI implementation and maintenance, only 13.4% of respondents found it “adequate” (6.7%) or “very adequate” (6.7%). Meanwhile, a striking 60.0% reported budget inadequacy, (30.0% “inadequate” and 30.0% “very inadequate”), and 26.7% were neutral. This overwhelming perception of financial insufficiency highlights a critical barrier to AI adoption in university libraries. The implication is that without a reallocation of resources or an increase in funding, many institutions will remain unable to invest in the necessary technology, staff training, or infrastructure upgrades.

On the question of library leadership support for the adoption of AI technologies, 46.7% of respondents viewed leadership as supportive (“adequate” at 40.0% and “very adequate” at 6.7%). On the other hand, 33.3% found leadership support lacking (“inadequate” at 30.0% and “very inadequate” at 3.3%), while 20.0% were neutral. This suggests a relatively positive perception of leadership engagement, which was encouraging given the pivotal role leadership plays in championing innovation. However, the significant proportion indicating inadequate support reveals the need for increased awareness and commitment among decision-makers. Institutions should consider capacity-building sessions and strategic planning workshops to better align leadership with the digital transformation agenda.

In summary, the findings indicate that although there is emerging readiness in certain areas, especially in ICT infrastructure and leadership support, there are significant deficiencies in budgetary allocation, staff competency, and access to hardware and

software. The neutral responses observed across several items may also suggest a knowledge gap among respondents, underscoring the necessity for improved assessment tools and the creation of greater awareness. These findings are supported by findings from several studies such as by Masinde et al. (2024), Sang (2024) and Sang (2025) that found that the main challenges in adoption of AI in Kenyan university libraries is inadequate funding, inadequate ICT skills and competencies among library staff, lack of technical expertise, poor ICT infrastructure and resistance to change. To enhance the readiness of university libraries in Kenya to adopt AI, there is need to mitigate these obstacles not only through investment in ICT infrastructure and human capital, but also in clear communication and change management strategies (Sang, 2025).

4.10.2 Findings from Undergraduate Students on the Readiness of University Libraries in Kenya to Adopt AI

The questionnaire administered to undergraduate students employed a five-point Likert scale to assess statements concerning the preparedness of university libraries in Kenya to integrate artificial intelligence in the delivery of information services. The scale provided ratings from 1 to 5, with 5 indicating “Strongly.” Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Emphatically Disagree =1. The responses were collated and presented in Table 4.29.

Table 4.29

Undergraduate Students' Responses Relating to the Readiness of University Libraries in Kenya to Adopt AI

Statements on perceived the readiness of university libraries in Kenya to Adopt AI	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
(i). Do you think AI technologies can improve the existent information services in your library?	168(46.8%)	153(42.6%)	34(9.5%)	1(0.3%)	3(0.8%)
(ii). Do you believe the university library has adequate ICT infrastructure to support AI-based services (e.g., virtual assistants, intelligent search systems)?	66(18.4%)	114(31.8%)	113(31.5%)	57(15.9%)	9(2.5%)
(iii). Do you think library staff are well-prepared to manage AI technologies in library services?	55(15.3%)	114(31.8%)	144(40.1%)	36(10.0%)	10(2.8%)

According to the data presented in Table 4.29, students were surveyed regarding their perceptions of AI technologies' potential to enhance existing information services within university libraries. A significant majority, comprising 89.4% of the 359 participants, expressed agreement with this notion. Specifically, 42.6% indicated "agree," and 46.8% indicated "strongly agree." Conversely, a mere 1.1% of respondents conveyed disagreement, with 0.3% selecting "disagree" and 0.8% selecting "strongly disagree." Additionally, 9.5% of participants opted for a "neutral" stance.

These results demonstrate overwhelming student optimism regarding the potential of AI to enhance library services. These findings are corroborated by the findings from studies by Shaheen and Khurshid (2023) where 60% of the students indicated they found

AI-powered recommendation systems helpful and Fraidan (2024) where 85% of the students agreed that AI-powered library systems significantly enhanced research efficiency. The minimal opposition and relatively small neutral group indicate a high level of awareness and belief in the advantages of technologies such as intelligent search, AI-driven reference services, and virtual research assistance. This suggests a strong existing user demand and openness to AI adoption within academic libraries. Libraries have the opportunity to leverage this enthusiasm to pilot and promote AI-powered solutions that align with student needs, including personalised recommendations, chatbots for research assistance, and predictive analytics for resource planning.

Undergraduate students were surveyed regarding their perceptions of whether the university library possesses adequate ICT infrastructure to support AI-based services, such as virtual assistants or intelligent search systems. Of the 359 respondents, 180 students (50.2%) either "agreed" (31.8%) or "strongly agreed" (18.4%) that their library's ICT infrastructure was sufficient. In contrast, 66 students (18.4%) expressed negative perceptions, with 15.9% selecting "disagree" and 2.5% "strongly disagree." A significant 113 respondents (31.5%) remained neutral.

These findings reflect a moderately positive outlook on library ICT readiness from the student perspective. The fact that over half of the respondents believed the infrastructure was adequate is encouraging. However, the substantial proportion of neutral responses (31.5%) indicates uncertainty or limited user awareness about the technical capabilities of their libraries. Additionally, nearly one-fifth of respondents expressed dissatisfaction, suggesting that not all students were experiencing the benefits of technology-enabled services. The findings of this study are corroborated by findings from

a study by Owolabi et al. (2019) on the readiness of Nigerian polytechnic students to adopt AI that established that majority of the respondents (40%) indicated weak communication infrastructure and intermittent power supply as the major challenges. The implication of these findings was twofold; libraries may need to enhance communication and visibility of existing AI-capable systems while continuing to upgrade their ICT infrastructure to meet growing user expectations.

Students were also asked if they thought library staff were well-prepared to manage AI technologies in service delivery. A total of 169 respondents (47.1%) either "agreed" (31.8%) or "strongly agreed" (15.3%) with the statement. In contrast, 46 students (12.8%) expressed skepticism, with 10.0% selecting "disagree" and 2.8% "strongly disagree." A notable 144 respondents (40.1%) selected "neutral."

This response pattern suggests that although nearly half of the students have confidence in the library staff's preparedness to handle AI technologies, there was a significant degree of uncertainty. The high level of neutrality, 40.1%, may indicate that many students have limited interactions with library staff in AI-related contexts, or they were unaware of the competencies required to manage such technologies. These findings concur with the findings of a study conducted by Shaheen and Khurshid (2023) in Pakistani where 39.7% of the respondents indicated their library staff were unlikely to interpret and explain the results generated by AI systems. These findings imply the need for greater visibility of staff roles in AI integration and possibly more interactive, AI-supported services that clearly showcase staff competence in this domain.

The undergraduate students' perspective on AI readiness in university libraries in Kenya was cautiously optimistic. The majority of students view the current ICT

infrastructure as somewhat adequate and have a fair level of trust in the preparedness of library staff to manage AI technologies. However, the significant neutral responses in both cases point to a potential disconnect between AI development efforts within libraries and student awareness or experience of these services. Libraries can respond to this by prioritising user engagement and outreach strategies that highlight AI-related developments (Shahzad et al., 2025). For instance, training sessions, promotional campaigns, and hands-on demonstrations of AI tools like chatbots or personalised search systems can bridge the perception gap. Additionally, strengthening both technological infrastructure and staff capacity will help ensure that student optimism was matched by tangible improvements in service delivery.

The comprehensive analysis of student responses indicates a promising outlook for the integration of AI-powered transformations within university libraries in Kenya. Approximately 90% of respondents express the belief that AI can enhance library services, while over 70% indicate a likelihood of utilising such tools if implemented. However, the perception of staff readiness and the state of ICT infrastructure is only moderately strong, with notable neutrality across several questions suggesting uncertainty or limited exposure. This underscores the necessity for university libraries to leverage student readiness by swiftly initiating AI pilot programs, particularly those that enhance information discovery and user experience. Furthermore, it is essential for university libraries to prioritise staff training and visibility to bolster student confidence and engagement. Investment in infrastructure and improved communication regarding existing capabilities are also required. Awareness campaigns and onboarding processes for AI-powered tools can transform neutral and hesitant users into enthusiastic adopters.

4.10.3 Qualitative Findings on Readiness of University Libraries in Kenya to Adopt AI

The views of University Librarians and Systems Librarians regarding the key critical factors affecting a library's readiness to adopt AI were gathered through interview sessions. An examination of the qualitative data from the librarians and Systems Librarians reveals several critical and intersecting themes regarding the readiness of university libraries in Kenya to adopt AI technologies. These themes highlight the most significant factors considered influential in the successful integration of AI within academic library environments. The key thematic categories identified include funding and budgetary constraints, the need for skilled human resources, robust ICT infrastructure, awareness and understanding of AI, and user acceptance. Each theme is discussed below in accordance with APA (7th edition) style and presented in standard prose.

1. Funding and budgetary constraints

The predominant theme identified across both University Librarians and Systems Librarians pertains to the challenge of insufficient financial resources. University Librarians explicitly highlighted this barrier, with remarks such as *"inadequate funds"* and *"lack of funds for training."* These observations underscore how constrained budgets limit both the procurement of AI technologies and the professional development of staff. This concern was similarly articulated by systems librarians, who emphasised the significance of *"budgetary allocation"* as a critical determinant of AI readiness. Evidently, without targeted investment, the meaningful advancement of AI adoption is improbable. Sustainable funding models must therefore be considered to ensure long-term AI integration in university libraries.

2. Need for skilled human resources

A second major theme centres on the need for skilled human resources. University Librarians frequently cited a *"lack of relevant training"* and a need to "*provide adequate funds and training."* Additionally, *"capacity building"* was specifically highlighted. These sentiments align with Systems Librarians who identified *"AI competencies among staff"* as essential to readiness. It was evident that the adoption of AI was not merely a technological shift but also a human capacity challenge.

3. Robust ICT infrastructure.

Both respondent categories highlighted the critical significance of a robust ICT infrastructure. Systems Librarians stressed the necessity for *"modern ICT infrastructure"* and elaborated on how *"reliable and fast Internet access is fundamental for AI adoption,"* emphasising that AI systems rely on real-time data processing and cloud computing. In parallel, University Librarians mentioned *"ICT infrastructure"* in conjunction with skilled staffing, underscoring its foundational importance.

4. Awareness and understanding of AI

A less technical but equally crucial theme was awareness and conceptual understanding of AI's role in libraries. One University Librarian observed, *"First is awareness of the effect of AI, then planning to address the adoption."* Another pointed to an *"unclear understanding of how to harness AI in libraries."* These observations highlight a gap not just in skills, but also in vision and strategic foresight regarding AI's potential.

5. User acceptance

Furthermore, Systems Librarians recognised user acceptance as a critical factor, in conjunction with infrastructure and staff competencies. As articulated by one participant, readiness is contingent upon "*infrastructure, staff competencies, and user acceptance and adoption."* The incorporation of user attitudes into the discourse on readiness underscores an acknowledgment that even meticulously designed systems may be unsuccessful without active user engagement. These results imply that libraries should proactively involve users, students, faculty, and researchers, in the AI implementation process.

The responses from University Librarians and Systems Librarians indicate a significant acknowledgment of funding and budgetary constraints, staff training and competencies, ICT infrastructure, awareness and comprehension of AI, and user acceptance as the key factors influencing the readiness of university libraries in Kenya to adopt AI. These findings are in line with the findings of a study by Chen (2023) that established that factors such as availability of ICT infrastructure and resources, proficiency in computer skills, establishment of appropriate policies and sufficient funding are key factors in adoption of AI in university libraries. A study by Owolabi et al. (2022) also found that availability of the technology, user confidence, acceptance of the adopted technology and training toward the use of the technology were critical in adoption of AI in libraries. According to Sang (2025), for university libraries in Kenya to successfully adopt AI, there is need for a comprehensive approach that looks into the cost concerns, training needs, and ethical use of AI in provision of information services.

Undergraduate students and HOSs were asked to state, through an open-ended inquiry, the key factors that would determine the readiness of university libraries in Kenya

to adopt AI, particularly in relation to infrastructure, staff competencies, and user acceptance. Additionally, HODs were engaged in a discussion regarding the question, *"how prepared is your university library to adopt AI technologies?"*. The analysis of the responses from these participants revealed six significant and recurring themes pertinent to the readiness of university libraries in Kenya for AI adoption. These themes encompass infrastructure readiness, staff training and capacity building, financial and institutional support, digital and technological integration, varying levels of AI readiness, and positive attitudes and future potential. The subsequent discussion elaborates on these factors.

1. Infrastructure readiness

A central theme evident across all respondent categories was the critical significance of a robust ICT infrastructure, encompassing reliable Internet connectivity, the availability of modern computing devices, and cloud-based systems, as a fundamental prerequisite for the adoption of AI. Many undergraduates noted that *"availability of Internet connection and some computers"* and *"sufficient computing power, cloud access, and high-speed Internet"* served as essential indicators of readiness. Likewise, HODs emphasised that while some libraries have made strides in digitisation, they continue to encounter challenges such as *"Internet speed, network stability, and access to cloud-based services,"* which remain inadequate for the full utilisation of AI technologies.

2. Staff training and capacity building

The necessity for staff training and professional development in AI technologies was consistently emphasised. Undergraduate students expressed uncertainty regarding the readiness of the staff, a sentiment echoed by the library HOSs, who frequently associated readiness with *"staff preparedness"* and advocated for *"further investment in staff*

training." One HOD stated, *"Library staff would require professional development in AI fundamentals, ethical considerations, and the effective utilisation of these technologies to support users."*

3. Financial and institutional support

Respondents consistently identified financial constraints as a significant impediment to the adoption of A. Some HOSs explicitly stated, *"Not ready due to financial challenges, library budget has greatly been reduced."* Similarly, HODs indicated that readiness was contingent upon *"full support in terms of funds and training."* This theme underscores the necessity of institutional support, encompassing budgetary allocations and strategic planning, for libraries to effectively adopt and sustain AI systems.

4. Digital and technological integration

The recurring theme of digital resources and technological initiatives was evident throughout the data. Numerous undergraduates highlighted initiatives such as *"the installation of new computers equipped with advanced programs that support AI"* and *"the university's implementation of online classes utilising AI."* These observations suggest that, although AI-specific tools may still be in the developmental stages, digital infrastructure was progressively being integrated into library services. As noted by one HOD, many libraries have *"already commenced the adoption of digital tools and platforms,"* although the incorporation of more sophisticated AI features necessitates further readiness.

5. Varying levels of AI readiness

The theme of variation in AI readiness was evident across all respondent groups. Undergraduate responses ranged from *"Very prepared"* to *"Not at all prepared"* to *"3ly*

prepared" (an informal rating frequently cited). The HOSs also demonstrated this inconsistency, with responses such as *"Partially," "Not yet,"* and *"Yes, in phases."* One HOD succinctly summarised this observation: *"University libraries in Kenya are at various stages of readiness to adopt AI technologies."* This theme highlights the disparity in AI readiness, with some institutions being more advanced than others.

6. Positive attitude and future potential

Despite existing limitations, numerous respondents conveyed optimism regarding the future integration of AI. Several undergraduate students observed that *"they are trying to incorporate the use of AI"* and *"the university is slowly accepting technologies but they will get there eventually."* Additionally, one HOD remarked that *"libraries may need to partner with IT specialists or external providers to maintain AI tools and ensure their reliability,"* indicating a proactive stance. This theme highlights that although current conditions may be restrictive, the overall perspective on AI within academic libraries remains hopeful.

The aforementioned six themes collectively suggest that the HOSs, undergraduate students, and HODs understand the critical factors influencing the readiness of university libraries to adopt AI in the provision of information services. The six themes identified concerning the preparedness of university libraries in Kenya to adopt AI technologies encompass infrastructure readiness, staff training and capacity building, financial and institutional support, digital and technological integration, varying levels of readiness, and positive attitudes and future potential. These findings align with those from University Librarians and systems librarians, who identified financial constraints, the need for skilled

human resources, and ICT infrastructure as the primary factors influencing the readiness of Kenyan university libraries to adopt AI.

The study aimed to elucidate the main barriers to AI adoption in university libraries in Kenya. Responses were obtained from system librarians through interviews and from focus group discussions with HODs. The analysis identified seven main barriers to AI adoption in university libraries in Kenya, including technological infrastructure limitations, financial constraints, skill and knowledge gaps among library staff, resistance to change and ethical concerns, lack of institutional and policy support, ambiguity in AI applicability and tool selection, and concerns over job security and role redundancy. These barriers are elaborated upon below.

1. Technological infrastructure limitations

A dominant theme across the responses was the inadequacy of technological infrastructure necessary to support AI applications. Several respondents pointed out poor Internet connectivity, unreliable electricity, outdated hardware, and general digital underdevelopment as significant barriers. One Systems Librarian emphasised that *"many university libraries in Kenya may lack the necessary IT infrastructure, such as high-speed Internet, modern hardware, and reliable electricity."* This theme underscores the need to enhance existent ICT infrastructure for successful deployment and functionality of AI systems, which depend heavily on stable, high-speed Internet and modern computing environments.

2. Financial constraints

Financial limitations emerged as another critical barrier to AI adoption. This theme was consistently echoed across all three respondent categories. One University Librarian

stated that *"finance is the most crucial because it will affect almost all other factors,"* highlighting the interconnectedness of budgetary support with other adoption requirements. Given the financial pressures facing many public universities in Kenya, securing adequate funding for AI was perceived as a major hurdle. Additionally, the high cost of AI systems and tools was viewed as a deterrent, especially where cost-benefit clarity was lacking.

3. Skill and knowledge gaps among library staff

The absence of competencies related to AI among library staff emerged as a recurring theme and a fundamental challenge to the successful implementation of AI. Respondents across all groups identified the *"lack of AI expertise" and "unskilled personnel"* as a pressing issue. As one HOD observed, *"many library staff may not have the necessary technical skills or knowledge to operate, maintain, or troubleshoot AI-driven tools."* Furthermore, there was a broader lack of awareness regarding the benefits and practical applications of AI in library services, which resulted in limited motivation to embrace the technology. This suggests an urgent need for capacity building and professional development initiatives focused on digital literacy and AI integration.

4. Resistance to change and ethical concerns

The human aspect of AI adoption was also emphasised, with resistance to change and ethical concerns representing another significant obstacle. Numerous respondents identified fear of job displacement, skepticism towards technology, and discomfort with the unfamiliar as reasons for hesitancy among library staff and users. As articulated by one HOD, *"AI tools… may be perceived as impersonal or intimidating,"* while another observed that *"fear of the unknown"* significantly influences the situation. Furthermore,

apprehensions regarding data privacy and algorithmic bias underscore deeper ethical challenges associated with AI adoption, especially in the absence of robust regulatory frameworks. As one Systems Librarian remarked, *"privacy and data protection concerns and user acceptance"* constitute substantial barriers that necessitate resolution.

5. Lack of institutional and policy support

A persistent concern highlighted by respondents, particularly University Librarians and HODs was the insufficient institutional support and the lack of clear regulatory or policy frameworks to guide AI adoption. One librarian noted the frequent occurrence of a *"lack [of] support from the parent organisation,"* indicating that numerous university administrations have not yet prioritised or actively endorsed AI-driven initiatives. This theme encompasses both the absence of strategic direction and constrained investment from leadership within higher education institutions. Additionally, some respondents referred to *"regulatory factors"* as impediments, underscoring the necessity for national or institutional policies that ensure ethical, secure, and coordinated AI deployment. In the absence of such support, the risks associated with AI adoption remain fragmented and unsustainable.

6. Ambiguity in AI applicability and tool selection

An additional nuanced yet significant theme was the uncertainty regarding the suitability of AI tools for library settings, and the methods for their effective selection or integration. This issue underscores not only a deficiency in technical expertise but also a conceptual uncertainty concerning AI's potential to enhance library services. One Systems Librarian highlighted the *"availability of various AI tools for similar tasks"* and the *"technicalities in selecting appropriate algorithms to apply,"* thereby emphasising the

confusion surrounding the relevance and functionality of AI tools. Furthermore, another respondent observed that *"there may not be tools that are ready to be used in the library,"* indicating a perception that AI tools may not yet be adequately suited for the Kenyan academic context. This ambiguity contributes to hesitancy and inconsistent adoption of AI innovations.

7. Concerns over job security and role redundancy

A final and distinct theme that emerged from the responses was the apprehension regarding job displacement and role redundancy resulting from AI integration. Numerous participants, including system librarians, University Librarians, and HODs, articulated concerns that the automation of certain library functions could lead job losses or diminish the significance of professional roles. Expressions such as *"loss of jobs," "fear of unknown,"* and *"fear that AI will replace their roles"* reflect a prevalent perception that AI may not serve as a complement to human efforts but rather as a substitute. This apprehension can function as a formidable psychological and organisational barrier, potentially engendering passive resistance or outright opposition to AI initiatives within libraries. This theme was closely associated with challenges in change management but merits its own category due to its profound emotional and labour-related implications.

The findings of this study concur with the findings of other studies conducted in Kenyan university libraries such as Masinde et al. (2024), Sang (2024) and Sang (2025) whose findings indicated inadequate funding, poor ICT infrastructure, lack of ICT skills and competencies among the library staff, user resistance, and lack of a policy framework as the impediments to AI adoption in Kenyan university libraries. Masinde et al. (2024) opine that although there is enthusiasm and backing for the implementation of AI in

university libraries, to fully realise the potential of AI in revolutionising library operations and services in Kenya, strategic planning and cooperative efforts are necessary.

4.10.4 Convergence of Quantitative and Qualitative Findings on Readiness of University Libraries in Kenya to adopt AI

4.10.4.1 Convergence of Quantitative Findings

The quantitative findings obtained from both the HOSs in the library and undergraduate students**,** revealed several key points of convergence as discussed below.

1. Infrastructural inadequacies

Both groups recognised infrastructural deficiencies as a substantial impediment to the effective integration of AI. A total of 43.3% of the HOSs assessed the ICT infrastructure as either "inadequate" (23.3%) or "very inadequate" (20.0%). Similarly, undergraduate students shared these concerns, with 18.4% indicating a negative perception regarding the sufficiency of ICT infrastructure to facilitate AI adoption. Additionally, 15.9% selected "disagree" and 2.5% "strongly disagree." This shared apprehension highlights the critical foundational role that infrastructure plays in enabling AI functionality.

2. Need for capacity building among library staff

There was a significant consensus on the necessity for capacity building among library staff. A substantial majority of HOSs, amounting to 43.3%, assessed the library staff's skills and knowledge to support AI adoption as either "inadequate" (30.0%) or "very inadequate" (13.3%). Similarly, undergraduate students expressed concerns, with only (47.1%) strongly agreeing (15.3%) or agreeing (31.8%) that the library staff were well-prepared to manage AI technologies in library services. These findings imply a

mutual acknowledgment that technological adoption is impeded by constrained human capacity.

3. Financial limitations

The findings from the HOSs pointed out financial limitations as a core challenge. Only 13.4% of the HOSs respondents found the library budget to be "adequate" (6.7%) or "very adequate" (6.7%). This suggests an understanding of the fiscal barriers that must be overcome to modernise library services.

4. Optimism about the potential benefits of AI in enhancing library services

Despite recognising various challenges, undergraduate students demonstrated optimism regarding the potential advantages of AI in improving library services. Notably, 89.4% of the undergraduate students affirmed this belief, with 42.6% selecting "agree" and 46.8% "strongly agree." These findings indicate that undergraduate students acknowledge AI's potential to enhance information services within university libraries.

4.10.4.2 Convergence of Qualitative Findings

Further analysis of qualitative responses from University Librarians, systems librarians, Heads of Departments, HODs and the findings from open-ended questions posed to HOSs and undergraduate students revealed a consistent recognition of several overarching themes related to the adoption of AI in Kenyan university libraries.

1. Inadequacy of technological infrastructure

All respondent categories underscored the insufficiency of technological infrastructure as a significant impediment to the adoption of AI. University Librarians and Systems Librarians emphasised the absence of high-speed Internet, modern hardware, and a reliable power supply. Similarly, HODs observed that many university libraries

encounter constraints regarding Internet connectivity, speed, and overall technological infrastructure. Undergraduate students also noted the availability of Internet connection, albeit not stable. This consensus highlights the fundamental necessity of investing in infrastructure to effectively support AI systems.

2. Limited funding

A clear consensus emerged regarding the role of limited funding as a barrier to the implementation of AI. Both University Librarians and HODs identified budgetary limitations as a significant obstacle. Systems Librarians similarly referred to budgetary constraints and "financial challenges as primary impediments. Additionally, some HOSs noted that their libraries were not ready for AI adoption due to financial challenge. The convergence on this issue underscores the critical importance of institutional investment and external funding opportunities to facilitate technological transformation.

3. Lack of technical expertise among library staff

Another significant area of convergence was the deficiency in technical expertise among library staff. Respondents from all three categories recognised the skills gap, particularly the absence of training in AI tools, ethical use, and system integration. Systems Librarians referred to the human resource skill gap, whereas HODs underscored the need for extensive staff training or the recruitment of new personnel with specialised expertise. University Librarians similarly observed that majority of staff exhibit a lack of understanding regarding the potential advantages of AI. The HOSs also reiterated this concern, frequently associating readiness with staff preparedness and advocating for further investment in staff training.

4. Emotional and cultural barriers

Respondents across all categories recognised emotional and cultural barriers, including apprehensions regarding job displacement and resistance to the adoption of new technologies. University Librarians and HODs both alluded to fear of the unknown and expressed concerns that AI might replace human roles. Systems Librarians concurred with these sentiments, highlighting apprehensions about loss of jobs and user acceptance. Several students observed that the universities are gradually embracing technologies, but were yet to get there. This convergence underscores the necessity for change management strategies and awareness initiatives to cultivate positive attitudes toward AI.

5. Privacy and data protection

All groups acknowledged the potential risks associated with privacy and data protection. For example, Systems Librarians referred to privacy and data protection concerns, whereas the HODs highlighted that the use of AI in libraries raises questions about data privacy and security. University Librarians also mentioned regulatory factors and the absence of comprehensive data protection laws. This collective concern indicates that the establishment of ethical frameworks and explicit data governance policies is essential to ensure the safe and responsible utilisation of AI.

6. Uncertainty regarding institutional readiness and leadership support

Finally, a consensus emerged regarding the uncertainty surrounding institutional readiness and leadership support. University Librarians highlighted a lack of support from the parent organisation, while HODs expressed skepticism about the willingness to adopt AI among decision-makers. Systems Librarians similarly noted inconsistent institutional backing. Responses from undergraduate students varied significantly, ranging from very

prepared to not at all prepared, and HOSs mirrored this variability with responses such as partially, not yet, and in phases.

4.10.4.3 Key Areas of Convergence across Quantitative and Qualitative Results

A comparative analysis of the quantitative data (collected from library HOSs and undergraduate students) and the qualitative data (collected from University Librarians, systems librarians, HODs, undergraduate students, and HOSs) identifies several intersecting themes across both datasets. These areas of consensus highlight common perceptions among various stakeholders concerning the opportunities and challenges linked to the adoption of AI in university libraries in Kenya.

a) Infrastructure inadequacy

The inadequacy of infrastructure was identified as a prevalent concern in both sets of findings. Quantitative data collected from HOSs and students revealed dissatisfaction with the existing digital infrastructure, including Internet connectivity, access to digital tools, and system reliability. This sentiment was corroborated in the qualitative responses, where all professional groups consistently identified poor technological infrastructure, such as limited bandwidth, obsolete systems, and frequent power outages, as a significant impediment to the effective integration of artificial intelligence.

b) Financial constraints

Financial constraints were unanimously recognised as a significant limitation across both datasets. Quantitative responses indicated perceptions that financial limitations impede investment in AI technologies. Similarly, qualitative insights underscored the cost implications associated with acquiring AI tools, training personnel,

and maintaining AI systems, highlighting a consensus on the foundational role of funding in facilitating AI adoption.

c) Lack of skills and technical preparedness

An additional significant area of convergence was the lack of skills and technical preparedness. Quantitative findings demonstrated that staff awareness and confidence in utilising AI tools were constrained, indicating a disparity in digital and AI literacy. This observation is consistent with qualitative data from Systems Librarians and university administrators, who underscored the necessity for extensive staff training and capacity development, highlighting the human resource skill gap and lack of understanding on the possible benefits of AI.

d) Uncertainty and resistance to change

Furthermore, both data sources highlighted uncertainty and resistance to change as emotional and institutional obstacles. Quantitative findings revealed skepticism regarding the utility and reliability of AI technologies, particularly among library staff. Qualitative responses from HODs and University Librarians corroborated this observation, identifying fear of the unknown, job insecurity, and resistance to change as psychological and organisational barriers to adoption.

e) Data privacy and ethical concerns

Finally, data privacy and ethical concerns were raised in both quantitative and qualitative findings. The quantitative data indicated a moderate level of apprehension regarding the management of user data within AI systems. In contrast, qualitative data offered more profound insights, emphasising the lack of comprehensive data protection frameworks and expressing concerns about algorithmic bias and surveillance.

The convergence of these findings across both datasets underscores a widespread acknowledgment of the systemic, financial, human, and ethical challenges associated with AI adoption in Kenyan university libraries. These aligned perspectives necessitate a multi-dimensional approach, including infrastructure investment, staff training, financial planning, change management, and policy development, to facilitate the responsible and effective implementation of AI technologies in academic library environments.

4.11 Developing a Framework for Adoption of Artificial Intelligence in University Libraries in Kenya

The ultimate goal of this research was to develop a framework for adopting AI within university libraries in Kenya. This objective was assessed using aspects that included stakeholders' involvement, infrastructure and scalability, staff training and capacity building, user education and awareness, funding and resource allocation, policies and governance, collaboration and innovation, implementation roadmap, evaluation and feedback. The study first provides analysis on questions that were posed to the respondents regarding developing a framework for adoption of AI in university libraries. The actual development thereafter was done, having considered all the data noted in each variable. Consequently, quantitative and qualitative data were collected from HOSs in the library and from the undergraduate students using open and closed-ended questionnaires, while qualitative data were collected from systems librarians, University Librarians, and HODs respectively.

4.11.1 Findings from Heads of Sections on Framework for AI Adoption in university Libraries

The first question in this variable was about factors that should be included in a framework for adopting AI in university libraries. The statements were presented to the library HOSs in a five-point Likert scale format, whose rating scale was 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree = 1. The interpretation combines agreement responses (Strongly Agree + Agree), disagreement responses (Disagree + Strongly Disagree), and considers Neutral responses separately. The descriptive statistics, including frequencies, percentages, means, and standard deviations are outlined in Table 4.30.

Table 4.30

HOSs Responses on the Factors That Should Be Included in a Framework for Adopting AI in University Libraries

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). A robust ICT infrastructure that can support the implementation and scalability of AI technologies in the library.	20(66.7%)	9(30.0%)	1(3.3%)	0	0	4.63	.556
(ii). Regular staff training and capacity building on AI and ICT to enhance skills for effective adoption and use.	21(70.0%)	9(30.0%)	0	0	0	4.70	.466
(iii). User education and awareness campaigns to promote understanding and acceptance of AI technologies among library users.	22(73.3%)	8(26.7%)	0	0	0	4.73	.450

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(iv). Adequate funding and resource allocation to support the acquisition, implementation, and maintenance of AI technologies in the library.	24(80.0%)	6(20.0%)	0	0	0	4.80	.407
(v). Collaboration with AI experts, researchers, and external partners to ensure effective AI integration and continuous innovation in library services.	23(76.7%)	7(23.3%)	0	0	0	4.77	.430
(vi). Clear government or institutional policies that guide AI adoption, including ethical considerations, privacy, and security issues.	22(73.3%)	8(26.7%)	0	0	0	4.73	.450
(vii). Development of an AI implementation roadmap, outlining clear goals, milestones, and timelines for integrating AI in library services.	21(70.0%)	8(26.7%)	1(3.3%)	0	0	4.67	.547
(viii). Stakeholder involvement and buy-in, including library staff, users, and administration, to ensure that AI adoption is well-supported and aligned with the library's strategic goals.	20(66.7%)	8(26.7%)	2(6.7%)	0	0	4.60	.621
(ix). Continuous evaluation and feedback mechanisms to monitor the effectiveness of AI technologies in the library and make necessary adjustments.	20(66.7%)	10(33.3%)	0	0	0	4.67	.479

The results presented in Table 4.30 show the responses from the HOSs within university libraries regarding key elements to be considered in the development of a framework for the adoption of AI in library services. The most strongly endorsed factor was adequate funding and resource allocation, a consensus shared by all respondents (n = 30), with 24 (80.0%) strongly agreeing and 6 (20.0%) agreeing. No respondents disagreed or remained neutral on this item. The mean score was M = 4.80, with a low standard deviation of SD = 0.407, indicating high consensus among respondents. This suggests that funding was universally viewed as a foundational requirement for AI adoption.

Closely following in agreement was collaboration with AI experts, researchers, and external partners, where 23 (76.7%) strongly agreed and 7 (23.3%) agreed, giving a combined agreement of 100%. The mean was M = 4.77, with a standard deviation of SD = 0.430. This low variability reflects a strong and shared view among the library HOSs that expert collaboration was critical for successful AI integration and innovation

User education and awareness campaigns also received near-unanimous support, with 22 respondents (73.3%) strongly agreeing and 8 (26.7%) agreeing (total agreement = 100%). The mean was M = 4.73 and the standard deviation was SD = 0.450, showing strong convergence of opinion. This underscores the perceived need to ensure users were not only aware of AI tools but were also prepared to engage with them meaningfully. Similarly, clear government or institutional policies, including ethical, privacy, and security considerations, received broad agreement, with 22 respondents (73.3%) strongly agreeing and 8 (26.7%) agreeing (total agreement = 100%). This item also recorded a mean of M = 4.73 and SD = 0.450, reinforcing the importance of regulatory clarity and ethical oversight in AI implementation.

Concerning regular staff training and capacity building on AI and ICT, a total of 21 respondents (70.0%) expressed strong agreement, while 9 (30.0%) indicated agreement, resulting in unanimous support (100%) with a mean score of M = 4.70 (SD = 0.466). This indicates that the library HOSs acknowledge the pivotal role of human capacity in the transition towards AI-driven services. Furthermore, continuous evaluation and feedback mechanisms garnered equally high support, with 20 respondents (66.7%) expressing strong agreement and 10 (33.3%) agreeing, resulting in a unanimous agreement rate of 100%. The mean score was M = 4.67, and the standard deviation was SD = 0.479. The findings underscore the significance attributed to accountability, impact assessment, and iterative improvement in the adoption of AI.

The development of an AI implementation roadmap was favourably viewed, as evidenced by 21 respondents (70.0%) expressing strong agreement, 8 (26.7%) indicating agreement, and 1 (3.3%) maintaining a neutral stance. Notably, no respondents expressed disagreement. This particular item yielded a mean score of M = 4.67, accompanied by a slightly elevated standard deviation of SD = 0.547, indicating a strong yet marginally less consensus-driven agreement compared to other results.

With respect to stakeholder involvement and buy-in, 20 (66.7%) expressed strong agreement, 8 (26.7%) indicated agreement, 2 (6.7%) were neutral, and there were no expressions of disagreement. The mean was M = 4.60, with a standard deviation of SD = 0.621, which was the highest among all items, indicating more variability in responses. Although there was a high level of overall agreement at 93.4%, the presence of neutral responses and a relatively high standard deviation suggest some divergence in perceptions regarding the current level of stakeholder engagement and the desired extent of their

involvement. The need for a robust ICT infrastructure was supported by 29 respondents, with 20 (66.7%) expressing strong agreement, and 9 (30.0%) expressing agreement. One participant (3.3%) adopted a neutral stance, and there were no instances of disagreement among the respondents. The mean was M = 4.63 and SD = 0.556, again reflecting strong but not absolute consensus.

The results indicate an overwhelming level of agreement among HOSs concerning the critical components required for the successful adoption of AI within university libraries. Each statement received agreement rates ranging from 93.4% to 100%, underscoring a shared comprehension of the importance of these strategic, technical, and operational elements. The complete absence of disagreement (0% for all items) and the minimal occurrence of neutral responses (only three across all items) suggest a widespread readiness to implement AI, provided the necessary enablers were available. The standard deviations for all items ranged from 0.407 to 0.621, indicating low to moderate variability in the responses. The highest standard deviation, (SD = 0.621), was observed in relation to stakeholder involvement, signifying diverse experiences or expectations regarding this aspect. This implies a need for improved communication and inclusive planning strategies among all library stakeholders.

In practice, these findings imply that university administrations should prioritise comprehensive policy frameworks, targeted training programs, sufficient funding, and stakeholder engagement to drive AI adoption in libraries. Moreover, the emphasis on collaboration and continuous evaluation suggests that AI initiatives should be iterative, consultative, and adaptable to technological and user needs. These findings concur with the findings of a study by Shahzad et al. (2024) where the study's proposed framework

for adoption of AI in Pakistani's university libraries included skilled human resources, adequate financial resources, strategic planning, formal documentation, collaborative approach, training opportunities, adequate IT infrastructure, and technical support. The framework for adoption of AI proposed by Intel Corporation (2019) also included appropriate ICT infrastructure, adequate AI skills and competencies, security and ethical considerations, and acceptance of AI technology.

The library HOSs were subsequently provided with statements relating to the stakeholders who should to be involved in the development and implementation of AI within university libraries. Respondents rated their level of agreement with each statement on a five-point Likert scale, where 1 = Strongly Disagree and 5 = Strongly Agree. The results reflect both the frequency and percentage of responses for each item, along with corresponding means and standard deviations, offering insights into both the level of agreement and the consistency of responses. Their responses were summarised as shown in Table 4.31.

Table 4.31

HOSs Responses on Stakeholders That Should Be Involved in Developing and Implementing AI in University Libraries

Statements on factors for successful adoption of AI in university libraries	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). University administration	25(83.3%)	5(16.7%)	0	0	0	4.83	.379
(ii). Library staff	23(76.7%)	7(23.3%)	0	0	0	4.77	.430
(iii). ICT department	26(86.7%)	4(13.3%)	0	0	0	4.87	.346
(iv). Government bodies	13(43.3%)	10(33.3%)	5(16.7%)	2(6.7%)	0	4.13	.937
(v). Library users	17(56.7%)	11(36.7%)	2(6.7%)	0	0	4.50	.630

The data presented in Table 4.31 summarises the responses from the HOSs in university libraries regarding key stakeholders who should be involved in the development and implementation of AI initiatives in university libraries. The highest consensus was observed on the role of the ICT department as a critical stakeholder. A total of 30 respondents (26 strongly agree = 86.7%; 4 agree = 13.3%) endorsed its involvement, yielding 100% agreement. There were no neutral or dissenting responses. The item recorded a mean of M = 4.87 and a very low standard deviation of SD = 0.346, indicating both strong support and minimal variability in responses. This underscores a widely shared view that technical departments were essential to the operationalisation and integration of AI technologies.

Similarly, university administration was also viewed as a key stakeholder. A total of 30 respondents (25 strongly agree = 83.3%; 5 agree = 16.7%) expressed agreement, also totaling 100%. The mean score was M = 4.83, and the standard deviation was SD = 0.379, again reflecting a high degree of consensus. This finding highlights the critical role of institutional leadership in providing direction, oversight, and resource support for AI-related initiatives.

Library staff also received unanimous support from the HOSs. A combined total of 30 respondents (23 strongly agree = 76.7%; 7 agree = 23.3%) endorsed their involvement. The mean score was M = 4.77 with a standard deviation of SD = 0.430, indicating strong agreement and relatively low response variability. This result affirms that library personnel were seen as central players in implementing AI solutions, given their proximity to service delivery and users.

For library users, a slightly lower level of consensus was observed. Twenty-eight respondents (17 strongly agree = 56.7%; 11 agree = 36.7%) supported user involvement, representing 93.4% agreement. Two respondents (6.7%) were neutral, and there were no disagreements. The mean score was M = 4.50, with a standard deviation of SD = 0.630. While the overall agreement remained high, the higher standard deviation suggests some divergence in opinions, potentially reflecting different levels of perceived user readiness or relevance in strategic planning.

The stakeholder with the least agreement was government bodies. While 23 respondents (13 strongly agree = 43.3%; 10 agree = 33.3%) supported their involvement, representing 76.6% agreement, 5 (16.7%) were neutral, and 2 (6.7%) disagreed. The mean was M = 4.13, and the standard deviation was SD = 0.937, the highest among all items. This relatively high standard deviation points to varied opinions and a lack of consensus, possibly reflecting uncertainty about the government's current role, capacity, or relevance in the AI integration process.

The results suggest that the HOSs overwhelmingly support the involvement of internal university stakeholders, especially the ICT department, university administration, and library staff, in AI development and implementation. These groups received 100% agreement, with mean scores between M = 4.77 and M = 4.87, and low standard deviations ranging from SD = 0.346 to SD = 0.430. This indicates a strong and shared recognition of their roles as both enablers and executors of AI-related activities in libraries. The inclusion of library users also garnered broad support (93.4% agreement), with M = 4.50 and SD = 0.630, suggesting that user perspectives and needs were seen as important in shaping AI tools and services. Conversely, the involvement of government bodies was met with more

mixed responses, with relatively low mean (M = 4.13) and the highest standard deviation (SD = 0.937), pointing to uncertainty or divided views, which may reflect perceived limitations in governmental support structures, regulatory frameworks, or engagement in higher education library systems.

Overall, the findings indicate that internal stakeholders such ICT department, library administration, library staff, and library users were considered the most critical for the successful adoption of AI in university libraries. While external support, particularly from government entities, was recognised as important by some, it was not viewed as universally essential. According to a study by Harisanty et al. (2024), while the university administration supports AI integration in university libraries through resource allocation and fostering the culture of technological innovation, the library staff are the ones responsible for the practical use of AI tools and systems in the libraries thus are key in adoption of AI.

Similarly, Asim et al. (2023) also noted that library users and the ICT department are essential in successful adoption of AI in university libraries in that the ICT department is critical in the development and maintenance of AI systems in the library, while the users feedback is key in the tailoring of the AI to meet their specific needs. These insights imply that for AI initiatives to succeed, universities should focus on strengthening internal collaboration across administrative, technical, and operational units, while also advocating for clearer and more supportive government policies to reduce ambiguity and enhance public-sector involvement.

The responses from the library HOSs present a clear roadmap that AI adoption in libraries requires a coordinated effort led by university administrations, facilitated by ICT

departments, and grounded in the active participation of library staff and users. These stakeholders form the backbone of any effective implementation strategy. Meanwhile, efforts to engage government bodies should aim to clarify their roles and enhance their contributions to policy, funding, and regulatory support.

4.11.2 Findings from Undergraduate Students Relating to Factors for Successful Adoption of Ai in University Libraries

Similarly, the study solicited response from undergraduate students regarding factors for successful adoption of AI in university libraries. Respondents rated their level of agreement with each statement on a five-point Likert scale, where 1 = Strongly Disagree and 5 = Strongly Agree. The results reflect both the frequency and percentage of responses for each item, along with corresponding means and standard deviations, offering insights into both the level of agreement and the consistency of responses. Their responses were summarised as shown in Table 4.32.

Table 4.32

Undergraduate Students' Responses on Factors for Successful Adoption of AI in University Libraries

Statements on factors for successful adoption of AI in university libraries	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(i). A robust ICT infrastructure that can support the implementation and scalability of AI technologies in the library.	157(43.7%)	149(41.5%)	43(12.0%)	7(1.9%)	3(0.8%)	4.25	.805

Statements on factors for successful adoption of AI in university libraries	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(ii). Regular staff training and capacity building on AI and ICT to enhance skills for effective adoption and use.	157(43.7%)	143(39.8%)	49(13.6%)	5(1.4%)	5(1.4%)	4.23	.839
(iii). User education and awareness campaigns to promote understanding and acceptance of AI technologies among library users.	152(42.3%)	140(39.0%)	54(15.0%)	8(2.2%)	5(1.4%)	4.19	.869
(iv). Adequate funding and resource allocation to support the acquisition, implementation, and maintenance of AI technologies in the library	156(43.5%)	144(40.1%)	44(12.3%)	11(3.1%)	4(1.1%)	4.22	.857
(v). Clear government or institutional policies that guide AI adoption, including ethical considerations, privacy, and security issues.	140(39.0%)	148(41.2%)	53(14.8%)	10(2.8%)	8(2.2%)	4.12	.915
(vi). Collaboration with AI experts, researchers, and external partners to ensure effective AI integration and continuous innovation in library services.	144(40.1%)	147(40.8%)	53(14.8%)	12(3.3%)	3(0.8%)	4.16	.857

Statements on factors for successful adoption of AI in university libraries	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std. dev.
(vii). Development of an AI implementation roadmap, outlining clear goals, milestones, and timelines for integrating AI in library services.	147(40.9%)	136(37.9%)	61(17.0%)	10(2.8%)	5(1.4%)	4.14	.893
(viii). Stakeholder involvement and buy-in, including library staff, users, and administration, to ensure that AI adoption is well-supported and aligned with the library's strategic goals.	139(38.7%)	141(39.3%)	60(16.7%)	11(3.1%)	8(2.2%)	4.09	.933
(ix). Continuous evaluation and feedback mechanisms to monitor the effectiveness of AI technologies in the library and make necessary adjustments.	153(42.6%)	142(39.6%)	46(12.8%)	10(2.8%)	8(2.2%)	4.18	.915

Table 4.32 delineates the responses of undergraduate students regarding the essential factors for the effective integration of AI within university libraries. The most significant consensus among students was the necessity for a robust ICT infrastructure to support the implementation and scalability of AI. A total of 306 students (157 strongly agree = 43.7%; 149 agree = 41.5%) supported this, representing 85.2% agreement. Neutral responses were 43 (12.0%), while only 10 students (2.7%) disagreed. The mean score was

M = 4.25, with a standard deviation of SD = 0.805. This indicates strong support for infrastructure readiness, and the moderate standard deviation reflects relatively consistent responses with some variation in opinion.

Regular staff training and capacity building was also strongly endorsed, with 300 students (157 strongly agreed = 43.7%; 143 agree = 39.8%) indicating support, representing 83.5%. Neutral responses were 49 (13.6%), and 10 students (2.8%) disagreed. The mean was M = 4.23 with a standard deviation of SD = 0.839, showing strong agreement and moderate variability. The statement regarding user education and awareness campaigns garnered agreement from 292 students (152 strongly agree = 42.3%; 140 agree = 39.0%), totaling 81.3%. A total of 54 students (15.0%) were neutral, while 13 (3.6%) disagreed. The mean was M = 4.19 with a standard deviation of SD = 0.869. The slightly higher standard deviation reflects a broader range of opinions, possibly indicating varying levels of awareness or perceived usefulness of user education.

Regarding adequate funding and resource allocation, 300 (83.65) students agreed (156 strongly agree = 43.5%; 144 agree = 40.1%), 44 (12.3%) were neutral, while 15 (4.2%) disagreed. The mean was M = 4.22 and the standard deviation was SD = 0.857. This underscores the importance students place on financial support as a foundation for successful adoption of AI, though variability in views was somewhat higher than infrastructure support.

Clear government or institutional policies also garnered notable support, with 288 (80.2%) students in agreement (140 strongly agree = 39.0%; 148 agree = 41.2%), 53 (14.8%) were neutral, while 18 (5.0%) disagreed. The mean was M = 4.12 with a standard deviation of SD = 0.915, suggesting slightly more divergent views, likely reflecting

students' varying familiarity with or confidence in institutional policy frameworks. On the importance of collaboration with AI experts and external partners, 291(80.9%) students (144 strongly agree = 40.1%; 147 agree = 40.8%) agreed, 53 (14.8%) were neutral, and 15 (4.1%) disagreed. The mean was M = 4.16 and SD = 0.857, reflecting general agreement and moderate variability.

The need for an AI implementation roadmap was supported by 283 students (147 strongly agree = 40.9%; 136 agree = 37.9%), totaling 78.8% agreement. Neutral responses were slightly higher at 61 (17.0%), with 15 (4.2%) in disagreement. The mean was M = 4.14 and standard deviation was SD = 0.893. This suggests recognition of strategic planning, though variability points to differing perceptions of its importance. Regarding stakeholder involvement and buy-in, 280 students (139 strongly agree = 38.7%; 141 agree = 39.3%) supported this aspect, yielding 78.0% agreement. Neutral responses were 60 (16.7%), and 19 students (5.3%) disagreed. The mean score was M = 4.09 with a higher standard deviation of SD = 0.933, suggesting wider variation in students' views on the necessity of inclusive engagement. The continuous evaluation and feedback mechanisms were supported by 295 students (153 strongly agree = 42.6%; 142 agree = 39.6%), making up 82.2% agreement. Neutral responses were 46 (12.8%), and 18 students (5.0%) disagreed. The mean was M = 4.18 and SD = 0.915, reflecting strong endorsement, though a moderate degree of variation in opinions was noted.

The aforementioned findings demonstrate that undergraduate students identify a comprehensive array of factors as crucial for the successful adoption of AI in university libraries. Across all statements, the levels of agreement were notably high, ranging from 78.0% to 85.2%, indicating a broad awareness and favourable perceptions of the strategic,

technical, financial, and educational elements required for AI integration. The strongest support was noted for a robust ICT infrastructure (M = 4.25, SD = 0.805), regular staff training (M = 4.23, SD = 0.839), and adequate funding (M = 4.22, SD = 0.857).

The findings indicate that students believe AI initiatives cannot succeed without essential resources and competent personnel. The relatively lower, though still strong, support for stakeholder involvement (M = 4.09, SD = 0.933) and institutional policy frameworks (M = 4.12, SD = 0.915) underscores the necessity for enhanced communication and engagement with students regarding governance structures and collaborative planning initiatives. The higher standard deviations on these items suggest a diversity of perspectives, potentially attributable to differing levels of student awareness or experience with institutional decision-making processes.

In summary, the responses from undergraduate students emphasise the significance of a comprehensive approach to AI adoption, which includes infrastructure, training, collaboration, funding, and governance. These findings align with those from the HOSs on the factors for successful adoption of AI in university libraries, where each statement garnered agreement ranging from 79% to 100%. This indicates a consensus on the critical importance of these strategic, technical, and operational elements. Institutions should take these findings into account when developing AI frameworks and prioritise communication strategies that facilitate students' understanding of the roles of policy, planning, and stakeholder engagement. The variability in certain responses further implies that targeted sensitisation and inclusive planning could improve the acceptance and utility of AI technologies in university libraries.

4.11.3 Qualitative Findings on a Framework for Adoption of AI in University Libraries

A question regarding, "*What are the key components to be included in a framework for successfully adopting AI in university libraries, particularly from an ICT perspective?*" was directed at University Librarians and Systems Librarians (during interviews), HODs (during focus group discussions), and the library HOSs (in open-ended questions). Based on the synthesised responses from University Librarians, systems librarians, HODs, and the library HOSs, several recurring themes emerged that delineate the essential components for a comprehensive framework to guide the adoption of AI in Kenyan university libraries. These themes transcend various professional perspectives, indicating a collective comprehension of the multifaceted requirements for successful AI integration. The most significant and prevalent components derived from the data are discussed below.

1. ICT infrastructure readiness

Across all respondent categories, the fundamental necessity for a robust ICT infrastructure was underscored. Respondents consistently highlighted infrastructure as an essential prerequisite to facilitate the scalability and functionality of AI systems. As articulated by one HOD, a successful framework must "*ensure reliable high-speed Internet, modern IT systems, and secure cloud storage.*" Similarly, a Systems Librarian highlighted "*AI-ready infrastructure, regulatory compliance, and secure integration*" as core pillars. This consensus underscores that, in the absence of adequate technological capacity, including Internet bandwidth, storage, and computing power, AI adoption initiatives are likely to encounter significant challenges.

2. Staff training and capacity building

Another significant theme that emerged was the focus on staff training and ongoing professional development. Both librarians and HODs emphasised the necessity for *"comprehensive training for library staff on AI tools, with continuous learning to keep pace with technological advancements."* System librarians further supported this perspective, highlighting the importance of *"training and awareness; ethics; AI data management*" as integral components of the integration process. Additionally, the library HOSs underscored the significance of "*skills, training, and awareness strategies*" not only for staff but also for users. This indicates a collective acknowledgment that human capacity is as crucial as technological capability for the sustainable utilisation of AI in libraries.

3. Development of clear policies and ethical guidelines

A significant number of respondents emphasised the necessity of institutional and national policies to guide AI adoption. University Librarians underscored the need to *"develop policies and guidelines on implementation of AI in libraries"* and to address *"human rights aspects and a suitable legal framework*." Systems Librarians and HODs similarly emphasised the significance of *"clear AI policies,"* "*ethical governance*," and the necessity to "*ensure fairness in AI algorithms*." These assertions illustrate an increasing awareness of the potential risks associated with AI, including threats to privacy, bias, and autonomy, as well as the need for regulatory measures to mitigate these risks.

4. Stakeholder engagement and collaboration

Engaging stakeholders, from university management to students, emerged as a cross-cutting theme. Multiple respondents emphasised the need for stakeholder support,

including faculty, students, and external partners. HOS number 23 stated, *"The university management, library management, and library users should form part of the key members involved in strategising the implementation of AI."* Collaboration with successful entities and AI experts was also highlighted, suggesting that partnerships were essential for acquiring knowledge, technologies, and financial support. This implies that AI adoption should be treated as an institutional transformation project requiring broad-based buy-in.

5. Continuous monitoring and evaluation

The need for frameworks to include mechanisms for continuous evaluation and feedback was another consistent theme. Several respondents underscored the importance of monitoring, evaluation and continuous improvement to ensure that AI tools remain relevant, effective, and user-friendly. One HOD noted the value of "*regularly assessing AI tools' performance and adapting solutions as needed*," while others called for *"pilot testing and evaluation"* before full implementation. This consensus underscores the need for continuous monitoring and evaluation of AI systems to address the evolving user needs and technological advancements.

6. User-centred services

Numerous responses underscored the significance of developing AI solutions with a focus on user needs. One HOD emphasised that AI should be capable of *"differentiating between plagiarised and non-plagiarised content,"* "*identifying predatory journals,*" and "*distinguishing between AI-generated text and authentic content."* These capabilities are directly related to maintaining academic integrity and delivering user value. Furthermore, several respondents advocated for personalised services, chatbots, and intelligent search systems, which not only enhance efficiency but also improve the user experience. User

education was also highlighted as a means to increase awareness and adoption, as noted by the HOSs. This implies that AI adoption should be user-centred to ensure maximum utilisation of AI tools and systems.

7. Legal and data protection frameworks

Finally, respondents underscored the necessity of incorporating legal and ethical components within the AI framework. University Librarians highlighted the significance of "*data protection laws*," "*human rights aspects*," and "*appropriate legal frameworks*." Similarly, the library HOSs expressed concerns, advocating for robust policies on "*cybersecurity*," "*data governance*," and "*protection of personal information*." The emphasis on these issues mirrors global trends concerning the responsible utilisation of AI, ensuring that AI tools adhere to both institutional and national data protection regulations.

The findings regarding the components of an AI adoption framework, as proposed by University Librarians, systems librarians, HOSs, and HODs, include ICT infrastructure readiness, staff training and capacity building, development of clear policies and ethical guidelines, stakeholder engagement and collaboration, continuous monitoring and evaluation, user-centred services, and legal and data protection frameworks. These components encompass a diverse array of professional perspectives, indicating a shared understanding of the intricate prerequisites for effective AI integration in university libraries in Kenya.

The findings of this study concur with the findings of several other studies on the components of an AI adoption framework. For instance, Studies by Intel Corporation (2019) and Shahzad et al. (2024) pointed out ICT infrastructure as a key component of

an AI adoption framework for university libraries. Moreover, Tinholt et al. (2018) and Shahzad et al. (2024) also put forward that advancement of library staff's IT skills is one of the key aspects of the libraries' readiness to adopt AI.

On privacy and ethical concerns, several studies such as Orubebe et al. (2024) and Owolabi et al. (2022) established that AI frameworks should guide the integration of AI in ways that adhere to moral principles and take into account worries about data privacy and ethical concerns. The findings on user stakeholder engagement are also corroborated with findings of a study by Shahzad et al. (2024) that suggested that AI adoption should take a collaborative approach where all stakeholders are involved. Moreover, a study by Mala (2024) established that the use of a user-centred approach in the adoption of AI in libraries in addition to training of users on the AI technologies is key in mitigating technology resistance among the users. On continuous monitoring as a key component of an AI adoption framework, a study by Gunter (2024) found that continuous monitoring, evaluation, and improvement of AI services in libraries is essential in ensuring that these technologies are effective, ethical, and are in line with the users' information needs.

The University Librarians who participated in the interview were required to comment on governance structures and policies for successful AI implementation in university libraries. Several recurring themes that reflect the strategic and structural considerations necessary for effective AI governance in academic libraries were noted, and the same are discussed below:

1. Establishment of robust policies and guidelines

A primary recommendation was the establishment of robust *"Policies and guidelines to ensure implementation."* This reflects the need for formal documentation

that defines the objectives, scope, procedures, and ethical boundaries of AI use in university libraries.

2. Centrality of a library policy framework

A recurring theme in the responses was the significance of a library policy framework. Numerous participants underscored that the effective integration of AI's technical and human dimensions can be achieved *"by entrenching all components in a library policy framework"* or *"factoring them in the library policy."* This suggests a consensus that policy serves as a binding reference delineating procedures, expectations, roles, and accountability structures to support both the technology and its users.

3. Formation of an inclusive oversight committee

There was a clear recommendation for the formation of an inclusive oversight committee. Notably, the suggestion to *"develop a committee that will handle the whole process that includes all involved individuals"* indicates the importance of participatory governance. Such a committee should ideally consist of representatives from the library, ICT department, legal office, faculty, and student body.

4. Integration of AI governance into higher-level strategic bodies

Respondents emphasised the need for a *"strong presence of [an] AI portfolio in university governance structures."* This implies integrating AI governance into higher-level strategic bodies to elevate its importance and ensure alignment with the institution's broader mission.

5. Cross-functional collaboration

The theme on a cross-functional collaboration including ICT, legal, and library units also stood out. A recommendation for *"a combination of ICT, legal(copyright/IP),*

and library" in governance structures underscores the multidisciplinary nature of AI implementation. Collaboration among these units is essential for addressing data management, system interoperability, ethical concerns, intellectual property rights, and operational workflows as a result of the diversity of the expertise of the team members

6. Top management support

Another critical theme was top management support. Support from university leadership was also considered crucial, with one respondent specifically noting the need for *"support from top management."* High-level backing ensures that AI initiatives receive the necessary funding, policy attention, and institutional prioritisation for success.

7. Balancing technical and human integration

University Librarians also noted a recurring theme concerning the balance between technical and human integration. The explicit reference to *"integration of both technical and human aspects"* as a strategy indicates a direct and comprehensive vision for implementation. Respondents acknowledged that the success of AI is not solely a technological endeavor; it also encompasses people, workflows, and organisational culture. This emphasises the necessity of balancing investments in infrastructure with a focus on human capabilities, user needs, and staff preparedness.

8. Awareness creation

The role of awareness creation as an enabler was also notably highlighted. One respondent emphasised that *"once there is awareness, it will be easy to ensure implementation works for both technical and human [aspects]."* This underscores the importance of awareness and sensitisation as essential prerequisites for successful adoption.

9. Piloting before full adoption of an AI framework

The study further noted a theme on piloting before full adoption of the AI framework. The mention of *"the framework must be piloted before adoption"* reflects a thoughtful and iterative implementation mindset. Piloting allows institutions to test the compatibility of technical systems and gauge human responsiveness, providing valuable data to refine the framework and enhance its effectiveness.

The responses point toward a governance framework that is policy-driven, inclusive, integrated into university-wide structures, and supported at the executive level. The emphasis on legal, technological, and ethical collaboration highlights the complexity of AI implementation and the need for coordinated governance structures. According to Organisation for Economic Co-operation and Development (2024), these insights align with best practices in technology governance, which advocate for institutional readiness, stakeholder engagement, and strong leadership as prerequisites for successful digital transformation. The findings of this study concur with the findings of several other studies on the governance structures and policies for successful AI implementation in university libraries. For instance, a study by Orubebe et al. (2024) pointed out the need for a robust policy framework for guidance on the adoption of AI in university libraries.

On formation of an inclusive oversight committee, a case in point is the university of Florida that has an AI committee that promotes the ethical use, understanding, and awareness of AI technologies in the George A. Smathers Libraries' operations, collections, and services (University of Florida, 2025). Further, a study by Abulibdeh et al. (2025) established that there was need to strategically align AI integration with the institutional objectives of higher learning institutions so as to ensure that AI implementations supports

the mission, vision and values of an institution. Deloitte Development LLC. (2025) also supported the use of cross-functional collaboration in integration of AI in university libraries since it ensures that the AI applications are in line with the organisation's objectives.

The findings on top management support corroborate the findings of a study by Masinde et al. (2024) that established that the need for top management support to ensure successful adoption of AI in Kenyan university libraries. Moreover, Masinde et al. (2024) argues that human adoption and engagement with AI is more likely when stakeholders understand the purpose, functionality, and benefits of AI tools, hence the need for training for both staff and users.

The Systems Librarians were on their part asked to point out the security protocols and data governance measures they would recommend incorporating into the framework. From their responses, six major themes emerged:

1. Cybersecurity practices

Respondents consistently emphasised traditional but critical cybersecurity practices such as encryption, access control, and the use of firewalls. Systems Librarian 06 noted, *"Security protocols should include encryption, access control, data anonymisation…"*. This underscores the importance of cybersecurity as an essential prerequisite for successful adoption of AI in university libraries.

2. AI cybersecurity frameworks and AI governance mechanisms

Several participants emphasised the necessity for frameworks in AI cybersecurity and mechanisms for AI governance. As one respondent highlighted, "*these frameworks should incorporate AI governance,"* thereby extending beyond conventional ICT security

to address the operational integrity of AI. This indicates an awareness that AI systems present distinct risks, including algorithmic vulnerabilities or the misuse of automated decisions, necessitating specialised governance

3. Data protection policies and regulatory compliance

There was a significant acknowledgment of the necessity for formal data protection policies and compliance with relevant regulatory standards. One participant emphasised the requirement for *"data protection policies, an AI cybersecurity framework, regulatory compliance, and user awareness training."* This underscores alignment with Kenya's Data Protection Act and global standards such as the General Data Protection Regulation (GDPR), ensuring that institutions maintain both legal and ethical compliance.

4. Privacy, confidentiality, and copyright protection

Numerous responses emphasised the critical significance of safeguarding privacy, confidentiality, and intellectual property rights. These elements were contextualised within the realm of ethical obligations in the application of AI. As articulated by one respondent, *"Privacy and confidentiality of data, copyright protection, data breaches"* must be integral to the governance framework, particularly in the management of academic research, student records, or proprietary content. This underscores the importance of Privacy, confidentiality, and copyright protection as essential components of AI security protocols and data governance.

5. Backup systems and audit trails

Several participants mentioned the need for backup systems and audit trails in the security protocol. As one respondent highlighted, these frameworks should incorporate *"backups ensure data recovery in case of loss"* while another highlighted the necessity of

"*audit trails to track data access and usage"*. The inclusion of backup strategies and audit trails in the security protocol shows a focus on operational resilience and accountability.

6. User awareness and staff security training

The importance of awareness creation and staff training on security protocols was consistently emphasised. One respondent underscored the significance of *"staff security training,"* while another highlighted the necessity of *"user awareness training."* These observations underscore the critical human component of cybersecurity, ensuring that individuals responsible for data management possess the knowledge and skills to protect it effectively:

The aforementioned responses indicate a comprehensive strategy for security and data governance. Consequently, these themes can be categorised into the following principal aspects:

- Technical safeguards (encryption, access control, firewalls, backups)
- AI-specific frameworks (governance tailored to intelligent systems)
- Legal and policy alignment (data protection laws, copyright)
- Organisational measures (audit trails, training, awareness)

The findings by the Systems Librarians concur with the findings of several other studies on the security protocols and data governance measures that should be incorporated in an AI adoption framework. For instance, on the technical safeguards, a study carried out by Gujar et al. (2024) established that university libraries in India have adopted cybersecurity measures such as data encryption, intrusion detection systems, firewalls, regular data backup, access control, and antivirus. Moreover, the findings on AI specific frameworks are supported by National Institute of Standards and Technology

(2023) whose AI Risk Management Framework (AI RMF 1.0) emphasises principles such as transparency, trustworthiness, and accountability throughout the AI life cycle.

The views by respondents on legal and policy frameworks corroborate the findings of several studies such as Orubebe et al. (2024), Owolabi et al. (2022) and Shahzad et al. (2024) that recommend the need for university libraries to have robust policy frameworks that can guide the integration of AI in ways that ensure privacy, confidentiality and ethical concerns in the use of patrons data. Additionally, the findings on organisation measures are supported by a study by Chandramouli and Pinhas (2021) that recommended effective implementation of backup systems and audit trails to ensure data is safeguarded from loss, in addition to enhancing transparency and accountability in AI environments. Further, a study by Kavak (2024) also recommended that library staff should undergo an awareness training on compliance with information security measures in the AI environment.

When undergraduate students were engaged in an open-ended question on *"What suggestions do you have for ensuring successful adoption of AI in university libraries?"* More than 200 suggestions were received. Upon critical analysis, six major themes were noted with corresponding sub-themes as highlighted below.

1. Capacity building and training

The most prominent theme reveals a strong demand for continuous training and capacity building for both students and library staff. Many respondents believe that successful AI adoption depends on *"equipping users with the skills to use AI effectively"*. There was also emphasis on *"awareness campaigns"* to reduce fear or misconceptions about AI and to build confidence in its use. The corresponding sub-themes are:

- Staff training

- Student training
- Continuous learning and refresher sessions
- Awareness and sensitisation campaigns

2. Infrastructure and technological readiness

AI adoption was seen as heavily dependent on having a robust ICT infrastructure, such as modern computers, stable and fast Internet connectivity, sufficient power supply, and updated library systems. Respondents frequently mentioned *"hardware upgrades"*, *"installation of digital facilities", and "enhanced network* bandwidth" as crucial enablers for effective AI implementation. The corresponding sub-themes were:

- Modern ICT infrastructure (computers, networks, power)
- High-speed Internet and server upgrades
- AI-compatible software and tools
- Library system modernisation

3. Inclusive stakeholder engagement

Respondents underscored the importance of *"inclusive and participatory approaches to AI implementation"*. Consequently, engaging multiple university stakeholders, rather than just experts or administrators, ensures that AI adoption reflects *"real user needs and concerns"*. The corresponding sub-themes were:

- Public participation and stakeholder consultations
- Feedback integration
- Interdepartmental collaboration
- Involving students in AI design (e.g., chatbots)

4. Policy, strategy, and governance

A substantial proportion of suggestions underscored the necessity for well-defined AI strategies, policies, and regulatory frameworks. Participants acknowledge the potential risks associated with inadequate planning and advocate for the creation of *"roadmaps, explicit objectives, and implementation schedules"*. Additionally, ethical considerations, including *"privacy, data protection, and excessive dependence,"* were highlighted, reflecting an awareness of the governance challenges presented by AI. The associated sub-themes were:

- Clear AI policy and strategic roadmap
- Responsible AI use, ethics, and privacy
- Gradual and phased implementation
- Monitoring and evaluation mechanisms

5. Financial investment and resource allocation

The adoption of sustainable AI necessitates sufficient financial resources, a point consistently emphasised. Participants advocated for *"increased budget allocation"* to support AI programs, the acquisition of equipment, the development of infrastructure, and training initiatives. Some respondents highlighted the necessity for *"government support and grants,"* suggesting that universities may encounter challenges in independently financing these endeavours. The associated sub-themes were:

- Funding for training and equipment
- Budget prioritisation and financial planning
- Seeking external support (e.g., government or donors)

6. Practical integration and implementation

There was a pronounced demand for the practical and user-centred incorporation of AI into library systems. Numerous students advocated for *"pilot testing"*, *"gradual integration with existing systems"*, and *"user-friendly platforms"*. They emphasised a preference for tools that augment research capabilities, facilitate access to educational resources, and provide personalised assistance. Proposals such as *"AI-driven LMS"*, *"recommendation systems"*, and *"smart cataloguing"* demonstrate a keen interest in tangible AI applications specifically designed to meet academic requirements. The associated sub-themes were:

- User-friendly AI services (e.g., chatbots, search tools)
- Pilot programs and testing
- Integration with learning and library management systems
- Balance between AI and human support

The foregoing themes and sub-themes reveal that undergraduate students view the successful adoption of AI in university libraries as a process that requires strategic investment in human capacity, technological infrastructure, inclusive stakeholder engagement, strong governance frameworks, adequate funding, and practical, user-friendly implementation. Their insights reflect a desire for responsible, equitable, and participatory approaches to AI integration, balancing innovation with ethical safeguards, digital literacy, and institutional readiness. The suggestion on capacity building and training is supported by the findings of a study conducted in Nigeria by Oyedokun et al. (2018) that established that majority of the respondents (63.3%) indicated lack of training and development was a major hindrance to the use of ICT tools in libraries.

A robust ICT infrastructure is also key in adoption of AI in university libraries as demonstrated by several studies such as Amoah and Minishi-Majanja (2023) in Ghana, Eiriemiokhale and Sulyman (2023) in Nigeria, Nakaziba and Ngulube (2024) in Uganda and Mwilongo and Mwageni (2022) in Tanzania that established that the university libraries in their respective countries were lagging in adoption of AI due to inadequate ICT infrastructure. Further, the suggestion on inclusive stakeholder engagement is corroborated with the findings of Shahzad et al. (2024) that suggested that AI adoption should take a collaborative approach where all stakeholders are involved. According to Barsha and Munshi (2023), a user-centric approach guarantees that AI applications are developed in accordance with the needs and preferences of library patrons, which increases the acceptance and sustainability of AI applications in the library.

For university libraries to successfully adopt AI in provision of information services, there is need for a robust policy framework that addresses privacy, confidentiality and ethical concerns to be put in place (Shahzad et al., 2024). A study by Sang (2025) also recommended the need for a robust AI policy framework in university libraries. In support of the findings on implementation of AI in university libraries, a study by Orubebe et al. (2024) also suggested gradual, phased implementation of AI applications to enable libraries to navigate any challenges relating to the ICT infrastructure and technical expertise more effectively.

According to Masinde et al. (2024), adoption of AI requires huge financial investment in ICT infrastructure and training, which necessitates increased funding of the university libraries. Consequently, the suggestion of financial investment is supported by the findings of several studies such as Sang (2024) and Sang (2025) whose findings

indicated inadequate funding at the major hurdle in AI adoption in Kenyan university libraries. Practical integration and implementation of AI in university libraries is essential in ensuring AI technology is put to use by the users. In support of this suggestion, a study conducted by Owolabi et al. (2019) in Nigeria established that the use of the AI technology was one of the factors that influenced the readiness of the students to adopt it.

When asked to discuss about the support mechanisms that they would want to see in place when AI services were introduced in the library, the HODs narrowed on training and education, technical support and maintenance, user assistance and helpdesk services, user feedback and system improvement, data privacy and ethical monitoring, accessibility and resource integration, management and institutional support, and monitoring and evaluation. These themes highlight a holistic approach that balances technological advancement with user support, security, and continuous improvement. In line with these findings, a study by Hodonu-Wusu (2024) established that for library users to effectively utilise AI tools adopted by the library, there was need for the support from the library, including training on the use of the AI tools, provision of a virtual help desk, and balancing data privacy and security concerns.

On key recommendations for successful implementation of AI, HODs identified the following: investment in infrastructure, comprehensive training and digital literacy, data privacy and security, user-centric AI development, balanced AI-human interaction, user support & accessibility, pilot testing and continuous evaluation, policy and institutional backing, simplification of AI technologies, and community engagement and expertise. These themes offer a structured framework for integrating AI into university libraries, while ensuring a balance between technological advancement, accessibility,

ethical considerations, and institutional support. These findings align with those of University Librarians, systems librarians, HOSs and undergraduate students regarding the factors essential for the successful implementation of AI in university libraries.

4.11.4 Convergence of Quantitative and Qualitative Findings on a Framework for Adoption of AI in University Libraries

4.11.4.1 Convergence of Quantitative Findings

The quantitative results obtained from the library HOSs in university libraries and undergraduate students revealed significant convergence on the key factors critical for the adoption of AI in university libraries. These points of consensus are delineated as follows:

1. Importance of robust ICT infrastructure

Both groups demonstrated a strong consensus on the importance of robust ICT infrastructure as foundational for the implementation and scalability of AI technologies. 96.7% of the HOS agreed (strongly agree = 66.7%; 9 agree = 30.0%) on the importance of ICT infrastructure, while 306 students (157 strongly agree = 43.7%; 149 agree = 41.5%) supported this, representing 85.2% agreement. This shared perspective highlights infrastructure as a non-negotiable enabler of successful AI integration.

2. Necessity of regular staff training and capacity building

There was a consensus on the importance of regular staff training and capacity building. The HOSs demonstrated strong support for these initiatives, with 21 (70.0%) strongly agreeing and 9 (30.0%) agreeing. Likewise, 300 (83.5%) undergraduate students (157 strongly agree = 43.7%; 143 agree = 39.8%), supported regular staff training and capacity building. Both stakeholders concurred that enhancing the technical and operational competencies of library staff is essential for optimising AI adoption and use**.**

3. User education and awareness campaigns

The findings further demonstrated consensus regarding the significance of user education and awareness initiatives. This was supported by 100% of the HOSs (73.3% = strongly agreeing and 26.7% = agreeing) and 81.3% of undergraduate students (42.3% = strongly agreeing and 39.0% = agreeing). The findings indicate that the library HOSs and students underscored the critical importance of educating library users to foster enhanced understanding, acceptance, and meaningful engagement with AI technologies.

4. Adequate funding and resource allocation

Furthermore, the necessity of adequate funding and resource allocation was unanimously recognised as a critical factor by both groups. All HOSs (100%) expressed agreement, with 80.0% strongly agreeing and 20% agreeing. Undergraduate students also demonstrated support for the requirement of adequate funding, with 43.5% strongly agreeing and 40.1% agreeing. This highlights a collective comprehension that sustainable financial support is essential for the acquisition, deployment, and maintenance of AI systems.

5. Importance of partnerships

A further area of agreement was the emphasis on collaboration with AI experts and external partners. Both groups recognised that such partnerships can substantially improve the integration process and foster continuous innovation in library services. A total of 23 HOSs (76.7%) strongly agreed, and 7 (23.3%) agreed, resulting in a unified agreement of 100%. Additionally, 80.9% of undergraduate students expressed support, with 40.1% strongly agreeing and 40.8% agreeing.

6. Clear government or institutional policies

Finally, there was a consensus on the critical significance of clear government or institutional policies to guide the adoption of AI, including ethical, privacy, and security considerations. Both groups acknowledged the necessity for structured governance frameworks to facilitate successful and responsible AI implementation. All HOSs (100%) expressed agreement, with 73.3% strongly agreeing and 26.7% agreeing. Echoing this, 80.2% of the undergraduate students were in agreement.

4.11.4.2 Convergence of Qualitative Findings

The qualitative data obtained from University Librarians, systems librarians, HODs, as well as the responses to open-ended questions from HOSs and undergraduate students, reveal substantial convergence on several critical components necessary for the successful adoption of AI in university libraries. These areas of consensus reflect a shared understanding across various professional perspectives and underscore essential aspects required for effective implementation. The common themes derived from the responses are elaborated upon below:

1. Recognition of ICT infrastructure readiness as foundational

A significant area of consensus was the acknowledgment of ICT infrastructure readiness as foundational. All respondent groups consistently underscored the importance of modern technological systems, reliable Internet connectivity, and secure data storage to support scalable and functional AI systems. One of the HODs noted that a successful framework must "*ensure reliable high-speed Internet*," a Systems Librarian emphasised the necessity of "*AI-ready infrastructure*," while undergraduate students highlighted *"hardware upgrades"* and *"enhanced network bandwidth*" as essential enablers for the

adoption of AI. This collective perspective emphasises that technological capacity is indispensable for AI adoption.

2. Emphasis on staff training and capacity building

Another recurring theme was the emphasis on staff training and capacity building. Respondents collectively underscored the necessity for comprehensive training programs for library staff to ensure technical proficiency and awareness of AI tools. There was a unanimous acknowledgment that human capacity, in conjunction with technological readiness, is essential for the sustainable integration of AI. Both librarians and HODs emphasised the need for *"comprehensive training for library staff on AI tools,"* while Systems Librarians further highlighted the necessity of *"training and awareness,"* and the HOSs stressed the importance of "*skills, training, and awareness strategies*." This collective perspective underscores the importance of technological proficiency among library staff for successful AI adoption.

3. The development of clear policies and ethical guidelines

The establishment of clear policies and ethical guidelines was universally endorsed. Participants from all groups underscored the significance of institutional and national policies addressing ethical governance, data protection, and privacy issues. University Librarians expressed the necessity to *"develop policies and guidelines on implementation of AI in libraries",* Systems Librarians and HODs also emphasised the importance of *"clear AI policies,"* "*ethical governance*," while undergraduate students stressed the need for *"well-defined AI strategies, policies, and regulatory frameworks."* This collective emphasis illustrates a comprehension of the potential risks linked to AI and the imperative for regulatory safeguards.

4. Strong consensus on the significance of stakeholder engagement and collaboration

Furthermore, the findings revealed a strong consensus on the significance of stakeholder engagement and collaboration. Participants agreed that successful AI adoption requires inclusive approaches involving university management, faculty, students, and external partners. The HODS indicated the need for *"stakeholder support",* one HOS indicated that *"library users and university management should be involved",* while undergraduate students emphasised on the importance of *"inclusive and participatory approaches to AI implementation"*. This convergence highlights that broad-based buy-in and interdepartmental cooperation were critical to institutional transformation.

5. Continuous monitoring and evaluation

The necessity for continuous monitoring and evaluation was identified as a prevalent theme. All respondent categories highlighted the significance of iterative processes, such as pilot testing and periodic assessments, to ensure that AI tools remain effective, pertinent, and user-friendly. Several respondents emphasised the importance of *"monitoring, evaluation, and continuous improvement."* One Head of Department (HOD) noted the value of *"regularly assessing AI tools' performance and adapting solutions as needed,"* while others advocated for *"pilot testing and evaluation prior to full implementation"*. This convergence underscores the importance of continuous monitoring and evaluation in ensuring successful implementation of AI in libraries.

6. Importance of user-centred AI services

Additionally, there was agreement on the importance of user-centred AI services. Respondents consistently advocated for designing AI solutions with users in mind,

incorporating functionalities that enhance academic integrity, efficiency, and personalised experiences. Multiple HODs called for *"personalised services, chatbots, and intelligent search systems tools, that not only improve efficiency but also enhance the user experience"*. *"User education"* was equally highlighted as a tool to improve awareness and adoption by the HOS. Undergraduate students also emphasised on the need to ensure that AI adoption reflects *"real user needs and concerns"*. This collective emphasis illustrates a comprehension of the importance of tailoring AI tools and services to the needs of the library users.

7. User awareness campaigns

Awareness campaigns aimed at educating users were similarly emphasised across the various respondent categories. The HOSs underscored the significance of *"skills, training, and awareness strategies for users,"* whereas the Systems Librarians highlighted the necessity of *"user awareness training."* Additionally, undergraduate students also recognised the importance of *"equipping users with the skills to use AI effectively."* This convergence highlights that user awareness and training is critical for AI implementation in university libraries.

8. Legal compliance and data protection frameworks.

Ultimately, the findings underscored a collective acknowledgment of legal compliance and data protection frameworks. Participants from all groups emphasised the necessity of incorporating robust policies to protect privacy, intellectual property, and cybersecurity, in accordance with both institutional and national regulations. University Librarians highlighted the significance of "*data protection laws*" and "*human rights aspects*," whereas HOSs advocated for stringent policies on "*cybersecurity*," "*data*

governance," and "*security of personal information*." Additionally, Systems Librarians stressed the requirement for "*data protection policies, AI cybersecurity framework, regulatory compliance, and user awareness training.*" This collective perspective emphasises that legal compliance and data protection frameworks are indispensable for AI implementation.

4.11.4.3 Key Areas of Convergence across Quantitative and Qualitative Results

The results from both quantitative and qualitative analyses demonstrate substantial areas of convergence concerning the framework for adopting AI in university libraries. These points of agreement underscore a collective understanding among various stakeholders, emphasising the strategic, technological, and human-centred components essential for the successful integration of AI.

a) ICT infrastructure readiness

Both sets of findings underscore the critical significance of ICT infrastructure readiness as a foundational component. Quantitative data collected from library HOSs and undergraduate students emphasise the necessity for robust ICT systems, updated library software, and dependable Internet connectivity. Concurrently, qualitative responses from librarians and Heads of Departments (HODs) corroborate this viewpoint, identifying infrastructure as essential for scalability, functionality, and adherence to AI requirements.

b) Staff training and capacity building

Another converging theme was the emphasis on staff training and capacity building. Quantitative findings underscore the importance of continuous training initiatives and awareness campaigns in equipping library staff and users with the necessary skills to effectively utilise AI technologies. Similarly, qualitative perspectives emphasise

the need for comprehensive training programs for librarians and IT professionals to guarantee technical competence and ethical awareness.

c) Development of clear policies and governance frameworks

The development of clear policies and governance frameworks also emerge as a shared priority. Quantitative findings point to the need for ethical guidelines and monitoring mechanisms to ensure responsible AI use. This aligns with qualitative data emphasising institutional policies for ethical governance, legal compliance, and fairness in AI systems.

d) Stakeholder engagement and collaboration

Stakeholder engagement and collaboration emerged as another area of convergence. Quantitative data emphasise the necessity of inclusivity in decision-making processes, whereas qualitative findings underscore the significance of involving faculty, students, and external partners to foster buy-in and institutional support for AI initiatives.

e) Continuous monitoring and evaluation

Both analyses underscore the necessity of continuous monitoring and evaluation. Undergraduate students recommend pilot testing and iterative enhancements, whereas librarians and HODs stress the importance of establishing frameworks for regular assessment and adaptability to changing user needs and technological progress.

f) User-centred AI services

Finally, the findings consistently highlight the significance of user-centred AI services. Quantitative data emphasises the necessity for user-friendly platforms and personalised tools, whereas qualitative responses advocate for functionalities that enhance academic integrity, efficiency, and overall user experience.

The convergence of quantitative and qualitative findings underscores a cohesive understanding of the technological, strategic, and human aspects essential for AI adoption in university libraries. This alignment provides a comprehensive foundation for developing a robust and inclusive framework.

4.11.5 Regression Analysis of Aspects Influencing University Libraries' Readiness for AI Adoption in Kenya

To ascertain the degree to which key aspects influence the readiness of university libraries in Kenya to adopt AI, a multiple regression analysis was performed. This analysis evaluated the predictive efficacy of four independent variables: information services for AI adoption, ICT infrastructure readiness, library staff ICT competence, and users' perception readiness, with the dependent variable being AI readiness in university libraries. This statistical approach was selected to assess both the individual and combined effects of these variables and to determine which among them significantly contribute to university libraries' readiness to integrate AI into their service delivery. The subsequent section delineates and interprets the results of the regression analysis, which provide critical insights for developing a practical and evidence-based framework for AI adoption. Table 4.33 presents the model summary, illustrating the extent to which the combination of the independent variables explains the variance in university libraries' readiness for AI adoption.

Table 4.33

University Libraries' Readiness for AI Adoption in Kenya: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.562[a]	.316	.206	.57598	2.132

a. Predictors: (Constant), X4, X2, X1, X3
b. Dependent Variable: Y (Readiness of university libraries to adopt AI)

Table 4.33 presents a summary of the regression model's overall fit in predicting the readiness of university libraries in Kenya for AI adoption. The multiple correlation coefficient (R) is 0.562, indicating a moderate positive correlation between the combined independent variables and the dependent variable, which is the readiness of university libraries to adopt AI. This suggests that, collectively, the independent variables exhibit a moderate association with the university libraries' readiness for AI adoption.

The coefficient of determination (R^2) is 0.316, signifying that approximately 31.6% of the variance in AI readiness is explained by the four predictor variables: information services for AI adoption (X1), ICT infrastructure readiness (X2), staff ICT competence (X3), and user perception readiness (X4). This implies that while these predictor variables are significant determinants in the adoption of AI in university libraries, other organisational, financial, policy, or technological factors may also play a role in AI adoption.

The adjusted R^2 of 0.206, which accounts for the number of predictors and the sample size, suggests a modest fit of the model. The standard error of the estimate is 0.576, representing the average distance that the observed values deviate from the regression line, indicating a reasonable level of prediction accuracy. The Durbin-Watson statistic is 2.132,

indicating the absence of autocorrelation in the residuals, which confirms that the regression model satisfies the independence of errors assumption.

Table 4.34 presents the results of the analysis of variance (ANOVA), which evaluates the overall significance of the regression model and assesses whether the predictors collectively have a statistically significant impact on AI readiness.

Table 4.34

University Libraries' Readiness for AI Adoption in Kenya: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.829	4	.957	2.885	.043[b]
	Residual	8.294	25	.332		
	Total	12.123	29			

a. Predictors: (Constant), X4, X2, X1, X3

b. Dependent Variable: Y (Readiness of university libraries to adopt AI)

The ANOVA Table 4.34 presents the findings regarding the overall statistical significance of the regression model. The results indicate an F-statistic of 2.885 with a p-value of 0.043, which is below the conventional alpha level of 0.05. This suggests that the regression model is statistically significant, and the combination of the four predictors—information services for AI adoption (X1), ICT infrastructure readiness (X2), staff ICT competence (X3), and user perception readiness (X4)—reliably predict the readiness of university libraries in Kenya to adopt AI.

Table 4.35 displays the regression coefficients for each independent variable, illustrating the direction, magnitude, and statistical significance of their individual contributions to predicting AI readiness in university libraries.

Table 4.35

University Libraries' Readiness for AI Adoption in Kenya: Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.428	1.273		.336	.039
	X1	.131	.183	.135	.716	.481
	X2	.514	.183	.480	2.811	.009
	X3	.339	.400	.195	.848	.405
	X4	-.224	.173	-.267	-1.294	.208

a. Predictors: (Constant), X4, X2, X1, X3

b. Dependent Variable: Y (Readiness of university libraries to adopt AI)

The coefficients Table 4.35 elucidates the individual impact of each predictor variable on the dependent variable. The variable X1, representing information services for AI adoption, exhibits a positive unstandardised coefficient (B =0.131) suggesting a positive association with AI readiness; however, this result was not statistically significant (p = 0.481), suggesting information services alone do not significantly predict readiness for AI adoption. In contrast, X2, which represents ICT infrastructure readiness, was found to be a statistically significant predictor (B = 0.514, p = 0.009). The findings indicate that university libraries with a higher level of ICT infrastructure readiness were more likely to be prepared for AI adoption. This factor emerged as the most significant predictor within the model, as evidenced by its high standardised beta coefficient (β = 0.480).

Library staff ICT competence (X3) also demonstrated a positive correlation (B = 0.339), but the result was not statistically significant (p = 0.405). This suggests that although staff ICT competence is significant, it does not independently predict AI readiness. Additionally, users' perception readiness (X4) had a negative unstandardised

coefficient (B = -0.224) and was not statistically significant (p = 0.208). The negative coefficient indicates that user perceptions might function as an impediment rather than an enabler, although this conclusion lacks statistical significance.

The outcomes of the multiple regression analysis provide empirical evidence that significantly informs the development of a comprehensive framework for the adoption of AI in university libraries in Kenya. Notably, the significant contribution of ICT infrastructure readiness (X2) underscores the foundational importance of a robust technological infrastructure in ensuring the successful integration of AI. Consequently, the findings suggest that the framework should prioritise investment in and enhancement of ICT infrastructure across university libraries. This encompasses hardware, software, connectivity, data storage systems, and security protocols essential for supporting AI applications.

Although information services (X1) and staff ICT competence (X3) did not individually emerge as statistically significant in this model, their positive coefficients imply that these factors remain important and should be incorporated into the framework. Specifically, targeted training and capacity-building initiatives for library staff will be crucial for the implementation, management, and maintenance of AI systems. Furthermore, identifying information services suitable for AI integration, such as virtual reference services, cataloguing, and personalised information retrieval, should be central to the strategic roadmap.

The finding that user perception readiness (X4) exhibits a negative and non-significant relationship suggests potential skepticism or lack of awareness among library users regarding the use of AI in university libraries. This underscores the necessity for the

framework to incorporate strategies for change management, user sensitisation, and digital literacy campaigns aimed at fostering trust and acceptance among users.

In summary, the regression findings suggest that a robust AI adoption framework for university libraries in Kenya should:

- Prioritise ICT infrastructure development
- Include staff training and upskilling programs
- Clearly identify and align AI applications with library services
- Address user engagement and awareness to enhance receptivity.

4.11.6 Proposed Framework for AI Adoption in University Libraries in Kenya

This study examined the readiness of university libraries in Kenya to adopt AI for provision of information services, culminating in the development of a proposed AI adoption framework. The proposed framework for AI adoption in Kenyan university libraries synthesises quantitative and qualitative insights from HOSs in the library, system librarians, University Librarians, students, and HODs, offering a comprehensive framework for sustainable AI integration in university libraries in Kenya.

The strong alignment between user needs, staff perspectives, and technological opportunities indicates a conducive environment for implementing AI-driven transformations, contingent upon institutional leadership making strategic investments in supporting infrastructure, training, and governance systems. Key findings demonstrate general optimism towards AI adoption while also identifying significant barriers, particularly related to inadequate ICT infrastructure, insufficient staff training, and financial constraints. Ultimately, the sources underscore the critical necessity for strategic

investment, targeted training, and policy frameworks to effectively leverage AI for enhanced library services and user experience.

Based on the results presented in sections 4.6 through 4.11 and their corresponding subsections, a comprehensive framework for adopting AI in university libraries in Kenya can be developed. This framework was informed exclusively by findings concerning information services that can supported by AI, ICT infrastructure readiness, library staff ICT competence readiness, users' perception readiness, overall readiness for AI adoption, as well as specific feedback on framework components. The key components identified across various population categories' perspectives (the library HOSs, undergraduate students, University Librarians, systems librarians, and the HODs) demonstrate a shared understanding of the prerequisites for successful AI integration.

The nine core components for a framework for AI adoption in university libraries in Kenya, identified in this study include: Core functional service areas for AI implementation, infrastructure and digital readiness, enabling technologies, adequate funding, capacity building and AI literacy, policy, ethics, and governance; strategic alignment and innovation, stakeholders' collaborations, and data-driven evaluation and feedback mechanisms.

1. Core functional service areas for ai implementation

This component represents the specific library services identified in the results as most amenable to AI integration. These include reference services, information retrieval, cataloguing, classification, circulation, and Selective Dissemination of Information (SDI). The service areas that were noted as having high convergence in the findings was reference and circulation (mean scores were above 3.4 from students) (Section 4.6.2). At

the same time, there was a strong support for adoption of AI in services like cataloguing (M = 4.60), classification (M = 4.57), and information retrieval (M = 4.57) by the library HOSs (Section 4.6.1). Additionally, qualitative endorsement by University Librarians, who cited cataloguing and information retrieval as key areas for automation (Section 4.6.3).

2. Infrastructure and digital readiness

This element pertains to the technological infrastructure essential for the effective deployment of AI. This component was identified as a foundational requirement for AI adoption. The findings consistently underscored deficiencies in the existing ICT infrastructure, including low Internet bandwidth, unstable networks, obsolete computer systems, and a lack of advanced computing systems capable of supporting AI applications. The focus group discussions with HODs highlighted challenges in accessing electronic resources and a desire for digital integration (Section 4.7.3). Additionally, the students' frequent utilisation of digital services and their demand for AI-supported online portals (Section 4.7.2), further corroborate the identification of this component.

Notably, the availability of necessary AI-related software and tools, such as machine learning frameworks, NLP tools, and AI model management platforms, was perceived as limited and needs improvement. Regression analysis indicates ICT infrastructure readiness as a significant predictor of overall AI readiness. Consequently, without a robust ICT infrastructure and system interoperability, even the most advanced AI tools will be ineffective.

3.Enabling technologies

Enabling technologies encompass the AI tools and technologies that power functional domains. This conclusion is derived from the findings regarding respondents' awareness of Natural Language Processing (NLP), machine earning, robotics, and expert systems, as presented in Table 4.8. Additionally, significant evidence was provided through the mention of technologies such as predictive analytics and AI-powered recommendation systems in qualitative interviews (Section 4.6.3), along with the perceived advantages of AI-driven search, classification, and recommendation systems as reported by both staff and students (Sections 4.6.1 & 4.6.2). This component is crucial, as the nature and accessibility of these technologies influence the scope and quality of AI applications within libraries.

4.Capacity building and AI literacy

This component is about preparing staff and users for effective AI use. The results noted neutral or negative responses from staff and students reflecting limited familiarity with AI, especially robotics and expert systems (Table 4.8); one systems librarian's admission of uncertainty about how AI technology's function (Section 4.6.3), and recognition by librarians and HODs that AI implementation "*creates opportunities for staff to develop new skills"* (Section 4.6.1). The need for targeted training, upskilling, and AI sensitisation was evident to ensure competent use and reduce resistance to change.

Further, the findings revealed that while staff possessed basic ICT literacy, there was a perceived gap in intermediate and advanced skills crucial for managing and leveraging AI tools, including proficiency in programming languages, cloud computing platforms, and understanding of AI model management (section 4.8.1). Consequently, the

framework must include regular, structured training and capacity-building programs focusing on basic AI concepts, data analytics, ethical use of AI, practical application of AI tools, cybersecurity, and potentially advanced areas like machine learning and cloud computing.

The component also entails user education and awareness campaigns to strengthen AI literacy. Students showed high interest (Figure 4.7) and perceived benefits from AI in services like search, recommendation, and 24/7 assistance (Table 4.25). However, they had concerns regarding data privacy, security, accuracy, usability, over-reliance, and lack of staff support (Table 4.23). This framework component must therefore focus on user education and awareness campaigns to demystify AI, explain benefits and limitations, address concerns, build trust, and enhance digital literacy.

5.Adequate funding

This component ensures there is adequate funding for AI implementation in university libraries. Implementing AI requires substantial investment in infrastructure, software licenses, training, and ongoing maintenance. In this this study, financial constraints were consistently identified as a critical barrier to AI adoption. There was a clear consensus on the role of limited funding as a barrier to AI implementation with both University Librarians and HODs citing budgetary limitations as a major obstacle. The University Librarians also endorsed adequate funding and resource allocation as one of the key factors in enhancing the readiness to adopt AI (Table 4.30). This component of the framework is expected to include an aspect of a strategy for securing adequate funding and resource allocation dedicated specifically to AI initiatives in libraries. This

underscores the need for budgetary prioritisation and seeking external funding opportunities.

6.Policy, ethics, and governance

This component ensures responsible and regulated AI use. This component includes the development of clear institutional and national policies that guide AI use, addressing ethical considerations, privacy, security, data protection, legal compliance, and intellectual property (like copyright). This was also supported by results from HODs' concerns about bias, inaccuracies, and copyright infringement in AI-generated content, recognition by students of the risks of misinformation and the need for *"fact-checking"* systems, and Librarians' acknowledgment that AI must be implemented with user consent and data protection considerations (Section 4.6.3).

7.Strategic alignment and innovation

AI adoption needs a clear roadmap. Therefore, this component focuses on aligning AI efforts with long-term institutional goals. It includes identifying specific information services that can benefit most from AI, such as cataloguing, information retrieval, reference services, and services for the visually impaired and outlining clear goals, milestones, and timelines for integrating AI into these services. In this study, the library's HOSs referred to AI as a *"driver of progress"* and expresses aspirations for the development of *"smart libraries"* (Section 4.6.3). Additionally, there is an acknowledgment of AI's contribution to *"reputation enhancement"* and its support for research, teaching, and learning (Section 4.6.1). The study also highlights the mention of support for AI tools capable of summarising academic literature, facilitating curriculum development, and guiding grant discovery (Section 4.6.3). Furthermore, the framework

proposes piloting prior to full implementation and establishes mechanisms for continuous evaluation and feedback to monitor effectiveness and facilitate necessary adjustments.

8.Stakeholders' collaboration

This entails collaboration among university management, library staff, students, and external partners to ensure alignment with institutional goals. The findings indicated strong consensus for involving university administration, library staff, the ICT department, and library users in the adoption of AI (Table 4.30). Collaboration with AI experts, researchers, external partners, and potentially government bodies was also recommended (Table 4.31). This component ensures that AI adoption is well-supported, aligns with strategic goals, and benefits from diverse expertise and perspectives throughout planning and implementation.

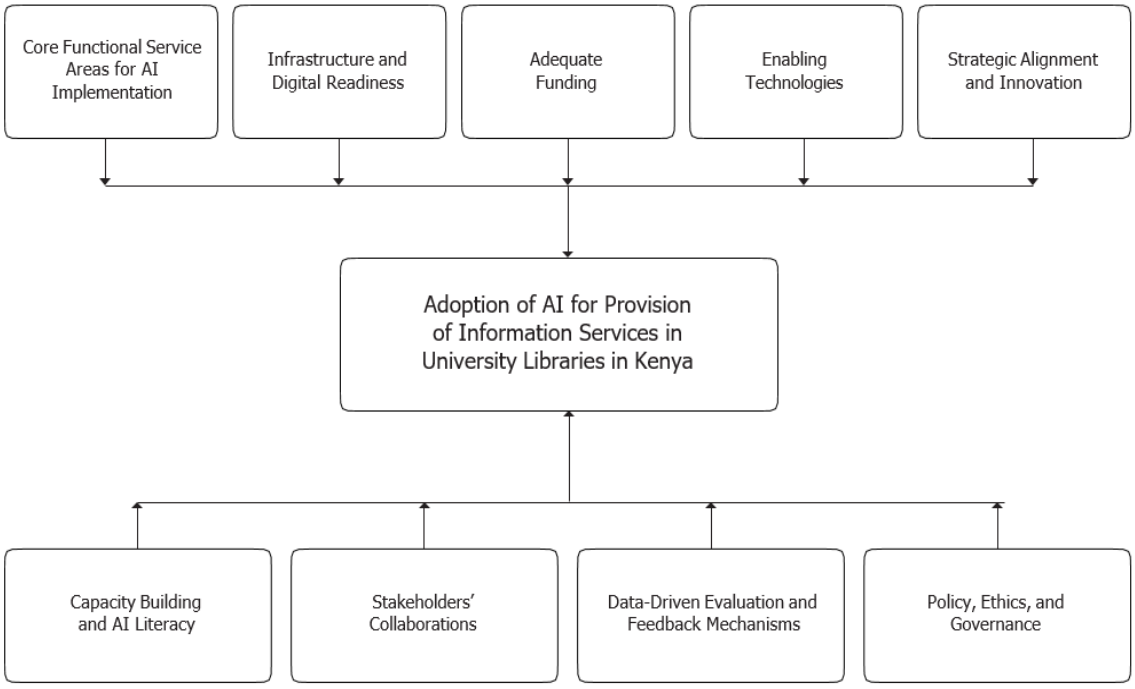
9.Data-driven evaluation mechanisms

The main function of this component is establishing mechanisms for continuous monitoring and evaluation of AI effectiveness to adapt the framework as required. There is evidence of quantitative findings showing student perceptions on service effectiveness (Section 4.6.2). Similarly, the HODs' comments advocating for continuous feedback and evidence-based adjustments (Section 4.6.3) provide further justification. This component underscores the importance of monitoring AI tools' impact to refine strategies and justify investments.

Figure 4.8 is an illustration of the proposed framework for AI adoption in university libraries in Kenya, with a diagrammatic demonstration of the main components.

Figure 4.8

Proposed Framework for Adoption of AI in University Libraries in Kenya



Source: Research Data

4.11.6.1 Description of the Interplay of Components in the Proposed Framework

The efficacy of the proposed framework for AI adoption in university libraries in Kenya is contingent upon the interdependence of its components. These components exhibit a high degree of interconnectedness and mutual reliance. The core functional service areas for AI implementation serve as the main touchpoints for users. These include the information services provided by university libraries, such as circulation, reference, classification, information retrieval, services for the visually impaired, SDI, acquisition,

plagiarism detection, content summarisation, curriculum development support, content recommendation, weeding, and security.

Effective implementation also necessitates robust ICT infrastructure readiness. This encompasses the availability of high-speed Internet, computer systems capable of supporting AI applications, cloud computing services, up-to-date security systems, machine learning platforms, a robust server capacity to manage AI-based processes and data, and a network infrastructure scalable to accommodate future AI advancements. Without the appropriate ICT infrastructure or interoperability of AI tools and systems with existing library systems, even the most well-trained staff cannot effectively deploy AI tools.

The enhancement of these services with AI is feasible only through the integration of enabling technologies, such as Natural Language Processing (NLP) for improving information retrieval, expert systems for enhancing decision-making in acquisition, pattern recognition for personalised recommendations, machine learning for personalised information services, robotics as a tool for automating tasks in reference service and information retrieval, machine learning for cataloguing and classification of library resources, and predictive analytics in acquisition and circulation of information resources.

The operation of these technologies requires skilled personnel and informed users, rendering capacity building indispensable. Without trained staff, AI tools may be underutilised or misapplied, as noted by Systems Librarians who expressed a lack of technical knowledge. Competent staff, equipped through capacity building, are crucial for implementing, managing, and maintaining the AI systems operating on the robust ICT infrastructure. They also play a pivotal role in supporting user education and awareness,

assisting users in understanding and effectively utilising the new AI-powered services. Structured training programs, such as conferences, workshops, and seminars, should be organised for library staff, while AI literacy programs should be provided for library users.

Similarly, adequate funding serves as the enabler that facilitates investment in a robust ICT infrastructure necessary for AI adoption, the purchase of AI-specific tools/licenses, and the provision of staff capacity-building initiatives. A strong ICT infrastructure, in turn, provides the technical foundation necessary for deploying and scaling AI applications. University libraries in Kenya should therefore be adequately funded by their parent organisations, in addition to seeking alternative funding, to ensure sustainable funding for AI adoption.

To prevent ethical dilemmas or misuse, all activities must occur within a regulated framework informed by policy, ethics, and governance. Policies and governance provide the regulatory and ethical framework for AI adoption, ensuring data privacy, security, and responsible use of AI technologies deployed on the infrastructure and managed by staff. Clear policies build user trust and guide the strategic planning and implementation process. This ensures transparency, data protection, and trust in AI systems.

Strategic alignment and innovation integrate all components toward a shared institutional vision. It fosters an environment where AI is adopted not for novelty, but as a core enabler of smart, user-centred library services. Achieving this requires well-considered strategic planning and a clear roadmap, identifying which information services will be enhanced by AI, setting goals, and outlining implementation steps. The planning relies on understanding the current infrastructure capacity, assessing staff skills, considering user needs and perceptions, and aligning with available funding.

Stakeholder collaboration is an overarching element that is vital throughout the process. Involvement in administration ensures strategic alignment and securing of funding. Collaboration with the ICT department is essential for infrastructure planning and maintenance. Library staff involvement is key for operational planning, training needs assessment, and user support. User engagement provides critical feedback for service alignment and user education strategies. External collaboration can bring expertise for advanced AI implementation and policy development.

A data-driven evaluation and feedback mechanism is necessary to ensure that AI systems in university libraries are effective, aligned with business goals, ethical, and continuously improving rather than static deployments. Without systematic measurement and structured feedback, AI initiatives risk becoming isolated experiments that generate limited value, accumulate hidden risks, and gradually lose relevance. However, with a strong evaluation mechanism in place, organisations can ensure that AI systems remain aligned with business objectives, ethical standards, and operational realities.

4.11.6.2 Validation of the Proposed Framework for Adoption of AI in University Libraries in Kenya

To ascertain the credibility, applicability, and utility of the proposed framework for the adoption of AI in university libraries in Kenya, the researcher employed an expert review process for validation. Consequently, three University Librarians and three Systems Librarians were selected. The selection of these subject matter experts was based on their roles, ensuring that the framework's components were pertinent, comprehensive, and logically structured. University Librarians were chosen due to their responsibilities in the strategic direction of the library, budgeting, policy interpretation, and the alignment of

technology with the university library's mission. Systems Librarians were selected for their expertise in implementing new technologies, integrating and maintaining library systems, and managing the digital infrastructure required for AI tools.

The proposed framework, along with a description and rationale for each component, as well as a questionnaire for validating the framework (see Appendix XI), was distributed to the respondents to solicit feedback on clarity, relevance, and completeness. Quantitative data obtained from the questionnaires were analysed using descriptive statistics, including mean, frequency, and percentages, while thematic analysis was employed for the qualitative data. Subsequently, the framework was revised to incorporate the experts' feedback.

Findings on the Validation of the Proposed Framework for Adoption of AI in University Libraries in Kenya

The University Librarians and Systems Librarians were presented with a series of statements concerning the evaluation of the proposed framework. They were instructed to indicate their level of agreement or disagreement with each statement. The rating scale employed ranged from 1 to 5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1. The findings are delineated in Table 4.36.

Table 4.36

Experts Responses on Validation of the Proposed Framework for Adoption of AI in University Libraries in Kenya

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std dev.
(i). The framework is comprehensive and logically structured	5 (83.3%)	1(16.7%)	0	0	0	4.8	0.374
(ii). It is applicable to the context of university libraries in Kenya	6 (100%)	0	0	0	0	5	0.000
(iii). It provides practical guide for AI adoption and implementation	5 (83.3%)	1(16.7%)	0	0	0	4.8	0.374
(iv). I would recommend this framework for adoption with or without minor improvements	4 (66.7)	2 (33.3%)	0		0	4.7	0.472

According to the data presented in Table 4.36, a majority of 5 respondents (83.3%) expressed strong agreement, while 1 (16.7%) respondent agreed that the framework was comprehensive and logically structured. This high level of agreement signifies a strong belief in the framework's comprehensiveness and logical organisation. In response to the inquiry regarding the framework's applicability to the context of university libraries in Kenya, all respondents (100%) unanimously strongly agreed that the proposed framework could be effectively applied within this context. This overwhelming endorsement reflects the experts' confidence in the framework's applicability to Kenyan university libraries.

Concerning whether the framework offered a practical guide for AI adoption and implementation, 5 (83.3%) respondents strongly agreed, while 1 (16.7%) respondent agreed. The near-unanimous agreement suggests that the framework is suitable for practical AI implementation in university libraries in Kenya. When queried about their

willingness to recommend the framework for adoption with or without minor improvements, 4 (66.7%) respondents strongly agreed, while 2 (33.7%) respondents agreed. These findings indicate that the proposed framework is viable for adoption by university libraries in Kenya for the integration of AI in information service provision.

Consequently, the quantitative data demonstrated strong support for the framework's adoption in Kenyan university libraries for AI integration. In an open-ended question within the questionnaire, experts were invited to provide additional feedback, suggestions for improvement, or identify any missing elements they believed should be included in the framework for AI adoption in Kenyan university libraries. Their responses highlighted several prominent themes reflecting their perspectives on the components necessary for such a framework. The recurring themes included the necessity of integrating AI with existing library systems and incorporating additional information services where AI could be utilised, such as weeding and security. The experts' input was subsequently integrated into the framework, with interoperability being incorporated into the infrastructure and digital readiness component, and the suggested additional services being included in the core functional service areas for AI implementation component.

4.11.6.3 Implementation of the Framework for AI Adoption in Kenyan University Libraries

The proposed framework for AI adoption in Kenyan university libraries commences with conducting comprehensive needs assessments to identify service areas that would derive the most benefit from AI integration. The initial deployment should prioritise high-impact functional areas such as reference services, information retrieval, cataloguing, and circulation, where stakeholders have demonstrated the strongest support.

Implementation necessitates sufficient funding for the acquisition of enabling technologies and the establishment of a robust ICT infrastructure, encompassing high-speed Internet, cloud-based platforms, and integrated library management systems capable of supporting AI tools.

Critical to successful implementation is building AI literacy through targeted capacity-building programs for both library staff and users, addressing the significant knowledge gaps identified in the study. Concurrently, libraries must develop ethical guidelines and governance structures to address concerns regarding misinformation, bias, copyright infringement, and data privacy. A phased, pilot-based rollout approach is recommended, rather than the simultaneous implementation of AI services across all areas, thereby facilitating monitoring, feedback collection, and refinement prior to wider deployment.

The framework underscores the promotion of inclusivity and accessibility, particularly for underserved groups such as visually impaired users, through AI-powered assistive technologies. Furthermore, libraries should foster innovation and enhance research support services through AI tools for citation management, plagiarism detection, and literature summarisation. Regular innovation displays and competitions can stimulate creative AI applications within the library ecosystem, thereby advancing the integration of AI into academic research and scholarly communication processes.

Continuous monitoring and evaluation systems must be integrated at every stage of AI deployment, augmenting existing assessment methodologies such as surveys and usage metrics while incorporating AI-driven analytics tools. Strategic alignment with broader university objectives is imperative to secure institutional support and integrate

library services with the university's overall innovation ecosystem. This alignment aids in facilitating management buy-in, ensures adequate funding, and positions the library as a fundamental component of the institution's digital transformation journey.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides an overview of the study's conceptualisation and a summary of the research findings and conclusions. It also provides recommendations based on the research findings and recommendations for future research.

5.2 Summary of Conceptualisation of the Study

The study aimed to evaluate the readiness of university libraries in Kenya to adopt AI in providing information services and to develop a framework for such adoption. The study was guided by the following objectives: to determine the information services where AI can be adopted in university libraries in Kenya, to examine the status of ICT infrastructure readiness in adopting AI in university libraries in Kenya, to assess the library staff level of ICT competence in readiness for AI adoption in information provision in university libraries in Kenya, to evaluate the users' perception readiness towards adopting AI in university libraries in Kenya and to develop a framework for adopting AI in university libraries in Kenya. The reviewed literature indicated that there were knowledge gaps.

The study employed a pragmatic research philosophy, a descriptive survey research design, and a mixed methods research approach. The target population encompassed seven University Librarians, seven systems librarians, 31 library Heads of Sections (HOSs), 90,091 undergraduate students, and 168 Heads of Departments (HODs) from the University of Embu, Jomo Kenyatta University of Agriculture and Technology

(JKUAT), Egerton University, Murang'a University of Technology, United States International University - Africa (USIU - Africa), Kenya College of Accountancy (KCA) University and Kenya Highlands University.

The classical formula by Fisher (1998) for a population of less than 10,000 followed by stratified random sampling was used to select the seven university libraries that participated in the study. Census approach was used in selection of the University Librarians and systems librarians, purposive sampling was used in selection of the HODs and library HOSs while undergraduate students were sampled using Saunders et al.'s (2012) table for calculating sample size with a 5% margin of error. Consequently, seven University Librarians, seven systems librarians, 31 library HOSs, 383 undergraduate students and 13 HODs were sampled for the study. Data for the study was collected through online questionnaires, interviews and focus group discussions (FGDs). Data quality was ensured through content, construct and face validity, while Cronbach value was used to check reliability of the research instruments. The researcher used descriptive and inferential statistics to analyse the quantitative data, and tables and figures used to present the results. Thematic analysis was used in the analysis of the qualitative findings.

5.3 Summary of the Major Findings

The study achieved an overall response rate of 89.76%. The summary of the major findings is systematically presented based on the study's main variables which included information services where AI can be adopted, ICT infrastructure readiness in adopting AI, readiness of staff's ICT skills and competencies to adopt AI, users' perception readiness in adopting AI, readiness of university libraries to adopt AI for provision of information services and development of a framework for adoption of AI in university

libraries. A summary of the key findings for each variable is presented in the subsequent sections.

5.3.1 Summary of results on the Profiles of Respondents

The seven university libraries included in the study exhibited a nearly balanced gender distribution among the Heads of Sections (HOSs), with 56.7% being male and 43.3% female. A substantial majority of the respondents possessed the necessary qualifications, with 50% of the HOSs holding a bachelor's degree and 46.7% having a master's degree. In terms of professional experience, an overwhelming majority (76.7%) had accumulated over a decade of experience as librarians. The HOSs were distributed across various library sections, including reader services, technical services, reference services, digital library, and special collections.

Among the undergraduate students, 61.6% fell within the 21-30 age range, with the largest group originating from the Social Sciences (46.8%), followed by those in Engineering and Technology (30.1%). The frequency of library usage indicated that 40.1% of students utilised the library on a weekly basis, 14.5% visited daily, 13.9% visited monthly, while a considerable proportion of students (31.5%) infrequently used the library.

The majority of University Librarians and Systems Librarians in the study had extensive tenure in the library sector, with some possessing over 25 years of experience. The Heads of Departments (HODs) were predominantly from the fields of Information Technology (IT) and Library and Information Science (LIS). In terms of years of experience, a significant number of HODs had served for a decade or more, with some reporting 15, 18, and even 20 years of experience in academia.

5.3.2 Summary of Results on Information Services Where Artificial Intelligence Can Be Adopted

The first objective of the study was to determine the information services where AI can be adopted in university libraries in Kenya. This was achieved through evaluating the staff's familiarity with the various AI technologies for information services, finding out the existing information services provided by university libraries that would benefit most from AI, and evaluating how AI adoption would improve these services.

On the staff's familiarity with the various AI technologies for information services, the findings of the study revealed that there was a relatively high level of awareness among HOSs, with the highest familiarity being recorded in the use of AI for cataloguing and classification (M = 4.37), followed by pattern recognition (M = 4.13) and predictive analytics (M = 4.00). However, neutral responses were recorded in familiarity with some of the AI technologies, highlighting areas where training or exposure was required to enhance understanding. The Systems Librarians also highlighted how machine learning could reduce errors and enhance metadata accuracy in cataloguing and classification. The results imply that to facilitate AI integration in university libraries, targeted professional development programs, AI literacy initiatives, and pilot projects should be introduced to demonstrate the practical applications of AI in enhancing library services.

Regarding the information services where AI can be adopted, the findings from the undergraduate students, library HOSs, University Librarians, systems librarians, and the HODs indicated that AI could be adopted to enhance existent information services such as reference services, information retrieval, cataloguing, classification, circulation, content recommendation and summarisation, and access to e-resources. Most of the

undergraduate students rated reference services and information retrieval among the most frequently used library services (M = 3.60 and M = 3.63, respectively), with high perceived potential for AI enhancement (reference: M = 4.07; information retrieval: M = 3.97). The results from the HOSs indicated strong support for AI adoption across various university library services in Kenya with an average mean of 4.47. The university and Systems Librarians consistently emphasised reference services, information discovery, literature search, cataloguing and classification as key areas where AI could improve accuracy, user engagement, and availability. These findings suggest that AI can be adopted in provision of various information services offered in Kenyan university libraries. However, there was a necessity for targeted AI training programs to address gaps in awareness and implementation readiness.

Concerning how AI adoption would improve the existent services, the study's findings established that undergraduate students, library HOSs, University Librarians, systems librarians, and the HODs believed AI could enhance existent services. Majority of the HODs indicated that AI had the ability to reduce wait times (M = 4.60), enhance accessibility through 24/7 assistance (M = 4.60), and improve digital collection organisation (M = 4.50) while undergraduate students revealed combined agreement levels across all the perceived benefits of AI, ranging from 76.1% to 83.6%. The Systems Librarians indicated that machine learning could reduce errors and enhance metadata accuracy in cataloguing and classification in addition to managing digital access and personalisation; the HODs indicated that AI could enhance searching in digital databases and provide personal recommendations; while the undergraduate students and HODs alike indicated AI could improve searchability, citation, and classification. These findings

suggest that AI has the potential to transform university library services by improving efficiency, reducing costs, and enhancing user experiences. However, its success is dependent on strategic investments in AI infrastructure, training programs, and continuous evaluation to ensure sustainable implementation.

The regression analysis indicated that information services for AI adoption had a positive unstandardised coefficient (B = 0.131), indicating a positive relationship with AI readiness. However, this result was not statistically significant (p = 0.481), suggesting that information services alone did not significantly predict readiness for AI adoption. The positive coefficient however suggests the need for university libraries to identify information services that are suitable for AI integration, such as virtual reference services, cataloguing, classification, and personalised information retrieval. Such services should be prioritised in the strategic roadmap for adoption of AI in university libraries.

5.3.3 Summary of Results on ICT Infrastructure Readiness in Adopting Artificial Intelligence

The second objective of the study was to examine the status of ICT infrastructure readiness in adopting AI in university libraries in Kenya. The primary indicators used to assess this objective were the availability of high-performance computing resources such as high-performance servers and super computers, large scale data storage systems, high-speed networking, specialised software and operating systems, and cloud computing infrastructure; AI development tools and platforms, reliable network Infrastructure and robust cybersecurity measures.

On availability of high-performance computing resources, the findings of the study indicated that a high proportion of respondents identified the need for updated computing

equipment with only 53.3% of the HOSs indicating that their libraries had advanced computer systems capable of supporting AI. Additionally, only 46.7% HOSs and 50.1% of the undergraduate students indicated that their libraries had robust server capacity to handle AI-based processes and data. Regarding cloud computing services, 18 HOSs (60.0%) indicated that such services were available in their libraries while 7 (23.3%) disagreed. Similar concerns emerged regarding server capacity, where only 14 HOSs (46.7%) agreed that their libraries have robust server infrastructure, while 9 (30.0%) disagreed. Qualitative findings echoed these concerns, with university and Systems Librarians emphasising the need for high-performance servers. These findings suggest the need for university libraries in Kenya to invest in high-performance computing resources to ensure smooth integration of AI into their services.

Regarding the availability of AI development tools and platforms, the study's findings indicated that there was low availability of AI software and tools necessary for adoption of AI. The findings from the library HOSs revealed low availability of AI-related software and tools with a mean of 2.8. Specifically, AI tools such as machine learning frameworks (M = 2.50) and AI model management platforms (M = 2.53) were rated low by the HOSs. The qualitative data from the HODs also indicated the need for digital transformation, including AI-powered discovery tools and recommendation systems, in enhancing research support in the digital library. These findings highlight the need for university libraries in Kenya to prioritise investing in both proprietary and open-source solutions that may offer scalable options for enhancing information services through AI`.

On the network infrastructure, the findings from the HOSs revealed that there were high levels of agreement on the availability of cable, Wi-Fi, fiber-optic, and Ethernet

Internet connections suggesting that the basic network infrastructure was largely in place. However, there was low rating of availability of advanced network connections such as satellite Internet (M =2.57) and 5G technologies (M = 3.63), reflecting a gap and redundancy in modern mobile access options, particularly for libraries in remote or underserved areas. Moreover, only 23.3% of the HOSs indicated that their Internet speed, quality and reliability were very good while only 34.5% of undergraduate students rated it as excellent. The qualitative findings confirmed this, with University Librarians, Systems Librarians and HODs emphasising the need for upgraded Internet bandwidth, and fiber-optic connectivity. The findings suggest the need for strategic upgrades in the network infrastructure to guarantee deployment of AI in university libraries in Kenya.

Findings on the availability of robust cybersecurity measures revealed that 50% of the HOSs and 52.4% of the undergraduate students indicated that their libraries had security systems in place to ensure safe implementation of AI technologies. These findings indicate that most libraries have implemented key cybersecurity measures necessary to support AI adoption. However, areas like multi-factor authentication (M = 3.67) and intrusion detection systems (M = 3.90) received slightly lower ratings, indicating room for improvement. The qualitative data from University Librarians also stressed the need for strengthened data protection, especially in the context of AI-generated or processed information, while the Systems Librarians emphasised the importance of re-evaluating and enhancing security protocols before full AI adoption. These findings highlight the need for promoting cybersecurity awareness and enforcing structured access protocols to strengthen the security framework to ensure responsible deployment of AI tools in library settings.

The findings from the responses also revealed concerns about the funding for the ICT infrastructure for AI adoption in libraries. The findings from the HOSs indicated that only 33.3% indicated that their libraries had a budget allocation for upgrading ICT infrastructure to integrate AI. Further, the mean score for availability of budget allocation for upgrading ICT infrastructure was the lowest among all items at 2.93 (SD = 1.08), highlighting budget constraints as a significant barrier to AI readiness. The findings from the University Librarians also indicated that there was lack of library-specific budgetary provisions for ICT infrastructure for AI adoption. These findings indicate the need for the university libraries to be allocated a budget for acquisition of ICT infrastructure needed for deployment of AI, employment of expertise to manage the infrastructure and training of the library staff on the use of AI tools and systems for provision of information services.

Concerns about the integration of AI with existing library systems such as the Library Management System (LMS) were also noted from the responses. The qualitative responses from the undergraduate students and the library HOSs suggested the importance of integration of AI with existent systems in the library, while the University Librarians, Systems Librarians and HODs also identified the compatibility challenges of current LMS platforms with AI tools and platforms. Based on this study's findings, there was need for university libraries in Kenya to collaborations with AI tool developers to ensure that AI tools were tailored to the requirements of their university libraries.

The regression analysis findings indicated that ICT infrastructure readiness was a statistically significant predictor ($B = 0.514$, $p = 0.009$), suggesting that university libraries with higher levels of ICT infrastructure readiness were more likely to be prepared for AI adoption. This was the most impactful predictor in the model, as reflected by its

high standardised beta coefficient (β = 0.480). This highlights the foundational role of robust ICT infrastructure, including hardware, software, connectivity, data storage systems, and security protocols, in ensuring successful AI integration in university libraries.

The findings from the various categories of respondents in the study presents a unified view of the ICT infrastructure requirements for AI readiness in university libraries. These include infrastructure development, optimisation of the Internet speed, bandwidth and reliability, enhancement of technical expertise, integration of AI tools and platforms with the existing library systems, efficient data storage and governance, advanced cybersecurity measures, and strategic budgeting for AI deployment in libraries.

5.3.4 Summary of Results on Readiness of Staff's ICT Skills and Competencies to Adopt Artificial Intelligence

The third objective of the study focused on assessing the library staff's level of ICT competence in readiness for AI adoption in information services provision in university libraries in Kenya. These objective assessed aspects that included the library staff's technical proficiency in basic, intermediate, and advanced ICT skills, availability and uptake of AI-focused training programs, such as workshops, courses, and certifications and assessment of the degree of confidence library staff have in their capacity to utilise AI technologies successfully.

The findings of the study on the technical proficiency of the library staff indicated that the library staff were not fully prepared to adopt AI technologies. The quantitative findings from the HOSs showed that while majority of the library staff had high proficiency in basic ICT skills (Average Mean = 4.56), and intermediate ICT skills

(Average Mean = 4.36), they had moderate proficiency in advanced ICT skills (M = 3.30). Similarly, the majority of the undergraduate students (42.9%) rated the library staff's ICT skills as average. The qualitative responses also reinforced this view with the Systems Librarians indicating the need for the library staff to upscale their skills while the HODs indicated the need for the library staff to be trained in preparation for adoption of AI. These results demonstrate a common recognition that while some foundational ICT skills may be present, AI-specific competencies remain largely underdeveloped hence the need for training of the library staff to enable them to effectively use AI tools and systems.

On availability and uptake of AI-focused training programs, the findings indicated a shared call for structured, role-specific, and continuous training. Quantitative data from the HOSs indicated their preference for interactive, applied, and flexible training methods such as on-the-job training (M = 4.8), workshops (M = 4.77), and seminars (M = 4.67). The findings from the HOSs also indicated lack of AI expertise (M = 4.33) and insufficient budget for training (M = 4.17) as the main barriers to acquisition of ICT skills. The qualitative findings echoed this with University Librarians and HODs emphasising the importance of workshops, seminars, webinars, and ongoing capacity-building initiatives. This alignment reflects a collective view that capacity-building is the most critical enabler of AI adoption in academic libraries

The findings on the confidence that library staff have in their capacity to utilise AI technologies successfully revealed that the library staff were not confident of their ability to handle AI tools and systems in the library due to inadequate AI literacy. The quantitative findings from the HOSs indicated an overwhelming support for the need of training in all proposed training categories on AI, with 96.7% to 100% of respondents

agreeing on the necessity of each type. Qualitative findings from the HODs, University Librarians and Systems Librarians also indicated the need for library staff to be trained on AI applications in libraries, data analytics, automation tools, and AI-system interface navigation. These results demonstrate the need for staff retooling to enable them to effectively utilise AI tools and systems in provision of information services.

Further, the study found that library staff do not need to master AI technologies at a technical level but rather must become proficient in using AI tools to improve library services. Quantitative responses from the HOSs emphasised the importance of training on usability and practical engagement with systems with areas of training such as basic AI concepts to understand AI fundamentals and applications in libraries, data analytics to enhance decision-making and information management skills and ethical considerations and responsible use of AI in library environments recording high means of 4.87, 4.83 and 4.80 respectively. The qualitative findings also echoed this finding, with comments from the HODs and librarians reinforcing the need for training that focuses on interface navigation and tool interaction. This point of convergence underscores the importance of role-appropriate and task-oriented training models, aimed at empowering staff to assist users and enhance service delivery, rather than turning them into AI experts.

The findings from the regression analysis indicated that the library staff ICT competence had a positive relationship (B = 0.339). This indicates that while staff ICT was important, it alone did not significantly predict readiness when combined with the other variables. However, the positive coefficient suggests that the library staff's ICT skills and competencies were important in adoption of AI in university libraries. Consequently, university libraries should invest in targeted training and capacity building

for library staff to ensure successful AI system implementation, management, and maintenance.

5.3.5 Summary of Results on Users' Perception Readiness in Adopting Artificial Intelligence

The fourth objective of the study was to evaluate the users' perception readiness towards adopting AI in university libraries in Kenya. The indicators for this objective were perceived benefits, perceived ease of use, perceived challenges and the attitude of users towards AI use in libraries.

The findings of the study revealed that majority of the library users perceive AI as highly beneficial in enhancing library services. The quantitative findings from the undergraduate students revealed that the combined agreement levels on the across all the perceived benefits of AI ranged from 76.1% to 83.6%, indicating that most undergraduate students strongly believe AI could improve library services. The qualitative findings from the HODs and HOSs also indicated that they believed AI could be beneficial in metadata tagging, optimising search algorithms, providing personalised recommendations, automating citation and referencing, and plagiarism checking. The findings reflect an optimistic outlook among library users toward AI, positioning it as an asset in the future of university libraries.

Regarding perceived ease of use, the study's findings revealed that the library users perceive that AI technologies for provision of information services were easy to use. The quantitative findings from the undergraduate students revealed that they perceive AI services in libraries as easy to use, efficient, and not mentally taxing, with an average mean of 3.95. The qualitative findings from the University Librarians further indicated

that to address potential resistance to the use of AI in the libraries by the users, strategies such as user education and capacity building, communication and transparency and use of peer influence would be handy. Given that students typically perceived AI systems to be user-friendly and helpful in achieving their objectives, it implied that university libraries were in a good position to incorporate AI into information services.

The findings on perceived challenges by the library users in adoption of AI in university libraries revealed notable challenges associated with the use of AI in the provision of information services. The quantitative findings from the HOSs revealed that lack of sufficient AI expertise among library staff, failure to establish clear policy guidelines for the ethical and practical use of AI in the library environment and lack of adequate training for library users were the main concerns of library users in the adoption of AI, with means of 4.23, 4.17, and 4.17 respectively. The findings from the undergraduate students revealed that the most widely recognised barriers to AI adoption in libraries were infrastructural limitations (M = 4.13), intermittent power supply (M = 3.97) and insufficient human capacity (M = 3.96). The qualitative findings from the University Librarians, Systems Librarians and HODs revealed infrastructure inadequacy, limited funding, inadequate human capacity and expertise, resistance to change, privacy and ethical concerns, reliability of AI tools, fear of diminishing human engagement in library services as some of the users' perceived challenges. These results imply that although users may acknowledge the potential benefits of AI in library services, they also recognise the ethical, social, and practical challenges that must be overcome for successful adoption to take place.

On the attitude of library users towards AI, the findings of the study revealed that generally, the users had a positive attitude towards AI. The quantitative findings from the HOS revealed that 70% of the undergraduate students were willing to use AI-powered services. Similarly, the findings of undergraduate students revealed that 83.3% of them stated they were likely to use AI- powered services, indicating their positive outlook on the potential use of AI in the university library context. The qualitative findings from the HODs also revealed that they had enthusiasm for AI adoption of AI with expected benefits like efficiency and enhanced research support and access. These findings suggest that the majority of the users were enthusiastic about the integration of AI technologies in the libraries, implying their readiness to utilise AI powered information services that potentially enhance information access, efficiency, and convenience

The findings of the study also revealed the need for continuous training and awareness on AI tools in the libraries to address user resistance. The quantitative findings from the HOSs indicated that lack of adequate training (M = 4.13) and resistance to change (M = 3.53) hampered the adoption of AI in university libraries. Similarly, findings by undergraduate students revealed that lack of adequate training (M = 3.96) and resistance to change (M = 3.85) hampered the adoption of AI in university libraries. The qualitative findings from the Systems Librarians indicated that they planned to provide continuous training and capacity building for the library users through information literacy and awareness campaigns, user engagement, educational materials and guides, and user engagement through online questionnaires. These findings underscore a shared recognition that capacity building is central to successful AI integration in university libraries.

The findings from the regression analysis indicated that the users' perception readiness had a negative unstandardised coefficient (B = -0.224) and was not statistically significant (p = 0.208), suggesting that user perceptions could act as a barrier rather than a facilitator, although this finding was not statistically robust. This implied potential skepticism or lack of awareness among library users regarding AI use in university libraries, highlighting the need for strategies for change management, user sensitisation, and digital literacy campaigns aimed at building trust and acceptance among users.

5.3.6 Summary of Results on Readiness of University Libraries to Adopt Artificial Intelligence for Provision of Information Services

The study aimed to assess the readiness of university libraries in Kenya to adopt AI for provision of information services. This was assessed based on information services where AI can be adopted in university libraries in Kenya, the status of ICT infrastructure readiness in adopting AI in university libraries in Kenya, the library staff level of ICT competence in readiness for AI adoption in information provision in university libraries in Kenya, and users' perception readiness towards adopting AI in university libraries in Kenya.

On existent information services where AI can be adopted in university libraries in Kenya, the findings indicated that AI could be adopted to enhance existent information services in university libraries in Kenya. The quantitative findings indicated that an average of 89% of the undergraduate students believed that AI technologies could improve the existent information services in their libraries such as reference service, information retrieval, cataloguing, classification, circulation, content recommendation and summarisation, and access to e-resources, while the HOSs strongly supported adoption of

AI across various university library services in Kenya with an average mean of 4.47. This was echoed by the qualitative findings from the University Librarians and Systems Librarians who consistently emphasised reference services, information discovery, literature search, cataloguing and classification as key areas where AI could improve accuracy, user engagement, and availability. The HODs also suggested using AI for automating checkouts, predicting demand, and managing collections efficiently. These findings demonstrate overwhelming optimism regarding the potential of AI to enhance library services.

Regarding the readiness of ICT infrastructure in adopting AI in university libraries in Kenya, the study established dissatisfaction with current ICT infrastructure's ability to handle AI tools and systems, including Internet connectivity, access to digital tools, and system reliability. The quantitative findings indicated that 47% of the HOSs rated their library's ICT infrastructure as inadequate for AI adoption, 40% of the HOSs indicated their library was inadequately equipped with the necessary hardware and software to implement AI technologies, while only 50% of the undergraduate students believed their library had adequate ICT infrastructure to support AI-based services. The qualitative findings from the University Librarians indicated lack of robust ICT infrastructure, while the HODs indicated infrastructural weaknesses such as low bandwidth, outdated systems, and frequent power outages, as a critical barrier to effective AI integration in university libraries in Kenya. These findings indicate the widespread agreement on the foundational role of ICT infrastructure in enabling AI adoption.

The findings on the library staff level of ICT competence in readiness for AI adoption revealed the lack of skills and technical preparedness among the library staff,

pointing to a gap in digital and AI literacy. The quantitative findings indicated that 43% of the HOSs rated their library staff's skills and knowledge to support AI adoption and use in the library as inadequate, while only 47.1% of the undergraduate students indicated that the library staff were well-prepared to manage AI technologies in library services. The qualitative findings from the HODs also echoed that there was a skills gap among the library staff. The University Librarians, HODs, and undergraduate students also indicated there was need for developing digital and AI literacy among the library staff to fast track AI adoption in Kenyan university libraries. These findings indicate the need for staff development programs focused on AI-related skills and digital literacy were essential to ensure effective implementation.

Regarding the users' perception readiness towards adopting AI in university libraries in Kenya, the study established that generally, the users had a positive perception towards AI. However, they had concerns such as uncertainty about the reliability of AI tools and data privacy and ethical concerns that could contribute to resistance to change. The quantitative findings from the HOS revealed that 70% of the undergraduate students were willing to use AI-powered services. Similarly, the findings of undergraduate students indicated that nearly 90% of them believed AI could improve library services, while 83.3% of them indicated they would likely use AI tools if introduced in the library. This strong inclination toward using AI tools reflects a high degree of openness to technological adoption among library users. However, the qualitative findings from the HODs indicated resistance to change and ethical concerns as barriers to adoption of AI in university libraries, while the University Librarians, HODs and undergraduate students indicated the importance of a positive attitude and technology acceptance as key factors

in adoption of AI in Kenyan university libraries. These results demonstrate overwhelming optimism regarding the potential of AI to enhance library services. However, there was a need for ethical frameworks and clear data governance policies to be put in place to ensure safe and responsible AI usage.

Further the study established that financial constraints was one of the key factors affecting the readiness of university libraries in Kenya to adopt AI. The quantitative findings indicated that only 13.4% of the HOS believed their library's budget was adequate to support the implementation and maintenance of AI technologies. The qualitative findings from the University Librarians, undergraduate students and HOSs also indicated that funding and budgetary constraints was one of the factors that would determine the readiness of university libraries in Kenya to adopt AI. Additionally, the findings from the undergraduate students and HOSs also revealed that financial constrains was one of the main barriers to AI adoption in university libraries in Kenya. These findings indicate the widespread agreement on the foundational role of funding in enabling AI adoption.

Lack of institutional support was also indicated as one of the factors hindering the adoption of AI in university libraries in Kenya, given the pivotal role leadership plays in championing innovations. The quantitative findings from the HOSs indicated that only 46.7% believed they received an adequate level of support for AI adoption from the library leadership. The qualitative findings from the undergraduate students and HOSs further indicated that institutional support was key in determining the readiness of university libraries in Kenya to adopt AI. Further, the Systems Librarians and HODs also indicated that lack of institutional support was one of the main barriers to adoption of AI in

university libraries in Kenya. These findings indicate the need for capacity-building sessions and strategic planning workshops to better align leadership with the digital transformation agenda.

The ANOVA results on the overall statistical significance of the regression model indicated that the F-statistic was 2.885, with a significance level (p-value) of 0.043, which was less than the conventional alpha level of 0.05. This indicated that the regression model was statistically significant, and that the combination of the four predictors, information services for AI adoption, ICT infrastructure readiness, staff ICT competence, and user perception readiness, reliably predict the readiness of university libraries to adopt AI in Kenya. Moreover, the findings from the regression analysis indicated that while ICT infrastructure readiness had a significant contribution to the readiness of university libraries in Kenya to adopt AI, information services and staff ICT competence did not individually emerge as statistically significant in this model. However, their positive coefficients suggested that these factors were still important in the adoption of AI in university libraries. The finding that user perception readiness had a negative and non-significant relationship implied potential skepticism or lack of awareness among library users regarding AI use in university libraries, hence the need for AI literacy among library users.

5.3.7 Summary of Results on Development of a Framework for Adoption of Artificial Intelligence in University Libraries

The ultimate goal of this study was to develop a framework for the integration of AI in university libraries in Kenya. Quantitative data collected from HOSs and undergraduate students demonstrated a high level of consensus, ranging from 93.4% to

100% for HOSs and 79% to 100% for students, regarding the inclusion of several key components in the framework. These components include stakeholder involvement, scalability of ICT infrastructure, staff training and capacity building, user education and awareness, funding and resource allocation, policies and governance, collaboration and innovation, an implementation roadmap, and evaluation and feedback mechanisms.

Qualitative responses from University Librarians, systems librarians, undergraduate students, and HODs further emphasised the necessity of scalable ICT infrastructure, comprehensive training programs for both staff and students, institutional policies for ethical governance and AI usage, collaboration with students and faculty, adequate funding, and an AI implementation roadmap as essential elements for the successful adoption of AI in university libraries in Kenya. These findings indicate a strong consensus on the critical components required for effective AI adoption in these institutions. In practical terms, this suggests that university administrations should prioritise the development of comprehensive policy frameworks, targeted training programs, sufficient funding, evaluation and feedback mechanisms, and stakeholder engagement to facilitate AI adoption in libraries.

The outcomes of the multiple regression analysis provided empirical evidence that significantly informed the development of a comprehensive framework for AI adoption in university libraries in Kenya. Notably, the substantial contribution of ICT infrastructure readiness underscores the importance of prioritising investment in and enhancement of ICT infrastructure across university libraries. Additionally, the positive coefficients for information services and staff ICT competence indicated that the framework should incorporate targeted training and capacity building for library staff, as well as the

identification of information services suitable for AI integration. Furthermore, the finding that user perception readiness exhibited a negative and non-significant relationship highlights the need for the framework to include strategies for change management, user sensitisation, and digital literacy campaigns to foster trust and acceptance among users.

5.4 Conclusions of the Study

The cross-examination of the research findings allowed the researcher to derive substantial conclusions. These conclusions, extracted from the data, were categorised according to the primary variables of the study to enhance comprehension and coherence.

5.4.1 Conclusion on Information Services Where Artificial Intelligence Can Be Adopted

The study concluded that there is a significant and collective interest in utilising AI to enhance information services within university libraries in Kenya. This was evidenced by the high level of awareness among the majority of participants regarding AI applications in these services. Furthermore, there was consensus among the participants that AI could be implemented to improve existing information services, including reference services, information retrieval, cataloguing, classification, circulation, content recommendation and summarisation, and access to electronic resources. The findings also suggested that participants perceive AI as having the potential to revolutionise university libraries' information services by increasing efficiency, reducing costs, and enhancing user experiences. However, due to neutral responses regarding familiarity with various AI technologies for information services, the study concluded that there is a necessity for targeted professional development to familiarise library staff with these technologies.

Additionally, the introduction of pilot projects is recommended to demonstrate the practical applications of AI in enhancing library services.

5.4.2 Conclusion on ICT Infrastructure Readiness in Adopting Artificial Intelligence

The study's findings indicate that the ICT infrastructure in Kenyan university libraries is insufficiently prepared for the adoption of AI. Although these libraries possess foundational ICT infrastructure, including basic network systems and cybersecurity protocols, they exhibit significant deficiencies in advanced computing systems, cybersecurity measures, machine learning tools, and network connectivity. Furthermore, challenges arise in integrating AI tools and systems with existing library systems, coupled with a shortage of technical expertise and inconsistent budgetary allocations for ICT infrastructure upgrades. The study asserts that to facilitate the successful integration of AI in Kenyan university libraries, it is essential for universities to invest in enhancing hardware, software, and network capabilities, improving cybersecurity measures, developing technical expertise, collaborating with AI tool developers for seamless integration, and securing long-term financial support dedicated to AI infrastructure.

5.4.3 Conclusion on Readiness of Staff's ICT Skills and Competencies to Adopt Artificial Intelligence

The study determined that library personnel are not adequately prepared to implement AI technologies, primarily due to a deficiency in advanced ICT skills, which also undermined their confidence in utilising AI tools and systems within the library. This necessitates the development of structured training programs to equip library staff with the essential ICT skills and competencies. Furthermore, the study concluded that library staff should be trained to achieve proficiency in using AI tools to enhance library services,

as it is not required for them to attain technical mastery of AI technologies. This highlights the significance of role-appropriate and task-oriented training models, designed to empower staff to assist users and improve service delivery, rather than transforming them into AI specialists. Additionally, the study concluded that institutional support and positive motivation are crucial for the acquisition of ICT skills. Consequently, technological advancements in libraries should be accompanied by inclusive leadership, encouragement, and staff involvement to mitigate resistance and ensure sustainability.

5.4.4 Conclusion on Users' Perception Readiness in Adopting Artificial Intelligence

The study's findings indicate that library users exhibit a positive attitude and perception towards the integration of AI within library settings, particularly regarding its usefulness and ease of use. This suggests their readiness for adopting AI technologies in libraries. Nonetheless, they also acknowledged the ethical, social, and practical challenges that necessitate the formulation of policies, active user engagement, training, and user-centred design of AI services to ensure successful AI adoption. Furthermore, the study concluded that there is need for training and AI awareness among library users to mitigate resistance to change and to equip them with the skills required to effectively navigate and utilise AI tools and systems.

5.4.5 Conclusion on Readiness of University Libraries to Adopt Artificial Intelligence for Provision of Information Services

The study concluded that university libraries in Kenya are not adequately prepared for the integration of AI in the delivery of information services. Despite the findings indicating significant optimism about AI's potential to enhance library services, the libraries face several challenges, including insufficient ICT infrastructure, inadequate ICT

skills and competencies among library personnel, insufficient budgetary allocations for AI adoption, and a lack of institutional support. These issues must be addressed to successfully implement AI in the provision of information services.

5.4.6 Conclusion on development of a Framework for Adoption of Artificial Intelligence in University Libraries

The study concluded that the core components of the proposed AI adoption framework for Kenyan universities encompass core functional service areas for AI implementation, infrastructure and digital readiness, enabling technologies, capacity building and AI literacy, adequate funding, policy, ethics, and governance; strategic alignment and innovation, stakeholder collaboration, and data-driven evaluation and feedback mechanisms. Furthermore, the study concluded that the efficacy of the proposed framework for AI adoption in university libraries in Kenya is contingent upon the interdependence of its components.

5.5 Implications of the Findings on Theories, Policies and Practices

The findings of this study have implications on theories, policies and practices as discussed below.

5.5.1 Implications of the Findings on Theories

Two theories, the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and the Diffusion of Innovation Theory (DOI) (Rogers, 1962) anchored this study. The findings resonate with the UTAUT by acknowledging the significance of Perceived Usefulness (PU), Effort Expectancy (EE), and Performance Expectancy (PE) in the readiness of university libraries in Kenya to adopt AI for provision of information services. This was demonstrated by the unanimous agreement by

undergraduate students and library staff that AI would enhance the efficiency and effectiveness of existent library services. Moreover, the undergraduate students indicated that AI-enhanced services were easy to use, which led to the finding of a high willingness of undergraduate students to use AI-enhanced services if introduced in the library.

Moreover, the study's findings highlight the critical role of Facilitating Conditions (FC) in the in the adoption of AI in university libraries in Kenya. These conditions encompass existing information services that could be enhanced by AI, a robust ICT infrastructure, and library staff possessing sufficient ICT skills and competencies. The results of the regression analysis reveal a positive correlation between information services that could be supported by AI, ICT infrastructure readiness, and the ICT skills and competencies of library staff, underscoring their significance in the readiness of Kenyan university libraries to adopt AI technologies. The study further emphasises the necessity of training for library staff and users, increased budgetary allocations, stakeholder engagement, and the establishment of an AI policy, all of which are vital components of Facilitating Conditions (FC) for the adoption of AI in university libraries in Kenya.

The study's findings also align with the Diffusion of Innovations (DOI) theory, which underscores the importance of AI's characteristics, such as relative advantage, complexity, trialability, observability, and compatibility, in influencing the decision-making process of Kenyan university libraries regarding AI adoption for provision of information services. The study established that both library staff and users perceive AI as a means to enhance existing information services by improving their efficiency and effectiveness. Additionally, users reported that AI-enhanced library services were user-

friendly and expressed willingness to utilise such services if implemented in their libraries. However, the study also identifies that Kenyan university libraries are currently unprepared for AI adoption in information service provision due to insufficient ICT infrastructure, inadequate ICT skills and competencies among library staff, and the absence of an AI policy to address ethical concerns associated with AI use. Consequently, Kenyan university libraries are classified in the laggard's adopter category based on DOI's theory.

5.5.2 Implications of the Findings on Policies

The study's findings necessitate several policy recommendations. Firstly, they have significant implications for university management concerning budgetary policies and the allocation of funds to university libraries. To facilitate the successful implementation of AI, it is imperative to increase the budgetary allocation for libraries. This increase will enable university libraries to enhance their ICT infrastructure, acquire AI tools and systems, recruit AI specialists, and provide training to library staff to improve their AI literacy.

Secondly, initiatives should be undertaken to enhance the ICT skills and competencies of library staff through policies focused on staff development. Such policies will ensure the provision of training programs and opportunities for library staff to engage with various AI technologies for information services. This will empower them to utilise AI tools and systems effectively in delivering information services. Lastly, library policies should prioritise AI literacy for library users to ensure they receive the necessary training to acquire the skills required to effectively navigate and utilise AI applications within the library.

5.5.3 Implications of the Findings on Practices

The study's findings underscore several critical implications for practice. They indicate that librarians need specialised training to become proficient with AI-powered tools, including automated cataloguing systems, AI-driven search engines, and virtual research assistants. Consequently, investing in professional development initiatives is essential to ensure that librarians are not only equipped to utilise AI technologies but can also leverage them to enhance library service delivery.

Considering the high perceived willingness of library users to use AI-enhanced information services, university libraries in Kenya should seize this opportunity to expand AI services and integrate user-centred AI tools. This can be accomplished by offering AI literacy programs and collaborating with AI tool developers to ensure that these tools are customised to meet users' needs. Furthermore, university libraries should continuously evaluate the performance and impact of AI applications in terms of user satisfaction and system efficiency, with the objective of enhancing the performance of AI applications in delivering information services.

The study also revealed that the ICT infrastructure in libraries was insufficient to support the use of AI in providing information services, yet university libraries in Kenya lacked adequate budgetary allocations to upgrade their ICT infrastructure. To develop alternative sustainable funding models that would support the maintenance, upgrades, and expansions of AI applications, university libraries in Kenya should partner with external funding sources to establish a stable financial foundation for AI adoption.

5.6 Recommendations of the Study

The recommendations of the study were formulated following a comprehensive examination of the data, observations, and conclusions presented in the preceding section. This analysis was followed by suggestions for additional research.

5.6.1 Recommendations on Research Findings

The following recommendations were made based on the study's findings on each of the study's variables.

5.6.1.1 Recommendations on Information Services Where Artificial Intelligence Can Be Adopted

To facilitate the effective utilisation of AI, the study recommends that university libraries should engage in collaborative partnerships with AI solution providers, industry specialists, and other university libraries. Such collaborations with AI tool developers will ensure that the AI tools are customised to meet the specific needs of university libraries. Furthermore, partnerships with AI researchers and other university libraries will enhance the exchange of best practices and knowledge concerning the integration of AI in information services. Additionally, it is imperative for university libraries to establish a comprehensive monitoring and evaluation framework to continuously assess the performance and impact of AI applications, focusing on user satisfaction, system efficiency, and the attainment of predetermined objectives. The feedback derived from these assessments should be utilised to enhance the performance of AI applications in delivering information services.

5.6.1.2 Recommendations on ICT Infrastructure Readiness in Adopting Artificial Intelligence

The study recommends that university libraries should invest in scalable and adaptable systems capable of managing the data processing and storage requirements associated with AI technologies, in addition to addressing concerns related to network bandwidth, data security, and cloud infrastructure. Furthermore, the study recommends an increase in budgetary allocations for university libraries to facilitate investments in ICT infrastructure that can support the deployment of AI applications. It also recommends the development of sustainable funding models by university libraries to support the maintenance, upgrades, and expansions of AI applications. This can be accomplished through partnerships with external funding sources, grants, and collaborative initiatives to establish a robust financial foundation for AI adoption.

5.6.1.3 Recommendations on Readiness of Staff's ICT Skills and Competencies to Adopt Artificial Intelligence

The study recommends that the implementation of workshops and training programs by university libraries and other educational institutions to enhance the proficiency of library staff in AI technologies. This initiative aims to ensure that university libraries possess competent personnel capable of utilising AI tools and systems. Furthermore, it is recommended to cultivate a culture of continuous learning among the staff of university libraries, thereby ensuring that librarians consistently acquire the necessary ICT skills and competencies to effectively operate and maintain AI-based systems.

5.6.1.4 Recommendations on Users' Perception Readiness in Adopting Artificial Intelligence

Based on the findings of the study, the study recommends that university libraries should engage in collaborative efforts with AI application developers to create applications that align with the needs and preferences of library users. By prioritising user needs, the acceptance and utilisation of AI applications within university libraries can be significantly enhanced. Furthermore, it is recommended that university libraries implement AI literacy programs to ensure that library users receive the requisite training to effectively utilise the AI applications available in the library.

5.6.1.5 Recommendations on Readiness of University Libraries to Adopt Artificial Intelligence for Provision of Information Services

The study recommends that key stakeholders, including librarians, IT personnel, and administrators, should collaboratively ensure the establishment of prerequisites for AI adoption, such as improved ICT infrastructure and digital libraries, capacity building for library staff, awareness and training for library users, sufficient funding for the library, enhancement of collaboration and knowledge sharing, and the implementation of the proposed AI adoption framework. Furthermore, the university library management should formulate an AI adoption strategy that aligns with the overall objectives of the university.

5.6.1.6 Recommendations on the development of a Framework for Adoption of Artificial Intelligence in University Libraries

The study recommends that university libraries in Kenya should adopt the proposed AI adoption framework to enable them to successfully adopt AI for provision of information services. However, implementation of this framework is likely to experience

challenges such as inadequate ICT infrastructure, skills gaps among the library staff, inadequate funding, resistance to change, privacy and ethical concerns, and challenges with integration of AI tools and systems with existent library systems. To counter these challenges, the study recommends that university libraries should secure adequate funding for investment in the ICT infrastructure, hiring AI experts and training library staff, in addition to putting in place policies that address privacy and ethical concerns in the use of AI in libraries

5.6.2 Recommendations for Further Research

This study has developed and validated a framework for the adoption of AI in university libraries in Kenya. However, further research is recommended to enhance its applicability and sustainability. Future studies could investigate the longitudinal implementation of the framework across various institutional contexts to assess its practical effectiveness and impact over time.

Furthermore, the study focused on the perceptions of users of university libraries, which include students and faculty. Consequently, there is a need for further research to ascertain the perceptions, trust, and willingness of university library staff to utilise AI in the provision of information services. This research will provide insights into how the perceptions of library staff influence the readiness of university libraries in Kenya to adopt AI for information service provision.

Additionally, the study suggests conducting a comparative study to evaluate the readiness of other types of libraries, such as public and special libraries, to adopt AI in the provision of information services. Such a study could identify unique needs and

constraints outside the university context that influence the adoption of AI for information service provision.

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APPENDICES

Appendix I: Consent Form

Title: Assessment of university libraries' readiness in adopting artificial intelligence in Kenya

Principle researcher:

Ephrine M'mbone Ubaga

Kirinyaga University

0722923844 or ubagae@gmail.com

Purpose of the study: This study aims to assess the readiness of university libraries in Kenya to adopt AI in providing information services and develop a framework for implementation of AI in university libraries.

What Participation Involves: If you consent, you will either be requested to participate in a 30- to 45-minute interview (if you are a university librarian) or complete an online questionnaire that should take 30 to 45 minutes (if you are an undergraduate student or the Head of Section at the library).

Risks and Benefits: Very few risks are associated with taking part in this study, such as discomfort or inconvenience during the interview or survey completion process. Nonetheless, the data presented will help determine how prepared Kenyan university libraries are to use AI to deliver information services.

Voluntary Participation and Withdrawal: It is entirely voluntary to take part in this study. You can decline to participate or leave at any moment without facing any repercussions.

Confidentiality: All data gathered will be treated with the confidentiality. Your answers will not be linked to any personally identifying information, and the data collected will only be utilised for the study. The responses will be securely accessible only to the researcher.

Rewards: Volunteers who consent to take part in the study will not receive any compensation.

Contact Information: You can reach Ephrine M'mbone Ubaga the study's primary researcher, at ubagae@gmail.com or +254 722923844 should you have any questions or concerns.

To indicate your readiness to participate in the study, please sign the consent form that is provided.

Declaration of consent: I have read the consent form and understood its contents. I have also gotten satisfactory answers to all the questions I asked. I, at this moment, give my voluntary consent to take part in this study.

Participant's serial umber.....

Signature……...

Date……...

Researcher's Statement

I declare that the study's goal, the steps it will involve, and the benefits and risks of participating in it have been clarified to the volunteer.

Interviewer's

Name…….

Signature……...……

Date……...……

Appendix II: Introduction Letter

Ephrine M'mbone Ubaga

Kirinyaga University,

P.O BOX 143-10300,

Kerugoya.

Dear Respondent,

I am Ephrine M'mbone Ubaga a postgraduate student pursuing a Doctor of Philosophy Degree in Library and Information Science at Kirinyaga University. I am studying "Assessment of university libraries readiness in adopting artificial intelligence in Kenya." This study aims to examine the readiness of university libraries in Kenya to adopt artificial intelligence in providing information services and develop a framework for AI implementation in university libraries. Your participation in this study is crucial, as it will provide valuable insights into this topic.

The study involves completing an online questionnaire that should take 30-45 minutes. Additionally, some participants will be invited for an interview or focus group discussion that will take 30-45 minutes. Your responses will be kept confidential and used solely for academic purposes.

Participation in this study is entirely voluntary, and you can withdraw at any moment without facing any repercussions. You can reach me at ubagae@gmail.com or 0722923844 should you have any questions or if you need more information on the study. Your input is valuable, and I appreciate your time and contribution to this research.

Thank you for your support!

Yours sincerely,

Ephrine M'mbone Ubaga

Appendix III: Questionnaire for Undergraduate Students

Section 1: Demographic Information

1. Age:

Below 20	[ ]
21-30	[ ]
31-40	[ ]
41-50	[ ]
50+	[ ]

2. Field of study:

Natural Sciences	[ ]
Social Sciences	[ ]
Engineering and Technology	[ ]
Humanities	[ ]
Other (Please specify): _____	

3. Name of University: _____

4. How often do you use your university library?

Daily	[ ]
Weekly	[ ]
Monthly	[ ]
Rarely	[ ]

Section 2: Existent information services that can be supported by AI

5. The table below presents information services offered by libraries. Please indicate by ticking **(√)** how often you make use of these services. The rating scale is 1-4, where Always = 4, Often= 3, Sometimes = 2, Never =1

Information Services	**Never**	**Sometimes**	**Often**	**Always**
(i). Circulation service				
(ii). Reference service				
(iii). Information retrieval				
(iv). Indexing				
(v). Cataloguing				
(vi). Classification				
(vii). Selective dissemination of information				
(viii) Service for the visually impaired				

6. The table below presents information services offered by libraries. Please indicate by ticking **(√)** your level of agreement or disagreement that these services could benefit from AI technologies. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Information Services	**Strongly Agree**	**Agree**	**Neutral**	**Strongly Disagree**	**Disagree**
(i). Circulation service					
(ii). Reference service					
(iii). Information retrieval					
(iv). Indexing					
(v). Cataloguing					
(vi). Classification					
(vii). Selective Dissemination of Information					
(viii) Service for the visually impaired					

7. What are the challenges or limitations in the current information services that AI could help overcome?

Section 3: ICT infrastructure Readiness for Adoption of AI

8. The table below presents statements relating to the ICT infrastructure components necessary for supporting adoption of AI. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Strongly Disagree**	**Disagree**
(i). Our library has access to high-speed Internet to support AI-driven services.					
(ii). Our library is equipped with advanced computer systems capable of supporting AI applications.					

Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
(iii). Cloud computing services are available in our library for AI-based information services.					
(iv). Our library has well-established digital libraries and databases for supporting AI adoption.					
(v). Up-to-date security systems are in place to ensure safe implementation of AI technologies.					
(vi). Machine learning platforms are available in our library to support AI functionalities.					
(vii). Our library has robust server capacity to handle AI-based processes and data					
(viii). There is adequate technical support and expertise available to maintain ICT infrastructure for AI adoption.					
(ix). Our library's network infrastructure is scalable to accommodate future AI advancements.					

9. In your opinion, what upgrades or additional resources do you think are necessary to prepare your library's ICT infrastructure for AI adoption?

_____

Section 4: Staff's ICT skills and Competencies Readiness for Adoption of AI

10. How would you rate the library staff's ICT skills in readiness for offering AI based information services?

Excellent [ ]
Good [ ]
Average [ ]
Poor [ ]
Very Poor [ ]

Section 5: Users' Perception Readiness for Adoption of AI

11. The table below presents statements relating to perceived benefits of using AI in provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Strongly Disagree**	**Disagree**
(i). AI-powered virtual assistants improve the speed of reference query responses					
(ii). AI systems effectively reduce wait times for basic information services					
(iii). Natural Language Processing capabilities make library searches more intuitive					
(iv). AI-powered recommendation systems help in discovering relevant resources more effectively					
(v). AI-enhanced search capabilities make it easier to find specific information within digital collections					
(vi). AI tools improve the discovery of inter-library resources and connections					
(vii). 24/7 AI assistance enhances the library's					
(viii). AI systems help create more inclusive library services					
(ix). Personalised AI recommendations improve the research experience					
(x). AI-powered translation services make resources more accessible to international students					

12. The table below presents statements relating to perceived ease of using AI in provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Strongly Disagree**	**Disagree**
(i). Overall, I believe AI powered information services are easy to use					
(ii). I believe I can easily learn how to use AI powered information services					
(iii). Utilising information services enabled by AI doesn't take a lot of mental effort					
(iv). Making use of AI-powered information services doesn't take a lot of effort					
(v). With AI, I could easily accomplish my goals					
(vi). Communicate with AI library systems would be easy for me					
(vii). Using AI for provision of information services takes too much time					

13. The table below presents statements relating to perceived challenges of using AI in provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Strongly Disagree**	**Disagree**
(i). Poor ICT infrastructure that may limit the effective use of AI-based services in the library.					
(ii). Intermittent power supply affecting the reliability of AI systems and the accessibility of library resources.					
(iii). Technophobia, or fear of new technologies, hindering the adoption of AI by library users.					
(iv). Concerns regarding privacy and security of personal and academic data stored or processed by AI systems.					
(v). Lack of adequate training for library staff and users to navigate AI-driven systems effectively.					
(vi). Resistance to change among library users, leading to reluctance in embracing AI technologies.					
(vii). Over-reliance on technology that might diminish personal interaction with library staff or lead to reduced critical thinking.					
(vii). Inaccuracy of AI tools in delivering precise, relevant, or useful results, diminishing trust in AI systems.					

Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
(viii). Lack of sufficient AI expertise among library staff, resulting in a lack of support for users in AI-related tasks.					
(ix). Failure to establish clear policy guidelines for the ethical and practical use of AI in the library environment.					
(x). Fear that AI may lead to the replacement of human library staff, contributing to job insecurity.					
(xi). The ethical implications of AI, including the risk of biased algorithms affecting information access or decision-making.					
(xiii). Concerns about the cost of AI implementation and the allocation of resources, which might divert funds from other library services.					
(xiv). Lack of transparency in AI decision-making, leading to users questioning how AI-driven recommendations or results are generated.					

14. What is your likelihood of using AI-powered services if they were introduced in your university library?

Very unlikely [ ]
Unlikely [ ]
Neutral [ ]
Likely [ ]
Very likely [ ]

15. In your opinion, what is the most significant benefit AI could bring to your university library?

_____

Section 6: Readiness of university libraries in Kenya to adopt AI

16. Do you think AI technologies can improve the existent information services in your library?

Strongly Agree	[ ]
Agree	[ ]
Neutral	[ ]
Disagree	[ ]
Strongly Disagree	[ ]

17. Do you believe the university library has adequate ICT infrastructure to support AI-based services (e.g., virtual assistants, intelligent search systems)?

Strongly Agree	[ ]
Agree	[ ]
Neutral	[ ]
Disagree	[ ]
Strongly Disagree	[ ]

18. Do you think library staff are well-prepared to manage AI technologies in library services?

Strongly Agree	[ ]
Agree	[ ]
Neutral	[ ]
Disagree	[ ]
Strongly Disagree	[ ]

19. How likely are you to use AI-powered tools in the library if they become available?

Very unlikely	[ ]
Unlikely	[ ]
Neutral	[ ]
Likely	[ ]
Very likely	[ ]

Section 7: Developing a Framework for AI Adoption in Libraries

20**.** The table below presents statements relating to factors for successfully adopting AI in university libraries. Please indicate by ticking **(**√**)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Strongly Disagree**	**Disagree**
(i). A robust ICT infrastructure that can support the implementation and scalability of AI technologies in the library.					
(ii). Regular staff training and capacity building on AI and ICT to enhance skills for effective adoption and use.					
(iii). User education and awareness campaigns to promote understanding and acceptance of AI technologies among library users.					
(iv). Adequate funding and resource allocation to support the acquisition, implementation, and maintenance of AI technologies in the library					
(v). Clear government or institutional policies that guide AI adoption, including ethical considerations, privacy, and security issues.					
(vi). Collaboration with AI experts, researchers, and external partners to ensure effective AI integration and continuous innovation in library services.					

Statement	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
(vii). Development of an AI implementation roadmap, outlining clear goals, milestones, and timelines for integrating AI in library services.					
(viii). Stakeholder involvement and buy-in, including library staff, users, and administration, to ensure that AI adoption is well-supported and aligned with the library's strategic goals.					
(ix). Continuous evaluation and feedback mechanisms to monitor the effectiveness of AI technologies in the library and make necessary adjustments.					

21. What suggestions do you have for ensuring successful adoption of AI in university libraries?

Conclusion

Upon submission, you will receive a confirmation message

Thank you for your participation! Your responses are crucial for assessing university libraries' readiness in adopting AI and will contribute to developing a framework for AI implementation in libraries across Kenya.

Appendix IV: Questionnaire for the Library Heads of Sections (HOSs)

Section 1: Demographic Information

1. Gender:
   - Male [ ]
   - Female [ ]

2. Age:
   - 21-30 [ ]
   - 31-40 [ ]
   - 41-50 [ ]
   - 51-60 [ ]
   - 60+ [ ]

3. Level of education:
   - Diploma [ ]
   - Degree [ ]
   - Master's [ ]
   - PhD [ ]

4. What section do you head in the library?
   - Reader services [ ]
   - Collection development [ ]
   - Technical [ ]
   - Reference [ ]
   - Periodicals [ ]
   - Multimedia [ ]
   - Other (Please specify): _____

5. How many years have you worked in a university library?
   - Less than 3 years [ ]
   - 3-5 years [ ]
   - 6-8 years [ ]
   - 9-10 years [ ]
   - More than 10 years [ ]

6. Name of your University: _____

Section 2: Existent information services that can be supported by AI

7. The table below presents statements relating to knowledge of AI technologies that can be used in libraries for provision of information services. Please indicate by ticking **(√)** to what extent you agree or disagree with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
(i). I am familiar with the use of Natural Language Processing (NLP) for improving information retrieval in university libraries.					
(ii). I am aware of the role of expert systems in enhancing decision-making for library operations.					
(iii). I recognise the importance of pattern recognition in understanding user behaviour and improving service delivery.					
(iv). I understand how machine learning can be used to personalise information services in university libraries.					
(v). I am familiar with robotics as a tool for automating tasks like digital assistance and physical book retrieval in university libraries.					
(vi). I am aware that that AI can improve the efficiency of cataloguing and classification of library resources.					
(vii). I understand the importance of predictive analytics, powered by AI, in anticipating user needs and managing library resources effectively.					

8. The table below presents information services offered by university libraries. Please indicate by ticking **(√)** your level of agreement or disagreement that these services could benefit from adoption of AI. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Information Services	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
(i). Circulation service					
(ii). Reference service					
(iii). Information retrieval					
(iv). Indexing					
(v). Cataloguing					
(vi). Classification					
(vii). Selective Dissemination of Information					
(viii). Collection development					
(ix). Service for the visually impaired					

9. The table below presents statements relating to the benefits of adopting AI for provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
(i). AI systems effectively reduce wait times for basic information services.					
(ii). AI-powered virtual assistants improve the speed of reference query responses.					
(iii). The implementation of AI helps library staff focus on more complex patron needs.					
(iv). AI-enhanced search capabilities make it easier to find specific information within digital collections.					

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(v). Automated cataloguing using AI improves the accuracy of resource classification.					
(vi). Predictive analytics help in better understanding user research patterns and needs.					
(vii). AI implementation leads to more efficient allocation of library staff resources.					
(viii). AI-driven analytics help in making better collection development decisions.					
(ix). Automated systems reduce operational costs in the long term.					
(x). 24/7 AI assistance enhances the library's accessibility to users.					
(xi). Personalised AI recommendations improve the user research experience.					
(xii). AI systems help create more inclusive library services.					
(xiii). AI tools improve the organisation of digital collections.					
(xiv). AI-powered analytics provide valuable insights into collection usage patterns.					
(xv). Automated data processing increases the efficiency of library operations.					
(xvi). AI adoption creates opportunities for staff to develop new skills					
(xvii). Implementation of AI promotes innovation in library services					
(xviii). Integration of AI enhances the library's reputation as a modern institution					

10. How do you envision AI being used in provision of information services in university libraries?

_____

Section 3: ICT Infrastructure Readiness for adoption of AI

11. The table below presents statements relating to availability of ICT infrastructure components required for adoption of AI for provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
(i). Our library has access to high-speed Internet to support AI-driven services.					
(ii). Our library is equipped with advanced computer systems capable of supporting AI applications.					
(iii). Cloud computing services are available in our library for AI-based information services.					
(iv). Our library has well-established digital libraries and databases for supporting AI adoption.					
(v). Up-to-date security systems are in place to ensure safe implementation of AI technologies.					
(vi). Machine learning platforms are available in our library to support AI functionalities.					
(vii). Our library has robust server capacity to handle AI-based processes and data.					
(viii). There is adequate technical support and expertise available to maintain ICT infrastructure for AI adoption.					

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(ix). The library has a budget allocation for upgrading ICT infrastructure to integrate AI technologies.					
(x). Our library's network infrastructure is scalable to accommodate future AI advancements.					

12. The table below presents statements of availability of AI-related software or tools that are necessary for adoption of AI for provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(i). Our library has access to machine learning frameworks (e.g., TensorFlow, PyTorch) to support AI applications.					
(ii). Our library uses data analytics tools (e.g., MATLAB, R, Python) for analysing information and supporting AI adoption.					
(iii). Natural Language Processing (NLP) tools (e.g., spaCy, NLTK) are available in our library to enhance AI-driven services.					
(iv). Pattern recognition software is utilised in our library to improve data organisation and user services.					
(v). AI model management platforms (e.g., MLflow, Kubeflow) are in place for managing AI workflows in our library.					

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(vi). AI-based research tools (e.g., AI-powered search engines) are integrated into our library's systems to improve information retrieval.					
(vii). Our library has access to open-source AI tools for experimentation and implementation of AI-based solutions.					
(viii). Collaboration tools with AI integration (e.g., Microsoft Teams with AI features) are available for library operations.					
(ix). Visualisation software (e.g., Tableau, Power BI) is used in our library to present data insights and trends effectively.					

13. The table below presents statements on the availability of network connections that are necessary for adoption of AI for provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(i). Our library uses cable connections that provide stable and reliable network access for AI-based service.					
(ii). Fiber-optic Internet connections are available in our library, offering high-speed connectivity for AI adoption.					
(iii). Wireless (Wi-Fi) networks are accessible throughout the library to support AI-driven information services.					

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(iv). Satellite Internet is utilised in our library to provide connectivity where other options are limited.					
(v). The library has Ethernet connections for dedicated and high-bandwidth network access.					
(vi). Our library has access to 5G or other advanced cellular network technologies to enhance AI service provision.					
(vii). The library employs Virtual Private Network (VPN) technology to ensure secure remote access for AI-based services.					

14. How would you rate the quality, speed, and reliability of the current network infrastructure in your library for supporting AI adoption?

Very Poor [ ]
Poor [ ]
Fair [ ]
Good [ ]
Very Good [ ]

15. The table below presents statements on availability of cybersecurity measures that are necessary for adoption of AI for provision of information services. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(i). Antivirus and malware protection systems are implemented to safeguard library systems against cyber threats.					
(ii). Firewall systems are in place to prevent unauthorised access to library networks.					

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(iii). Data encryption methods are used to secure sensitive information in library systems.					
(iv). Multi-factor authentication (MFA) is required for accessing library resources to ensure security.					
(v). Regular security updates and patches are applied to keep systems protected against vulnerabilities.					
(vi). User education and awareness programs are conducted to promote cybersecurity best practices among library staff and users.					
(vii). Intrusion detection and prevention systems (IDPS) are used to monitor and mitigate network threats in the library.					
(viii). Access control policies are implemented to ensure that only authorised personnel can manage AI-related systems					
(ix). Data backup and recovery systems are in place to protect against data loss or corruption.					

16. In your opinion, what upgrades or additional resources do you think are necessary to prepare your library's ICT infrastructure for AI adoption

_____

_____

Section 4: Staff's ICT skills and Competencies Readiness for Adoption of AI

17. The table below presents basic ICT skills necessary for adoption of AI. Please indicate by ticking **(√)** to rate your level of competence in these skills. The rating scale is 1-5, where Very High = 5, High = 4, Moderate= 3, Low = 2, Very Low =1

Basic ICT skills	**Very High**	**High**	**Moderate**	**Low**	**Very Low**
(i). Proficiency in basic computing tasks, such as word processing (e.g., Microsoft Word).					
(ii). Ability to create and make PowerPoint presentations effectively					
(iii). Skills in copying, saving, and organising documents in digital formats.					
(iv). Competence in retrieving documents from storage devices (e.g., USB drives, cloud storage).					
(v). Ability to use statistical tools like Excel for data analysis and reporting.					
(vi). Skills in digitising documents, including scanning, and creating digital archives.					
(vii). Proficiency in using email and online communication tools for collaboration and information sharing.					
(viii). Ability to navigate and utilise digital library management systems or databases.					
(ix). Familiarity with troubleshooting basic technical issues, such as resolving printer or connectivity problems.					

18. The table below presents intermediate ICT skills necessary for adoption of AI. Please indicate by ticking **(√)** to rate your level of competence in these skills. The rating scale is 1-5, where Very High = 5, High = 4, Moderate= 3, Low = 2, Very Low =1

Intermediate ICT skills	**Very High**	**High**	**Moderate**	**Low**	**Very Low**
(i). Proficiency in browsing the Internet to locate and access information effectively.					
(ii). Ability to create and manage web content using tools like content management systems (e.g., WordPress).					
(iii). Skills in utilising Web 2.0 technologies (e.g., blogs, wikis, and social media) for information sharing and collaboration.					
(iv). Competence in using search engines effectively for advanced searches and research.					
(v). Proficiency in using email for communication, including attaching files and organising messages.					
(vi). Ability to navigate and utilise subject gateways to access specialised resources.					
(vii). Familiarity with managing cloud-based storage platforms (e.g., Google Drive, OneDrive) for collaborative work.					
(viii). Competence in basic data visualisation techniques using tools like Excel or Google Charts.					
(ix). Proficiency in integrating multimedia tools (e.g., video editing or audio recording software) to create engaging digital content.					

19. The table below presents advanced ICT skills necessary for adoption of AI. Please indicate by ticking **(√)** to rate your level of competence in these skills. The rating scale is 1-5, where Very High = 5, High = 4, Moderate= 3, Low = 2, Very Low =1

Advanced ICT skills	**Very High**	**High**	**Moderate**	**Low**	**Very Low**
(i). Proficiency in designing and integrating software to enhance library services.					
(ii). Ability to install and configure operating systems for optimal functionality.					
(iii). Skills in the development of information systems tailored to library needs.					
(iv). Competence in designing user interfaces (UI) for library applications and systems.					
(v). Ability to perform minor computer repairs, such as troubleshooting hardware issues.					
(vi). Expertise in data mining techniques to extract meaningful insights from large datasets.					
(vii). Proficiency in data analysis and developing algorithms for AI and library services.					
(viii). Knowledge of cybersecurity measures and network management to secure library systems.					
(ix). Competence in managing database management systems to organised and retrieve data efficiently.					
(x). Skills in setting up and maintaining network infrastructure to support AI-driven services.					
(xi). Proficiency in programming languages (e.g., Python, Java) for developing AI applications.					

Advanced ICT skills	Very High	High	Moderate	Low	Very Low
(xii). Knowledge of cloud computing platforms (e.g., AWS, Azure) for deploying AI solutions.					
(xiii). Ability to train and fine-tune machine learning models to support AI applications in libraries.					

20. The table below presents types of training required to prepare library staff for adoption of AI in university libraries. Please indicate by ticking **(√)** your level of agreement or disagreement with the necessity of these trainings. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Types of Training	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(i). Training on basic AI concepts to understand AI fundamentals and applications in libraries.					
(ii). Workshops on data analytics to enhance decision-making and information management skills.					
(iii). Training on machine learning applications specific to library operations and services.					
(iv). Digital literacy training to ensure staff can effectively use digital tools and platforms.					
(v). Cybersecurity and data privacy training to safeguard library systems and user information.					
(vi). Hands-on training on AI tools and software (e.g., TensorFlow, PyTorch) used in library services.					
(vii). Training on managing and integrating cloud computing platforms for library operations.					
(viii). Workshops on ethical considerations and responsible use of AI in library environments.					

21. The table below presents methods of training on new technologies such as AI. Please indicate by ticking **(√)** to indicate the extent to which you prefer each of these methods. The rating scale is 1-5, where Strongly Prefer = 5, Prefer = 4, Neutral = 3, Do not Prefer= 2, Strongly Do Not Prefer =1

Methods of Training	**Strongly Prefer**	**Prefer**	**Neutral**	**Do Not Prefer**	**Strongly Do Not Prefer**
(i). Workshops and conferences for hands-on experience and knowledge sharing.					
(ii). Seminars to gain insights and updates on AI and related technologies.					
(iii). Further studies in Library and Information Science (LIS) with a focus on emerging technologies.					
(iv). Web tutorials for flexible and self-paced learning.					
(v). Online courses offering in-depth knowledge on AI and its applications.					
(vi). On-the-job training for practical application of new skills in real-time.					
(vii). Personal training sessions tailored to individual staff needs.					
(viii). Learning from friends and colleagues with expertise in AI technologies.					
(ix). Training provided by software suppliers to ensure proper usage of AI tools and systems.					

Methods of Training	Strongly Prefer	Prefer	Neutral	Do Not Prefer	Strongly Do Not Prefer
(x). Professional certifications in AI and ICT, such as courses offered by Coursera or edX.					
(xi). Internships or attachments in organisations already leveraging AI in library services.					
(xii). Blended learning programs combining face-to-face and online training for a comprehensive approach.					

22. In your opinion, how prepared are library staff in terms of their ICT skills and competencies to adopt AI technologies?

Section 5: Users' Perception Readiness for Adoption of AI

23. How often do library users inquire about AI-based services (e.g., chatbots, virtual assistants)?

Never [ ]
Rarely [ ]
Sometimes [ ]
Often [ ]
Always [ ]

24. Based on your observations, how willing do you think library users are to adopt AI-powered services?

Very Unwilling [ ]
Unwilling [ ]
Neutral [ ]
Willing [ ]
Very Willing [ ]

25. The table below presents the concerns users might have regarding AI in libraries. Please indicate by ticking **(√)** your level of agreement or disagreement with these concerns. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Users Concerns Towards AI	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
(i). Poor ICT infrastructure that may limit the effective use of AI-based services in the library.					
(ii). Intermittent power supply affecting the reliability of AI systems and the accessibility of library resources.					
(iii). Technophobia, or fear of new technologies, hindering the adoption of AI by library users.					
(iv). Concerns regarding privacy and security of personal and academic data stored or processed by AI systems.					
(v). Lack of adequate training for library staff and users to navigate AI-driven systems effectively.					
(vi). Resistance to change among library users, leading to reluctance in embracing AI technologies.					
(vii). Over-reliance on technology that might diminish personal interaction with library staff or lead to reduced critical thinking.					
(viii). Inaccuracy of AI tools in delivering precise, relevant, or useful results, diminishing trust in AI systems.					

Users Concerns Towards AI	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(ix). Lack of sufficient AI expertise among library staff, resulting in a lack of support for users in AI-related tasks.					
(x). Failure to establish clear policy guidelines for the ethical and practical use of AI in the library environment.					
(xi). Fear that AI may lead to the replacement of human library staff, contributing to job insecurity.					
(xii). The ethical implications of AI, including the risk of biased algorithms affecting information access or decision-making.					
(xiii). Concerns about the cost of AI implementation and the allocation of resources, which might divert funds from other library services.					
(xiv). Lack of transparency in AI decision-making, leading to users questioning how AI-driven recommendations or results are generated.					

Section 6: Readiness of university libraries in Kenya to adopt AI

26. How would you rate your library's current ICT infrastructure in terms of its ability to support AI technologies?

Very inadequate [ ]
Inadequate [ ]
Neutral [ ]
Adequate [ ]
Very adequate [ ]

27. To what extent does the library staff have the necessary skills and knowledge to support AI adoption and use in the library?

Very inadequate [ ]
Inadequate [ ]
Neutral [ ]
Adequate [ ]
Very adequate [ ]

28. What is your perception of library users' readiness to accept and use AI technologies in university libraries?

Very Negative [ ]
Negative [ ]
Neutral [ ]
Positive [ ]
Very Positive [ ]

29. How equipped is your library with the necessary hardware and software to implement AI technologies effectively?

Very inadequate [ ]
Inadequate [ ]
Neutral [ ]
Adequate [ ]
Very adequate [ ]

30. How adequate is the library's budget to support the implementation and maintenance of AI technologies in the long term?

Very inadequate [ ]
Inadequate [ ]
Neutral [ ]
Adequate [ ]
Very adequate [ ]

31. What level of support do you think library leadership provides for the adoption of AI technologies?

Very inadequate [ ]
Inadequate [ ]
Neutral [ ]
Adequate [ ]
Very adequate [ ]

Section 7: Developing a Framework for AI Adoption in Libraries

32. The table below presents statements relating to factors that should be included in a framework for adopting AI in university libraries. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
(i). A robust ICT infrastructure that can support the implementation and scalability of AI technologies in the library.					
(ii). Regular staff training and capacity building on AI and ICT to enhance skills for effective adoption and use.					
(iii). User education and awareness campaigns to promote understanding and acceptance of AI technologies among library users.					
(iv). Adequate funding and resource allocation to support the acquisition, implementation, and maintenance of AI technologies in the library.					
(v). Collaboration with AI experts, researchers, and external partners to ensure effective AI integration and continuous innovation in library services.					
(vi). Clear government or institutional policies that guide AI adoption, including ethical considerations, privacy, and security issues.					

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(vii). Development of an AI implementation roadmap, outlining clear goals, milestones, and timelines for integrating AI in library services.					
(viii). Stakeholder involvement and buy-in, including library staff, users, and administration, to ensure that AI adoption is well-supported and aligned with the library's strategic goals.					
(ix). Continuous evaluation and feedback mechanisms to monitor the effectiveness of AI technologies in the library and make necessary adjustments.					

33. The table below presents statements relating to stakeholders that should be involved in developing and implementing AI in university libraries. Please indicate by ticking **(**√**)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(i). University administration					
(ii). Library staff					
(iii). ICT department					
(iv). Government bodies					
(v). Library users					

34. What key components do you believe should be included in a framework for AI adoption in university libraries?

_____

Conclusion

Upon submission, you will receive a confirmation message

Thank you for your participation! Your insights will contribute to developing a comprehensive framework for AI adoption in university libraries across Kenya.

Appendix V: Interview Schedule for University Librarians

Research Title: *Assessment of University Libraries' Readiness for Adopting Artificial Intelligence (AI) in Kenya*

Introduction

Your willingness to participate in this interview is appreciated. This study aims to assess the readiness of university libraries in Kenya to adopt AI in providing information services and develop a framework for AI implementation in university libraries. Your experience as a university librarian/director of the university library is crucial in understanding which information services could benefit from AI, the readiness of ICT infrastructure, the competence of library staff, and users' perceptions of the use of AI in libraries. The information you provide will help develop a framework AI implementation in university libraries. Your responses will confidential and utilised solely for the research.

Section 1: General Background Information

1. Can you please share your current role and responsibilities in the university library?
2. How long have you worked in the library sector?

Section 2: Existent Information Services that Can Be Supported by AI

3. What are the key information services in your library that you believe could benefit most from AI technologies?
4. In your assessment, which user-facing library services would be most suitable for initial AI implementation?

Section 3: ICT Infrastructure Readiness for Adoption of AI

5. Could you provide a detailed assessment of your library's current ICT infrastructure capacity in readiness for AI implementation?
6. What budgetary and resource allocation strategies do you have in place to support the necessary ICT infrastructure upgrades for AI adoption?

Section 4: Staff's ICT Skills and Competencies Readiness for Adoption of AI

7. How would you evaluate your library staff's current ICT skills in relation to adopting AI-based tools for information services?
8. How do you plan to address potential resistance or concerns from staff regarding AI implementation while ensuring their active participation in the transition?

Section 5: Users' Perception Readiness for Adoption of AI

9. What concerns or reservations have users expressed regarding the introduction of AI in library services, particularly in relation to privacy, security, or over-reliance on technology?
10. How do you plan to address potential resistance or skepticism from library users regarding the integration of AI tools in library services?

Section 6: Readiness of University Libraries in Kenya to Adopt AI

11. What do you consider to be the most critical factors affecting your library's readiness to adopt AI, and how are you addressing them?
12. What do you believe are the most significant barriers to AI adoption in university libraries in Kenya, such as financial constraints, lack of infrastructure, or regulatory issues?

Section 7: Developing a Framework for AI Adoption

13. What key components do you believe should be included in a framework for AI adoption in Kenyan university libraries?
14. What governance structures and policies would you recommend for successful AI implementation in university libraries?

Closing remarks

Thank you for your time and valuable insights. Your feedback will be instrumental in developing strategies and frameworks to help university libraries in Kenya effectively adopt AI.

Appendix VI: Interview Schedule for Systems Librarians

Research Title: *Assessment of University Libraries' Readiness for Adopting Artificial Intelligence (AI) in Kenya*

Introduction

Your willingness to participate in this interview is appreciated. This study aims to assess the readiness of university libraries in Kenya to adopt AI in providing information services and develop a framework for AI implementation in university libraries. Your experience as a systems librarian/Head of ICT in the library is crucial in understanding which information services could benefit from AI, the readiness of ICT infrastructure, the competence of library staff, and users' perceptions of the use of AI in libraries. The information you provide will help develop a framework for AI implementation in university libraries. Your responses will confidential and utilised solely for the research.

Section 1: General Background Information

1. Can you please share your current role and responsibilities in the university library?
2. How long have you worked in the library sector?

Section 2: Existent Information Services that Can Be Supported by AI

3. In your opinion, which existing information services within the library could benefit the most from the implementation of AI technologies, such as automated cataloguing, reference assistance, or information retrieval?
4. In your opinion, what specific AI technologies (e.g., Natural Language Processing, machine learning, etc.) would be most beneficial for enhancing library services?

Section 3: ICT Infrastructure Readiness for Adoption of AI

5. How would you assess the current ICT infrastructure (e.g., Internet bandwidth, server capacity, hardware, and software) in your library in terms of supporting AI adoption for library services?

6. What specific hardware and software upgrades would be necessary to support AI implementation in your library services?
7. How would your current data centre capabilities and cloud infrastructure support AI workloads?

Section 4: Staff's ICT Skills and Competencies Readiness for Adoption of AI

8. What is your assessment of the current ICT skills of library staff, specifically in relation to adopting AI technologies in library services?
9. What technical competencies would your ICT team need to develop to support AI systems in the library?

Section 5: Users' Perception Readiness for Adoption of AI

10. What are the major concerns or issues users have raised regarding the potential adoption of AI in the library, particularly around usability, privacy, or security?
11. How do you plan to engage users and educate them about AI technologies, ensuring that they are open to adopting these innovations in library services?

Section 6: Readiness of University Libraries in Kenya to Adopt AI

12. What do you consider the key factors that would determine the readiness of university libraries in Kenya to adopt AI, particularly in relation to infrastructure, staff competencies, and user acceptance?
13. What challenges do you foresee in the widespread adoption of AI in university libraries across Kenya?

Section 7: Developing a Framework for AI Adoption

14. In your view, what key components should be included in a framework for AI adoption in university libraries, especially from an ICT perspective?
15. What security protocols and data governance measures would you recommend incorporating into the framework?

Closing remarks

Thank you for your time and valuable insights. Your feedback will be instrumental in developing strategies and frameworks to help university libraries in Kenya effectively adopt AI.

Appendix VII: Focus Group Discussion Guide for Heads of Departments (HODs)

Section 1: Introduction

- Welcome and introduction of the facilitator
- Introduction of participants:
    - Your current role in the university
    - Your experience in the current role
    - Any other details you would like to share
- Explanation of the purpose of the discussion:
    - To gather insights on adopting AI in university libraries in Kenya.
    - Emphasis on confidentiality and voluntary participation.
- Brief explanation of AI in libraries and its potential relevance.
- Outline of the discussion structure and time allocation.

Section 2: Existent Information Services that Can Be Supported by AI

1. Based on your research and teaching needs, what library services do you find most time-consuming or challenging that could benefit from AI automation?
2. How would you feel about using AI technologies, such as chatbots or automated reference services, in the library?

Section 3: ICT Infrastructure Readiness for Adoption of AI

3. How do you assess the current ICT infrastructure in your university library (e.g., Internet speed, computer systems, access to digital resources) in terms of its readiness to support AI technologies?
4. What technical challenges do you currently face when accessing library resources remotely?
5. Are there any specific technological upgrades or changes that you believe should happen in the library to support AI adoption?

Section 4: Staff's ICT Skills and Competencies Readiness for Adoption of AI

6. What kind of technical support do you expect from library staff when using digital resources?
7. In your opinion, what kind of training or support would be needed to help library staff to effectively provide AI enhanced services?

Section 5: Users' Perception Readiness for Adoption of AI

8. How do you feel about the idea of incorporating AI into library services?

9. What concerns, if any, do you have about AI adoption in libraries (e.g., privacy, data security, the reliability of AI tools)?

Section 6: Readiness of University Libraries in Kenya to Adopt AI

10. Based on your experiences, do you think university libraries in Kenya are ready to adopt AI technologies in terms of infrastructure, support, and staff preparedness?
11. What do you think are the main barriers to AI adoption in university libraries in Kenya?

Section 7: Developing a Framework for AI Adoption

12. In your opinion, what should be the key elements of a framework to successfully introduce AI into university libraries?
13. What support mechanisms would you want to see in place when AI services are introduced?

Concluding Questions:

14. What final thoughts would you like to share about AI adoption in our library?
15. What key recommendations would you make to ensure successful AI implementation?
16. Is there anything else we haven't discussed that you think is important?

Follow-up Probes for Deeper Discussion:

- Could you elaborate more on that point?
- How do others in the group feel about this perspective?
- What specific examples can you share from your experience?
- How might this impact different disciplines differently?
- What alternatives would you suggest?

Conclusion

- Summary of key points discussed.
- Appreciation for participation and reiteration of confidentiality.

Appendix VIII: List of Chartered Universities in Kenya as at March 2025

COMMISSION FOR UNIVERSITY EDUCATION

Quality-Our Agenda

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Tel: + 254 (02) 7205000; 0726-445566; 0717-445566; 0780656575

Email –General enquiries/comments: info@cue.or.ke ; Complaints: complaints@cue.o.ke
Website: www.cue.or.ke

UNIVERSITIES AUTHORISED TO OPERATE IN KENYA

No.	NAME OF UNIVERSITY/ UNIVERSITY COLLEGE	YEAR OF ESTABLISHMENT/ ACCREDITATION
	Public Chartered Universities	
1.	University of Nairobi	Established - 1970 Chartered - 2013
2.	Moi University	Established - 1984 Chartered - 2013
3.	Kenyatta University	Established - 1985 Chartered - 2013
4.	Egerton University	Established - 1987 Chartered – 2013
5.	Jomo Kenyatta University of Agriculture and Technology	Established - 1994 Chartered - 2013
6.	Maseno University	Established - 2001 Chartered – 2013
7.	Masinde Muliro University of Science and Technology	Established - 2007 Chartered – 2013
8.	Dedan Kimathi University of Technology	2012
9.	Chuka University	2013
10.	Technical University of Kenya	2013
11.	Technical University of Mombasa	2013
12.	Pwani University	2013

13.	Kisii University	2013
14.	University of Eldoret	2013
15.	Masaai Mara University	2013
16.	Jaramogi Oginga Odinga University of Science and Technology	2013
17	Laikipia University	2013
18.	South Eastern Kenya University	2013
19.	Meru University of Science and Technology	2013
20.	Multimedia University of Kenya	2013
21.	University of Kabianga	2013
22.	Karatina University	2013

23.	Kibabii University	2015
24.	Rongo University	2016
25.	The Co-operative University of Kenya	2016
26.	Taita Taveta University	2016
27.	Murang'a University of Technology	2016
28.	University of Embu	2016
29.	Machakos University	2016
30.	Kirinyaga University	2016
31.	Garissa University	2017
32.	Alupe University	2022
33.	Kaimosi Friends University	2022
34.	Tom Mboya University	2022
35.	Tharaka University	2022

Private Chartered Universities		
1.	University of Eastern Africa, Baraton	1991
2.	Catholic University of Eastern Africa (CUEA)	1992
3.	Daystar University	1994
4.	Scott Christian University	1997
5.	United States International University	1999
6.	Africa Nazarene University	2002
7.	Kenya Methodist University	2006
8.	St. Paul's University	2007
9.	Pan Africa Christian University	2008
10.	Strathmore University	2008
11.	Kabarak University	2008
12.	Mount Kenya University	2011
13.	Africa International University	2011
14.	Kenya Highlands Evangelical University	2011
15.	Great Lakes University of Kisumu	2012
16.	KCA University	2013
17.	Adventist University of Africa	2013
18.	KAG EAST University	Registered -1989 Chartered - 2016
19.	Umma University	2019

20	Presbyterian University of East Africa	2020
21.	Aga Khan University	2021
22	Kiriri Women's University of Science and Technology	2022
23	The East African University	2022
24	Zetech University	2022
25	Lukenya University	2022
26	Management University of Africa	2024
27	Tangaza University	Established-1997 Chartered-2024

Appendix IX: Random Numbers for Public Chartered Universities in Kenya

4 Random Numbers
28 **05** **0**4 27

Specs: This table of 4 random numbers was produced according to the following specifications: Numbers were randomly selected from within the range of 1 to 35. Duplicate numbers were not allowed. This table was generated on 8/16/2024.

Note: This random number table was generated by Stat Trek's Random Number Generator, which can be found at https://stattrek.com/statistics/random-number-generator.

Appendix X: Random Numbers for Private Chartered Universities in Kenya

3 Random Numbers
05 16 14
Specs: This table of 3 random numbers was produced according to the following specifications: Numbers were randomly selected from within the range of 1 to 27. Duplicate numbers were not allowed. This table was generated on 8/16/2024.

Note: This random number table was generated by Stat Trek's Random Number Generator, which can be found at https://stattrek.com/statistics/random-number-generator.

Appendix XI: Questionnaire for Validation of the Proposed Framework for Adoption of AI in University Libraries in Kenya

Section 1: Demographic Information

Institution name_____

Position/Designation_____

Section 2: Evaluation of the Proposed Framework

Instructions
The table below presents statements regarding the evaluation of the proposed framework. Please indicate by ticking **(√)** your level of agreement or disagreement with these statements. The rating scale is 1-5, where Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree =1

Statement	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
(i). The framework is comprehensive and logically structured					
(ii). It is applicable to the context of university libraries in Kenya					
(iii). It provides practical guide for AI adoption and implementation					
(iv). I would recommend this framework for adoption with or without minor improvements					

Section 3: Final suggestions

Please provide any additional feedback, suggestions for improvement, or missing elements that you think should be included in the framework.

_____

_____

Appendix XII: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 342416

Date of Issue: 06/January/2025

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Appendix XIII: Ethics Review Board (ERB) Clearance

VERDICT: APPROVED WITH COMMENTS

DAYSTAR UNIVERSITY
Excellence-Transformation-Servant Leadership

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P.O. Box 17, Daystar University,
90145, Athi River, Kenya

Valley Road Campus
P.O. Box 44400 - 00100,
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Tel: 0709 972 000
0716 170 313
0748 100 759
0724 256 408/9

Email: admissions@daystar.ac.ke OR
info@daystar.ac.ke

Website: www.daystar.ac.ke

Daystar University Institutional Scientific and Ethics Review Committee (DU-ISERC)

Our Ref: **DU-ISERC/04/02/2025/000138**

Date: 4th February 2025

To: Ephrine M. Ubaga

Dear Ephrine

ASSESSMENT OF UNIVERSITY LIBRARIES' READINESS FOR ADOPTING ARTIFICIAL INTELLIGENCE IN KENYA

Reference is made to your ISERC application reference **No. 210125-01** dated **21st January 2025** in which you requested for ethical approval of your proposal by Daystar University Institutional Scientific and Ethical Research Committee (DU- ISERC).

We are pleased to inform you that ethical review has been done and the verdict is **Revise to the satisfaction of supervisors then proceed to the next level.** As guidance, ensure that the attached comments are addressed. Please be advised that it is an offence to proceed to collect data without addressing the concerns of DU- ISERC. Your application approval number is **DU-ISERC-00138**. The approval period for the research is **between 4th February 2025 to 3rd February 2026** after which the ethical approval lapses. Should you wish to continue with the research after the lapse you will be required to apply for an extension from DU-ISERC at half the review charges.

This approval is subject to compliance with the following requirements.

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by Daystar University ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to Daystar University ISERC within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to Daystar University ISERC within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of a signed one-page executive summary report and a closure report within 90 days upon completion of the study to Daystar University DU- ISERC via email [duiserc@daystar.ac.ke].

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and other clearances needed.

Yours sincerely

Dr. Roseline Olumbe, PhD
Ag. Chair, Daystar University Institutional Scientific and Ethics Review Committee
Encl. Review Report

*"...until the day dawn and the **daystar** arise in your hearts"*
2 Peter 1.19 KJV

Appendix XIV: Clearance to Collect Data – USIU - Africa

United States International University-Africa
Education to take you places

MS. EPHRINE M'MBONE UBAGA
ubagae@gmail.com

12TH /02/2025

Dear Ephrine,

REF: PERMISSION TO CONDUCT RESEARCH AT USIU-AFRICA

Following your request to conduct research at USIU-Africa on the topic **"Assessment Of University Libraries' Readiness For Adopting Artificial Intelligence In Kenya"** the university's Research Office has authorized you to collect data from the respondents in the Institution.

However, the university imposes the following conditions:

1. No personal information will be asked of the respondents.
2. You will share the preliminary report findings with the university prior to completion.
3. You will provide a copy of the completed research to USIU-Africa.
4. Under no circumstances will the information obtained from USIU-Africa be re-used or disclosed for other purposes.

Your research period expires on 12th May, 2025. Kindly respond to the undersigned to confirm your acceptance to the condition stated above.

Sincerely,

UNITED STATES INTERNATIONAL UNIVERSITY RESEARCH OFFICE AFRICA

Prof. Amos Njuguna,
DVC- Transformative Teaching,Learning and Research.
Tel: 0730116442
Email: amnjuguna@usiu.ac.ke

Appendix XV: Clearance to Collect Data – Murang'a University of Technology

MURANG'A UNIVERSITY OF TECHNOLOGY

OFFICE OF THE REGISTRAR

(Administration and Human Resource)

Cell: +254-0115326176
E-mail: registrar-ahr@mut.ac.ke
Website: www.mut.ac.ke

P.O Box 75-10200
Murang'a, Kenya

REF: MUT/EXT-COMM/REG-AHR/29/2020/VOL.1 **DATE:** 15th January, 2025

Ephrine M. Ubaga
Kirinyaga University
P.O. Box 143-10300,
Kerugoya

Phone No: 0722923844

Email: ubagae@gmail.com

Dear Ms. Ubaga,

RE: REQUEST FOR PERMISSION TO COLLECT DATA

Reference is made to your letter dated 15th January, 2025 on the above subject matter.

Your request to collect data on **"Assessment of University Libraries' readiness in adopting Artificial Intelligence (AI) in Kenya"** has been granted.

Kindly treat the information you will obtain in strict confidence and thereafter share the findings of your study with us for information purposes.

Kindly liaise with the University Librarian -Mr. Benjamin Butuk Telephone No. 0723493737 for guidance.

Yours Sincerely,

DR. PEACE B. AGUFANA, PhD., IHRM.
REGISTRAR, AHR

Copy to: University Librarian

Appendix XVI: Clearance to Collect Data – JKUAT

JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
P.O. Box 62000-00200 Nairobi Kenya, Tel: +254-067-5870001-4, +254-67-53-52711,
Office of the Registrar (Administration & Finance)

JKU/ACA/3D-3(17) **23RD JANUARY, 2025**

Ms. Ephrine M. Ubaga
Kirinyaga University
P.O. Box 143 – 10300
KERUGOYA
Email: ubagae@gmail.com
Tel. 0722 923844

Dear Ms. Ubaga

RE: PERMISSION TO COLLECT DATA

Reference is made to your letter dated 10th January, 2025 requesting for permission to collect data for your PhD research project entitled **"Assessment of university libraries' readiness in adopting Afriticial Intilligence (AI) in Kenya".**

Approval has been granted for you to collect data from the specified target group only on the understanding that all the data collected will be for academic purpose only and will be kept confidential throughout the project and after completion of the project. This is also on condition that the JKUAT University Library will receive a copy of your final thesis for future reference.

Yours sincerely,

DR. ROSE M. GITHU, PhD
REGISTRAR (ADMINISTRATION & FINANCE)
RG/mw

Copy to: Deputy Vice Chancellor (Admin. & Finance)

Appendix XVII: Clearance to Collect Data – University of Embu



UNIVERSITY OF EMBU
OFFICE OF THE REGISTRAR
(ACADEMICS, RESEARCH & EXTENSION)

P.O. Box 6 – 60100
EMBU - KENYA
Email: registrar-are@embuni.ac.ke
Website: www.embuni.ac.ke

Tel: +254 020 2444136
+254 0706528876
+254 0743936436

REF: UoEm/REG(ARE)/DATA/VOL.1 (067)

DATE: January 8, 2025

EPHRINE M'MBONE UBAGA,
KIRINYAGA UNIVERSITY,
P.O. Box 143-10300,
KERUGOYA.

Dear Ms. M'mbone,

RE: REQUEST TO CONDUCT RESEARCH

Reference is made to your letter on the above subject.

Permission is hereby granted to you to collect data for your research project at the University of Embu on the following conditions:

1. The information gathered should be used strictly for academic purposes.
2. Confidential information that may come your way during the study should not be revealed to a third party.
3. You shall not mention any interviewee by name without a written approval from the University.
4. You will deposit the final copy of your project with the Librarian, University of Embu.
5. You must obtain a personal accident insurance policy while working at the University.
6. At all times adhere to the code of conduct as shall be brought to your attention by the undersigned.

Before starting your research, you are advised to visit the undersigned for guidance on the University expectations and assistance on how to make your way around.

If you agree to these conditions, please sign in the space provided below, and return a copy of this letter to the undersigned.

Thank you.

For:
PROF. JACKSON WACHIRA
REGISTRAR (ACADEMICS, RESEARCH AND EXTENSION)

UNIVERSITY OF EMBU
08 JAN 2025
P.O. Box 6-60100
EMBU

aww/bkg

I, EPHRINE M. UBAGA agree to abide by the above conditions while collecting data for my research project at the University of Embu.

Signature ..... Date 11.1.2025

Copies to:
- Vice-Chancellor
- Deputy Vice-Chancellor (ARE)
- Head of Admissions
- Director Research
- Librarian

Appendix XVIII: Clearance to Collect Data – Egerton University

EGERTON UNIVERSITY

P. O. Box 536 – 20115
Egerton, Kenya

Cell: 0775015388/0743473632
Email: director.research@egerton.ac.ke

OFFICE OF THE DIRECTOR
(RESEARCH AND EXTENSION)

EU/DVC/RE/089

21st February, 2025

Ephrine M. Ubaga,
Kirinyaga University,
P.O Box 143-10300,
KERUGOYA

Dear Ms. Ubaga

RE: PERMISSION TO CONDUCT RESEARCH AT EGERTON UNIVERSITY

Reference is made to your letter dated 8th January, 2025 requesting for authority to collect data for your doctoral thesis titled: **"Assessment of University Libraries' Readiness in Adopting Artificial Intelligence (AI) in Kenya".** It is noted that the data will be collected from Undergraduate students, Library staff, Head of Department – ICT and BLINS Coordinator at Egerton University.

Authority is hereby granted for you to collect data from Undergraduate students, Library staff, Head of Department – ICT and BLINS Coordinator at Egerton University. Kindly liase with the University Librarian via email librarian@egerton.ac.ke and manager ICT via email ictmanager@egerton.ac.ke.

You will be required to strictly adhere to the regulation by various research regulatory bodies in Kenya for your research and handle the data with the highest level of confidentiality in line with the Data Protection Act, 2019. This is also to request you to deposit a copy of your thesis with Egerton University Repository.

Thank you.

Maureen Ngala
SENIOR ASSISTANT REGISTRAR
For: DIRECTOR, RESEARCH & EXTENSION

cc: Deputy Vice Chancellor (AR&E)
University Librian
Manager ICT
BLINS Coordinator

MN/smw

Appendix XIX: Clearance to Collect Data – KCA University

Thika Road, Exit 5, Utalii Lane, Ruaraka
P.O. Box 56808-00200 Nairobi, Kenya
Telephone: 0734 888022, 0710888 022
Email: dvcrio@kcau.ac.ke
Website: www.kcau.ac.ke

OFFICE OF THE DVC RESEARCH, INNOVATION & OUTREACH

Ref: KCAU/DVCRIO/RDC/10 Date: 12th February, 2025

Ephrine Ubaga
Department of Pure and Applied Sciences
Kirinyaga University
P.O Box 143 – 10300
Kerugoya

Dear Ms. Ubaga,

RE: AUTHORIZATION TO COLLECT RESEARCH DATA AT KCA UNIVERSITY

Reference is made to your letter received on 4th February, 2025 requesting authorization to collect data at KCA University on the topic **"Assessment of University Libraries' Readiness for Adopting Artificial Intelligence (AI) in Kenya"** for your PhD (Information Systems) degree of Kirinyaga University.

I am pleased to inform you that your request to collect data has been considered and approved. It is noted that your data will be collected from Undergraduate students, Library staff and Chairpersons of Departments. KCA University guidelines and policies as well as the Data Protection Act of 2019 shall apply as you collect your data within the University. It is further noted that the data collected shall solely be used for academic purposes and will be treated with utmost confidentiality.

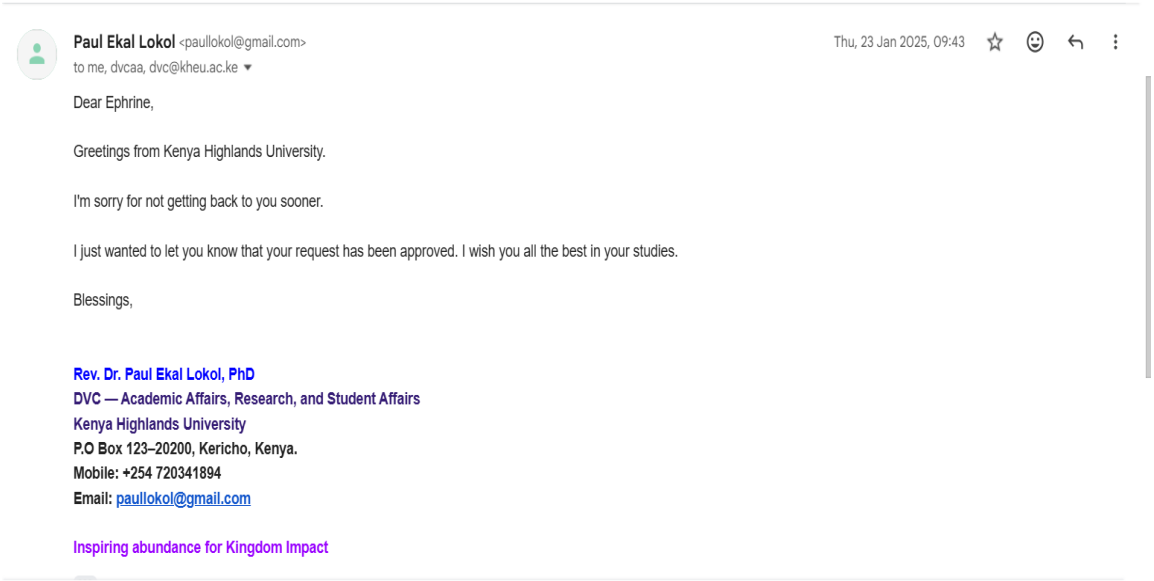
The University requires that upon completion of your research, you will submit a copy of your report to the Deputy Vice-Chancellor (Research, Innovation and Outreach) for records.

Yours sincerely,

Prof. Vincent O. Onywera
DEPUTY VICE -CHANCELLOR RESEARCH, INNOVATION AND OUTREACH AND PROFESSOR OF EXERCISE AND SPORTS SCIENCE

cc: Vice-Chancellor & CEO
DVC, Academic and Student Affairs
DVC, Finance, Planning and Development
Dean Research, Innovation and Outreach
Head of Library Services
Dean of Students
Chair, KCAUSERC
KCA University Data Protection Office

Appendix XX: Clearance to Collect Data – Kenya Highlands University



Paul Ekal Lokol <paullokol@gmail.com> Thu, 23 Jan 2025, 09:43

to me, dvcaa, dvc@kheu.ac.ke

Dear Ephrine,

Greetings from Kenya Highlands University.

I'm sorry for not getting back to you sooner.

I just wanted to let you know that your request has been approved. I wish you all the best in your studies.

Blessings,

Rev. Dr. Paul Ekal Lokol, PhD
DVC — Academic Affairs, Research, and Student Affairs
Kenya Highlands University
P.O Box 123–20200, Kericho, Kenya.
Mobile: +254 720341894
Email: paullokol@gmail.com

Inspiring abundance for Kingdom Impact

Appendix XXI: A Map of Kenya Showing the Locations of Universities Where Data Was Collected



Appendix XXII: Similarity Index Report

DrillBit

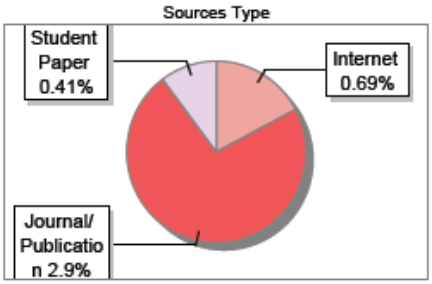
The Report is Generated by DrillBit Plagiarism Detection Software

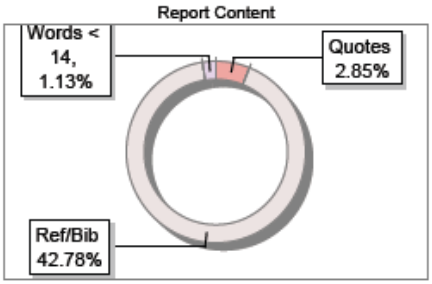
Submission Information

Author Name	Ephrine M'mbone Ubaga
Title	ASSESSMENT OF UNIVERSITY LIBRARIES' READINESS FOR ADOPTING ARTIFICIAL INTELLIGENCE IN KENYA
Paper/Submission ID	6353784
Submitted by	bkamau@kyu.ac.ke
Submission Date	2026-07-18
Total Pages, Total Words	510, 116618
Document type	Thesis

Result Information

Similarity 4 %





Exclude Information

Quotes	Not Excluded
References/Bibliography	Excluded
Source: Excluded < 14 Words	Not Excluded
Excluded Source	0 %
Excluded Phrases	Not Excluded

Database Selection

Language	English
Student Papers	Yes
Journals & publishers	Yes
Internet or Web	Yes
Institution Repository	Yes

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