ADOPTION AND USE OF ARTIFICIAL INTELLIGENCE TOOLS FOR SERVICE PROVISION IN SELECTED UNIVERSITY LIBRARIES IN KENYA

TECLAH JEBET

(BACHELOR OF LIBRARY AND INFORMATION SCIENCE)

E65/37393/2017

DEPARTMENT OF COMPUTING AND INFORMATION SCIENCE

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DECLARATION

I declare that this project is my original work and has not been submitted for any degree in any university/institution for any certification. This project has been complemented by referenced sources duly acknowledged using APA 6th edition and by following anti-plagiarism regulations.

Signature.....**Date**.....26/6/2025.....

Teclah Jebet

E65/37393/2017

Department of Computing and Information Science.

SUPERVISOR

This research project has been submitted with my approval as the University supervisor.

Signature.....**Date**.....26/06/2025.....

...

Dr. Martin Gichugu

Department of Computing and Information Science, Kenyatta University

DEDICATION

I dedicate this work to my Spouse; Moses Murithi Kijugu and Children, my parents Sally and John Chepkwony and siblings who have stood by me during my academic journey.

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This academic journey has been full of ups and downs, but my family, colleagues and friends have been supportive.

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ACRONYMS AND ABBREVIATIONS

AI : Artificial Intelligence

ANOVA : Analysis of Variance

DOI : Diffusion of Innovation

JKUAT : Jomo Kenyatta University of Agriculture and Technology

NACOSTI : National Commission for Science Technology and Innovation

SPSS : Statistical Package for Social Sciences

USIU : United States International University

DEFINITION OF KEY TERMS

University libraries: libraries domiciled in universities for purposes of offering support to students and academic staff.

Artificial Intelligence: Methods by which computers and other technologies may mimic human intelligence in areas such as learning, understanding, problem solving, decision making, creativity, and autonomy.

Awareness Level: Extent to which librarians and other library staff are aware of existence of artificial intelligence tools

Service Delivery: Effective rendering of services to students in a manner that meets industry standards of quality.

Uptake Level: Extent to which university libraries have adopted artificial intelligence tools

ABSTRACT

University libraries are adopting AI technologies more and more to improve productivity, accessibility and improve user experience in the digital age. However, despite its potential in libraries, artificial intelligence still seems like a grey idea, especially in the Kenyan context. The objective of the study was to assess the adoption and use of artificial intelligence tools on service delivery in selected university libraries in Kenya. Specifically, the study sought to examine librarians' awareness levels on existence of artificial intelligence tools, to determine the uptake levels of artificial intelligence tools, to establish the contribution of AI in the core academic library functions and to identify challenges of adopting and using artificial intelligence tools in selected university libraries in Kenya. Diffusion of innovation theory served as the study's anchor theory. The research design used in the study was descriptive research design. A total of eighty-seven library employees were considered in the study as the study population. The research institutions chosen for the study were USIU, Strathmore, the University of Nairobi, and Jomo Kenyatta University of Agriculture and Technology (JKUAT). A total of seventy-one participants were chosen using a stratified random selection method. The study relied on primary data gathered via research questionnaires. Descriptive statistics were used to analyze the data, including frequencies, percentages, means, standard deviations, and scores. Tables were used to display the study's findings. According to the results, university librarians in Kenya are well-informed about the availability of AI resources. University librarians' familiarity with AI technologies and their possible uses was, nevertheless, minimal. The study also found that several university libraries have a high level of AI tools adoption. The study identified that AI tools were used in information retrieval and search optimization, cataloguing, user support, data analysis and decision-making as well as data preservation. The study also found that university libraries face obstacles like financial, economic, and technical hurdles while trying to use AI capabilities. The results highlight the need to overcome challenges occurring in the process of adopting AI technologies. This calls for raising awareness and highlighting the advantages of AI adoption in improving library services. To overcome obstacles and increase the acceptance and usage of AI technologies in university libraries, the study recommends developing targeted training programs, properly allocating resources, and cultivating a supportive corporate culture.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter covers the background of the study, statement of the problem, justification of the study, research objectives, research questions, significance of the study, scope of the study, limitation of the study and the conceptual framework and operational terms in the study.

1.1 Background Information

In a world characterized by an ever-accelerating digital transformation, libraries have emerged as steadfast guardians of knowledge, serving as repositories of information, culture, and heritage. Libraries, especially in academic institutions have always been a foundation of ground-breaking research and studies, including in Kenya (Otike & Barát, 2021). However, with the volume and complexity of library information, and thus user needs, continuing to grow exponentially, libraries have the Herculean task ahead of them of how to effectively handle, retrieve, and distribute this plethora of data so as to meet the varied requirements of their customers. Artificial intelligence is changing the game for libraries and the way in which they do their day-to-day work.

This generally adopted role of the library through adapting to the digital age has, in turn, outgrown traditional roles of libraries. The adoption and usage of Artificial Intelligence tools have emerged as the transformative trend. Artificial Intelligence technologies powered through machine learning and big data have changed ways of collecting, curating, and delivering information in libraries. From deep search algorithms that allow for tailored recommendations to automated cataloging and metadata tagging, AI has increasingly been instrumental in the enhancement of value on efficiency, accessibility, and user experience within the environment of university libraries. This trend is particularly seen in university libraries, changing the face of service delivery and support to students, faculty members, and researchers alike. With the continuous growth of digital landscape, AI tools in the form of chatbots, smart assistants, search functions, IoT, Virtual Reality for immersive learning, Shelf-reading Robots, and MATLAB have started continuously to make their way into the library.

Regionally, the integration of AI technologies has taken centre stage in ways to enhance the management, accessibility, and delivery of academic resources and services (Collins et al., 2021). Artificial intelligence is continuously being used as a means of enhancing several core functions of academic such as in referencing services, book processing, information retrieval process and circulation. For example, ask a Librarian chatbot is now an important of most library systems to answer common questions about the library services and resources. Similarly, as African nations increasingly embrace digital technologies and connectivity spreads, libraries have a unique opportunity to leverage AI to bridge the information gap. For example, several AI tools are finding their ways into the Nigerian University libraries. According to Adejo & Misau (2021), there are increasing use of virtual assistive services in material recommendations, and user support in the libraries. AI is assisting librarians in the management and organization of collection using various tools enabled by machine learning, computer visions and robotics. These AI technologies work through collection and analysis of metadata, content and patterns in the library materials thus effectively organizing them. Bookbot, is an example of an AI tool that has been used in international university libraries to sort out materials in shelves.

In Kenya, the nation's proactive approach to technology adoption and innovation has positioned it as a leader in Africa's digital transformation. As libraries in Kenya adapt to the digital age, they are increasingly incorporating AI technologies to streamline operations, facilitate research, and enhance the learning experience. University libraries in Kenya should therefore recognize the need to further harness the adoption and use of AI technologies to enhance their service provision. In a study on adoption of artificial intelligence in Kenyan academic libraries Sang (2025), analysed the current state of awareness and adoption of AI in Kenyan university libraries and established that there is a positive perception of AI-powered tools and a readiness for adoption. However, university libraries continue to face the challenge of lack of qualified personnel and adequate resources which hampers full scale adoption of AI and training.

Besides, Masinde et al. (2024) exploring the current landscape of artificial intelligence adoption in Kenyan academic libraries revealed a growing adoption of AI tools among Kenyan academic libraries, with notable applications in information retrieval, data management, user services, and decision support systems. On the other hand, in their study on integrating artificial intelligence literacy in library and information science training in

Kenyan academic institutions, Chepchirchir (2024) sought to identify the current state of AI literacy in library and information science training in academic institutions in Kenya. The revealed limited AI literacy among library staff in Kenyan academic institutions which limit optimization and adoption of AI technology. Thus, there is a dire need for library and information science professionals to have the requisite skills and competencies in AI for proper implementation of AI to meet the evolving needs of library users. This phenomenon paints a picture of sub optimization of AI tools in Kenyan universities.

1.2 Problem Statement

With the rapid advancement of technology and the increasing demand for innovative solutions in academic environments, university libraries face the challenge of effectively integrating technologies to enhance their services and meet the evolving needs of their users. One of the most important emerging technologies which has been considered to have potential of revolutionizing library services is artificial intelligence. This will mean finding suitable ways to incorporate AI tools into library infrastructures and to enhance its operations. Artificial Intelligence has a lot of potential in the libraries including in knowledge discovery which is often the standard of gauging the user experience (Cox, 2023). University libraries therefore need to explore how AI can be leveraged to provide personalized and efficient services to users, such as advanced search capabilities, recommendation systems for research materials, and virtual assistants to support information queries (Adejo & Misau, 2021). These tools could also be used to enhance daily repetitive library tasks such as information management process, administrative duties and material security.

Despite its potential, the idea of artificial intelligence in libraries, especially within the context still seems like a grey idea, especially in the Kenyan context. This puts the university libraries in Kenya at a risk of missing the opportunities to enhance library services, thus losing a competitive edge against other resource databases. While some traces of the technology such as chatbots have found their ways into the library management systems, the technology still possess more widespread and long-term solutions to library practices (Onyalo, 2022). With the idea still less explored, there is need for more research on artificial intelligence and its usefulness in the libraries.

Kagoiya and Chepchirchir (2025) explored the possibility of integrating artificial intelligence literacy in library and information science training in Kenyan academic institutions and established that there is need for immediate integration of AI in training of library and information science in academic institutions in Kenya. This would provide valuable practical skills to future librarians which would significantly increase AI literacy level and opportunities for adoption of AI while at the same time reducing challenges in adoption of AI in academic libraries in Kenya. However, the study aimed to determine the possibility of integrating artificial intelligence literacy in library and information science training in Kenyan while the current study aimed to determine the level of awareness and adoption of AI in University libraries.

Masinde et al. (2024) conducted a study explore the current landscape of artificial intelligence adoption in Kenyan academic libraries. The study was anchored on the maturity model. Mixed-method research design incorporating both quantitative and qualitative approaches was adopted in the study. Purposive sampling technique was used to select the study sample of academic libraries. It was revealed that there is a growing interest in AI adoption among Kenyan academic libraries, with applications such as information retrieval, data management, user services, and decision support systems being the commonly adopted applications. Among the key challenges identified in AI adoption include limited infrastructure, resource constraints and staff capacity. The study however, adopted Mixed-method research method while the current study adopted descriptive research design which indicates that there is a methodological gap.

In another study, Chepchirchir (2024) sought to determine the current state of AI literacy in library and information science training in academic institutions in Kenya and the extent to which AI literacy has been integrated into library and information science curricula in academic institutions. The study applied a mixed-methods approach, combining qualitative and quantitative methods. The study reveal that library and information science professionals must possess essential skills and competencies in AI to meet the evolving needs of the job market. To this end the study determined that academic institutions can equip future information professionals to harness the potential of AI in enhancing information services, facilitating knowledge discovery, and improving user experiences. The study sought to determine the current level of AI literacy in library and information

science training while the current study focused on level of adoption of AI in academic libraries which signify that there is a conceptual gap.

Existing literature points to numerous gaps. First the study determined that most studies on AI adoption were conducted in other jurisdictions other than Kenya, presenting a contextual gap. The study further determined that the studies in Kenya used different research methods thus leaving methodological gaps. The study further identifies that there are conceptual gaps. Filling such knowledge and application requires a study that would delve into the potential of the technology in improving user experiences and library services in the university libraries. If the situation continues as it is, libraries would continue with insufficient service delivery which includes missed opportunities in cost-saving, limited personalization of material recommendation which ultimately means inefficiency in information retrieval. Through adoption of AI university libraries can harness their services, support research and learning, and remain relevant and valuable in the digital age.

1.3 Justification of the Study

It's noted that despite the potential of artificial intelligence in enhancing service delivery in university libraries, the level of adoption in Kenya is still wanting. As a result, universities keep losing opportunities associated with use of technology to enhance service delivery in university libraries. If the status quo remains, Kenyan universities become less and less competitive compared to other universities across the world and other digital data bases. Additionally, universities would miss chances to provide efficient services and improve on service cost management. As a result, empirical evidence of adoption of artificial intelligence on service delivery is required urgently thus necessitating the current study.

1.4 Research Objectives

1.4.1 General Objective

The general objective of the study is to assess adoption and use of artificial intelligence tools in service delivery in selected university libraries in Kenya.

1.4.2 Specific Objectives

i. To examine librarians' awareness levels on existence of Artificial Intelligence tools in selected university libraries in Kenya.

ii. To determine the uptake levels of artificial intelligence tools in selected university libraries.
iii. To establish the contribution of AI in the core university library functions
iv. To identify challenges of adopting and using Artificial Intelligence tools in selected university libraries in Kenya.

1.5 Research Questions

i. What is the level of adoption and use of artificial intelligence tools on service delivery in selected university libraries in Kenya?
ii. What is the level of awareness of artificial intelligence tools in the selected University Libraries?
iii. What are the uptake levels of artificial intelligence tools in the selected University Libraries?
iv. What are the contributions of artificial intelligence in the core library functions?
v. What are the challenges of adopting artificial intelligence tools in the selected University Libraries?

1.6 Significance of the Study

Library Staff: This study enables them to accept these advances and utilize them in their work by providing them with the knowledge and understanding of cutting-edge AI tools and technologies that can be used in library operations.

Educational Institutions: The study helps higher education organizations to make decisions about adopting as well as utilizing AI-driven systems within their libraries. It might result into many losing too much or little resources in their libraries.

Researchers: Thus, the findings of this research may serve as a useful guide for researchers carrying out similar investigations. This broadens their knowledge on this subject and possibly gives them some important insights to consider when planning for future studies.

Finally, this research is part of an ongoing conversation about integrating AI into libraries. There are practical lessons that different stakeholders can take from it as they negotiate a landscape that is changing all the time.

1.7 Scope of the Study

The research set out to examine how some university libraries in Kenya have embraced and made use of AI technologies to enhance their service offering. The study's objectives are to examine university libraries' AI awareness, adoption, and use, as well as the benefits and drawbacks of AI in these settings. Therefore, academic library staff members in the selected university libraries will constitute the study's target group. The library collections of four different universities will be examined in this study: USIU, the University of Nairobi, Strathmore University, and Jomo Kenyatta University of Agriculture and Technology (JKUAT). Between June and July of 2024, data was adjusted.

1.8 Limitations of the Study

The study experienced some limitations. First the study collected primary data directly from the library staff in the universities. The study targeted senior library staff who had busy schedules which made it difficult for them to create time to respond to the research instrument. The study thus took more time than anticipated. The study mitigated the situation by adopting drop and pick technique to improve response rate. The researchers encouraged the targeted respondents to participate in the study since the outcome of the study would benefit their library.

The study experienced reluctance to provide information fearing that the information could be used against the institution. Mainly respondents feared being reprimanded by their seniors for providing information to strangers. In order to overcome this obstacle, the researcher had already planned to visit the libraries that would be replying in order to get to know the organization and get permission to start collecting data. To further prove the study's academic nature and convince the respondents that the study their data would be used only for academic reasons, the researcher obtained an introduction letter from Kenyatta university and a research permit from NACOSTI.

1.9 Conceptual Framework

The anticipated link between the research variables is shown by the conceptual framework. University libraries may improve their service delivery with the use of artificial intelligence, according to the research. Additionally, the research found that the link between AI and service delivery in university libraries is influenced by staff training and capabilities. Information material management, resource discovery, information security,

and library administration are all directly impacted by the amount of knowledge about AI tools, the rate of AI tool adoption, and the role of AI in the library's core functions.

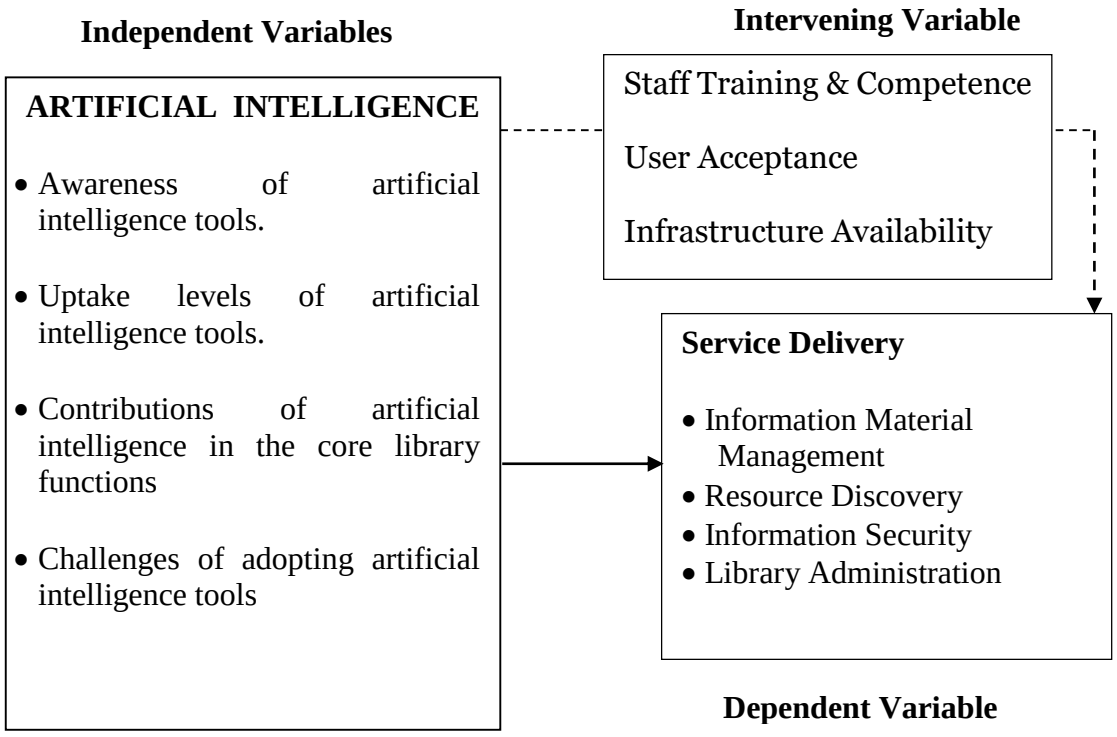

Figure 1.1: Conceptual Framework
Source: Author and Literature Review

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Using six main categories, this chapter summarizes the relevant literature on the following topics: the concept of artificial intelligence, the future of AI in library and information science, the effects of AI on the field in the twenty-first century, How far down the AI adoption curve university libraries are, The theoretical framework, the many forms of artificial intelligence (AI) already present in University Libraries, the ways in which these libraries employ AI to improve their services, and the obstacles that prevent these libraries from fully embracing AI. The study's aims informed the execution of the literature review.

2.2 Concept of Artificial Intelligence

Artificial intelligence comprises a range of technologies enabling machines to mimic human capabilities. These include sensing, comprehension, action, and a spectrum of functions mirroring human behaviour (Zhang & Lu, 2021). Furthermore, Chowdhary (2020) believed that important elements of this technological environment were machine learning, large data processing, natural language comprehension, decision-making algorithms, data visualization, and advanced analytics. Notably, AI explores the creation of computer systems that can perform jobs requiring intelligence comparable to that of humans. From deciphering natural language to recognizing patterns and making decisions, AI's advancements have radicalized its application across diverse fields like healthcare, finance, transportation, and even entertainment (Dissanayake, 2021).

For decades, AI has captivated researchers and the practitioners alike, with its applications continuously evolving and expanding across the globe (Chowdhary, 2020). At its core, artificial intelligence is based on the premise that every level of human intellect, from the most fundamental to the most sophisticated, can be modeled by computers. It follows that one of AI's primary aims is to simulate human thought processes. The foundation for developing intelligent robots was built by trailblazers such as Alan Turing and John McCarthy in the 1950s, when artificial intelligence was in its infancy (Zhang & Lu, 2021). In the time after, artificial intelligence (AI) grew into a complex area that incorporates several subfields, including mathematics, computer science, psychology, linguistics, and neuroscience.

Artificial intelligence (AI) is a field that is advancing at a fast pace and has the potential to revolutionize human labour, entertainment consumption, and global interaction (Nicole, 2023) in profound ways. Automation of formerly human-intensive tasks is becoming more common as businesses turn to artificial intelligence (AI) for tasks including customer support, lead generation, fraud detection, and quality control. Legal document review is one area where AI is obviously superior to humans, because to the high data quantities and meticulous attention to detail required (Enholm et al., 2022). Moreover, businesses are increasingly relying on AI to find solutions to their operational challenges as well as to create value for investors. This is largely occasioned by the computational capability and problem-solving capacity of AI especially in data mining.

By using its ability to analyse huge information, AI may uncover hidden patterns and insights within businesses, resulting in better informed decision-making and operational benefits. Generative AI, a rapidly developing topic, shows great promise for changing a variety of fields. Specifically, in the business sphere, AI is used to provide solutions in customer service, security, supply chain management and quality control (Pallathadka, et al., 2023). Artificial intelligence (AI) has found a home in customer service, where it has helped boost satisfaction and provide better results for clients.

2.3 Prospect and Impact of Artificial Intelligence on Library and Information Science in the 21st Century

Libraries are increasingly adopting AI technology, making it a prominent trend in the information sector. Artificial intelligence has revolutionized the information sector, particularly in university libraries, where it has transformed search and retrieval methods, discovery search, chatbots, text mining, and data mining" (Fernandez, 2023). The rise of AI has significant implications for libraries new technology, particularly artificial intelligence, is transforming how many businesses operate, and libraries are joining the party. They're utilizing AI to make things operate smoother, enhance how consumers locate information, and overall give a better experience for everyone (Bawden 2019). Libraries underwent a technological transformation in the 2000s, embracing AI as if it were an old friend. These brainiac devices, which resemble supercharged search engines and smart organizers, are revolutionizing how libraries operate. Finding information is now simple, collections are well-organized, and utilizing the library feels like a walk in the park.

Basically, AI is making libraries more wonderful, which benefits everyone (Kumar and Rani, 2022).

Libraries are now adopting AI to make it easier to find information. Modern libraries adopt advanced technologies with advanced search engines such as chatbots that remember user preferences and direct them to preferred content. Such technologies are able to identify user preference for develop a sequence for their preferred search and materials. Furthermore, AI assists libraries in organizing massive amounts of data using sorting algorithms. Essentially, AI is a magical improvement for libraries, making them more enjoyable for everyone (Adapted from O'Leary, 2020 and Chandrashekara, 2018). Libraries are getting a technological makeover thanks to AI, a brilliant tool that revolutionizes how you find information. Consider search engines that can read your mind, chatbots that remember your book preferences, and systems that can organize mountains of data in an instant.

Although AI is perceived as a threat to librarians, it is in fact an enabler because it empowers them to make libraries better and more efficient (Chandrashekara, 2018). It acts as a personal research assistant. It understands the context and what they intend to search, delivering outcomes that are more focused. No more skimming through extraneous information. In addition, AI has made cataloguing which used to be a laborious, manual process to be faster and easier. AI, the lightning-fast sorter that tags and arranges data like a pro allows librarians to be more efficient by helping library users to identify the ideal books faster. AI-powered chatbots also act as miniature library assistants who respond to user queries, recommend possible sites, and even remember your preferences for the next time.

Besides, libraries are embracing AI helpers and chatbots that function as friendly librarians. These geniuses, powered by natural language processing, comprehend your questions, recommend resources, and even remember your favourite genres (Agrawal, 2017). However, AI is about more than just providing services to users. It's a data analysis powerhouse Libraries collect a wealth of information about what people borrow, search for, and use. AI analyses this data, revealing patterns and trends that assist librarians in making informed judgments (Thakur, 2019). Imagine knowing exactly which books to buy, which services are in high demand, and how to best spend resources.

Finally, AI is a knowledge management expert. Consider automating summaries of complicated publications, extracting vital information from massive amounts of text, and facilitating knowledge transfer between scholars and librarians. With AI as their assistant, everyone can cooperate and access information more quickly and effectively. AI isn't simply a futuristic curiosity; it's changing libraries into smarter, more user-friendly environments.

2.4 Adoption level of AI by University Libraries

While a few libraries are exploring the realm of intelligence it is not widely used especially in developing nations. In response to the specific problems faced by libraries in developing countries, AI is being used in Nigerian university libraries (Yusuf et al., 2020). Contrarily, Grant and Camp (2018) point out that well-equipped university libraries, particularly in wealthy nations, are using AI to improve services like circulation management and reference aid.

The topic of readiness is also brought up. Ajani et al. (2022) delved into the perspectives of librarians regarding AI integration in libraries and found conflicting sentiments suggesting that they are not fully prepared for its implementation yet. This aligns with studies such as Okunlaya et al. (2022) which revealed acceptance of AI as a substitute for current services at university libraries. Nonetheless technology does have a presence in libraries. Olayode (2022) emphasizes the utilization of technology, across library functions emphasizing that Nigeria is not lagging behind in this aspect.

The fact that engineering college libraries in Karnataka, India, are conversant with smart technologies like blockchain, AR, and AI is further supported by the research of Manjunatha and Patil (2020). University libraries, especially those in developing nations, are slow to embrace AI, but it's clear that technology is playing an increasingly important role in library operations worldwide. Libraries, whether using AI or other creative tools, are constantly looking for ways to improve services and suit their patrons' changing requirements.

Research conducted by Yoon et al. (2022) in North American public and university libraries sought to gain insight into the current state of AI and related technology utilization as well as librarians' perspectives on the implementation of new technology in their respective institutions. In all, 242 librarians from North American university and public libraries filled

out an online survey for the research. University libraries exhibited higher levels of AI usage and awareness compared to public libraries, according to the study's reliance on multiple chi-square tests and crosstab analyses. One difference between academic and public librarians is their outlook on artificial intelligence and related technologies. While the research did provide useful insight into the use of AI and associated technologies, it was carried out in North America, a region with a more advanced economy than Kenya.

The use and acceptance of AI by librarians in Southern Nigeria was examined in separate research by Ogochukwu (2023). Finding out how librarians in Southern Nigeria's many university libraries embraced and made use of AI was the driving force behind the research. The study surveyed 848 librarians working at university libraries in Southern Nigeria. Structured questionnaires were used to gather primary data, which was then analyzed using descriptive statistics. University libraries in Southern Nigeria have not made much use of AI, according to the research. It was also determined that disturbances, a lack of expertise, and the need for training are significant obstacles to the use of AI in libraries.

2.5 The Types of AI Available in University Libraries

Olayode (2022) aimed to learn how academic and research libraries around the world, especially in developing nations, use AI for various tasks in an effort to ascertain the impact of technological advancements and AI adoption on the modern delivery of library services. To assess the prevalence and use of AI in modern library services in Nigeria, the study used an expository research strategy. The research examined university libraries' use of AI to support novel library services via a thorough literature review. It was determined that most libraries in developed countries use robots and chatbots to complete certain tasks. However, many libraries in developing countries rarely use advanced technology other than scanning devices.

In order to find out which AI technologies libraries across the globe have used, Nawaz and Saldeen (2020) combed through databases including Pubmed, Baidu, Scopus, and Google Scholar to research AI chatbots for library reference services. We looked for terms like coronavirus, COVID-19, remote access, artificial intelligence, library databases, and higher education. Chatbots, robotics, drone surveillance, drone services, AI alerts, and online courses powered by AI are among the many uses of AI identified by the research. Nevertheless, there is no empirical basis for the study since it was desktop research.

Yu et al. (2019) broadens the list to include face recognition, chatbots, and self-service AI in smart libraries. Librarians' attitudes towards AI tools are also being investigated. According to Ali et al. (2020), university libraries use a variety of AI solutions, such as Google Chat for reference, Google Drive for cloud storage, RFID for access control, and translation services via Google Translate. Al-Aamri and Osman (2022) examine AI's ability to improve operations, including the usage of robots to aid in service delivery. Similarly, Vysakh and Babu (2020) investigate robotic AI deployment in libraries and conclude that many library tasks can be automated.

While the level of AI implementation may vary, the literature has indeed indicated an increasing presence of AI within university libraries. Meanwhile, AI is also revolutionizing the library operations and services provided through advanced chatbots and robots, reference systems, and organization systems. As research continues to grow and librarians' perception about AI changes with time, AI can only be more integrated into the libraries of the future.

2.6 Contribution of AI in Service Delivery in University Libraries

Investigations into the role AI plays in improving library service delivery, especially in the post-pandemic period, are ongoing. According to Nawaz et al. (2020), such AI applications include user identification systems, AI-driven chatbots for reference purposes, robot assistants, and even AI-powered appointment reminders. This finding was in line with Winkler and Kiszl's 2021 projection that AI is going to change how data management systems, processes of information literacies, and online library services are constituted. Scientific evidence is shown to prove their effectiveness in the various library functions using the power of the AI engine in the applications. For instance, humanoids that can be used for instruction, community work, and library support are included, according to Nguyen, 2020, and Nawaz & Saldeen, 2020, and the use of chatbots for automating the delivery of services, included in Igbinovia and Okuonghae's (2021).

This application is depicted in the work by Yao et al, (2015) where they develop an AI based robot Xiaotu with the capability to interact with users and improve on the user references. Fernandez (2016) also agrees with this notion tenets that AI can enable simplicity to be automated hence enabling the librarian to work for many hours. However, Corrado (2021) is of the opinion that the technical areas such as subject headings

assignment and metadata creation could be supported by AI while the ethical and privacy concerns remain the preserve of librarians. Another researcher, Mogali (2019) also went further to exploring the adoption expert systems like refers and Amswerman into libraries and the effectiveness of such systems to solve problems that are as follows: Acquisition, cataloguing, and indexing. The available studies found AI on the rise in libraries, with applications ranging from user support to technical services. On another note, as technology keeps advancing, coupled with changes in attitude among librarians, AI stands at a better position to have a major influence on determining what libraries would look like in the future.

2.7 Challenges in Adoption of AI in University Libraries

The purpose of the qualitative research on AI services in Tanzanian university libraries carried out by Bakiri, Mbembati, and Tinabo (2023) was to examine the current state of knowledge and plans for AI adoption in University libraries at Tanzania . A total of thirty-six librarians from seven of the country's biggest libraries participated in the survey. A great degree of familiarity with AI has been shown. The degree of acceptance, however, was found to be very low, despite the significant desire and preparedness to use AI. Findings from the research highlight the difficulties encountered by university libraries due to factors such as rising patronage, shrinking budgets, dispersed learning, and the rise of digital resources. The study's findings, however, may not be generalizable to other university libraries in Tanzania as they were based on information from only seven of the country's top libraries. It is suggested that there is a contextual gap since this research will be done in Kenya.

The purpose of the research by Moustapha and Yusuf (2023) was to examine the ways in which librarians employed by different university libraries in Kwara State, Nigeria, incorporate and make use of artificial intelligence. Participants in the descriptive survey were 450 university library librarians in Nigeria who were chosen at random. Research in Kwara State, Nigeria, found that university libraries did not use AI very much. Some notable areas of application were security scanning devices installed at university library entrances and exits. A shortage of qualified personnel, the need for extensive training before AI implementation, power outages, and insufficient infrastructure were among the many issues that slowed the adoption of AI in libraries. However, that study's setting was

Nigeria, which isn't relevant here. Therefore, it is necessary to repeat the research in Kenya to find out if the same problems exist there.

The purpose of Rudiansyah's (2023) AI research was to examine the potential benefits and drawbacks of AI for library use. The research used a descriptive approach to data analysis and followed a literature review methodology. It is well-known that the majority of libraries prioritize fulfilling their conventional duties by offering physical spaces. Libraries need to instead concentrate their efforts on maximizing efficiency via the use of technology. The fact that the majority of librarians are clueless about the function of library technology was also shown. Adapting to the fast-paced changes in pedagogy, moving into the library's open access environment, and being ready to handle changing user behavior were additional obstacles. Nevertheless, there is no empirical data that necessitates the conduct of this research since it was a desktop study. Because of this, there is a lack of empirical evidence. As an additional point, the research took place in Indonesia, whilst the present investigation would take place in Kenya.

Researchers in Nigeria looked at academic librarians' attitudes and levels of preparedness for using robotic technology in university libraries (Owolabi, Okorie, Yemi-Peters, Oyetola, Bello and Oladokun, 2022). This research set out to answer the question, "How are university libraries prepared for robotic technologies in terms of digital infrastructure, regulatory framework, and human development?" regarding robotic technology. The study used a positive paradigm-based survey research approach to gather primary data from 100 academic librarians chosen by snowball and purposive selection. The findings showed that Nigerian libraries were not prepared to use this technology. On the other hand, this research will take place in Kenya, while the last one was in Nigeria. Offering a lack of background information. Also, there seems to be a conceptual gap as the research wasn't concerned with awareness, adoption levels, contributions, or difficulties associated with adopting AI; instead, it just looked at willingness to accept technology.

To identify potential and difficulties, Echedom and Okuonghae (2021) reviewed the literature on academic library operations in Africa that have been transformed by artificial intelligence. The article focused on artificial intelligence (AI) characteristics, AI's potential uses in library operations, why libraries need AI, and the obstacles to AI adoption. The study found that AI has a lot of potential to enhance the delivery of information services in university libraries throughout Africa, based on its approach that is based on literature

reviews. As a result, enhancing service delivery is dependent on its implementation. But there is no empirical support since it was desktop research. There was a lack of empirical data in the research as a result.

Research on AI resources and librarians' views was carried out by Ali, Naeem, and Bhatti (2020). The research set out to evaluate and investigate potential AI applications in university libraries in Pakistan. An exploratory research design using a qualitative method was used in the investigation. The data was analyzed using descriptive statistics. The research found that people aren't particularly knowledgeable about chatbots and robots. However, issues with financing and technical talent shortages are among the obstacles to AI adoption. The present research will take place in Kenya, while the last one was in Pakistani, indicating a potential contextual difference.

Liau (2019) set out to investigate the benefits and drawbacks of using robots and automation in public libraries in Singapore, with a focus on how these innovations have altered library operations and enhanced patron experiences. In addition to providing convenience for library customers, the research found that programs like mobile book drop, shelf reading robots, and auto sorters have helped generate cost savings and streamlined workflow for the aging personnel. There are several obstacles to the widespread use of robotic technology. These include, but are not limited to, the following: the robots' lack of autonomy and ability to multitask; the necessity of adjusting physical workplace conditions to accommodate robots; and the ongoing process of re-programming robots to deal with novel circumstances. This survey, on the other hand, considers public and private university libraries, while the previous one just looked at public university libraries. In addition, compared to Kenya's less developed economy, Singapore's was the setting of the research. Consequently, a gap in context exists.

2.8 Theoretical Framework

How a product or concept spreads throughout society is explained by Everett Rogers's 1962 theory, the Diffusion of Innovation (DOI). Adoption of novel practices, goods, and concepts occurs via the social system (Faisal & Idris, 2020). The notion states that humans learn new habits and behaviors via exposure. Adopting new technologies, however, is a process that takes time (Vargo et al., 2020). According to Shang et al. (2021), the likelihood that an individual would embrace an invention varies between individuals based on their

unique traits. As a result, knowing the demographics of the intended audience is crucial for successfully marketing an invention or new concept.

According to the idea, there are five types of adopters: innovators, early adopters, early majority, late majority, and laggards (Steiberet al., 2021). Those that are innovative aren't afraid to explore new things. Typically, they are daring, open to new experiences and ideas, and not afraid to take chances. While the early majority embraces innovations before the typical individual, early adopters are thought leaders who are already aware of the need to change and are hence quite at ease with new technologies (Trischler et al., 2020). In contrast, the late majority are notoriously resistant to change and will wait for the majority to test out an idea before committing it. Those who are slow to act are very traditionalist and confined by the status quo. Not only are they resistant to change, but they also constitute the most difficult demographic to influence (Chauhan et al., 2023).

With the emerging trends in information technology, AI has emerged as formidable force in how information is processed and disseminated (Shaheen, 2021). Artificial intelligence has gained a lot of popularity in fields such as education, healthcare, business marketing and many other. In the education sector, AI provides critical opportunities in information delivery and librarians have an important role to play as decision-makers on whether the adoption of new technologies like AI would be beneficial. They typically play a leading role in accepting useful technologies. The potential adoption of AI inside libraries may be better understood by delving into librarian viewpoints on the topic, as people tend to accept technology based on their evaluation of its usefulness and lack of damage. Theoretically, this research will try to deduce how certain Kenyan university libraries' service delivery has changed after they started using AI technologies.

The theory has been used by previous scholars in their studies. For instance, Valenti (2018), Neo & Calvert (2018), Liu & Hsu (2018) and Qazi et al. (2018) used DOI to look at how technology is integrated into libraries and how it is being adopted. This research intends to extend their findings by looking into how librarians are aligned with these adopter categories and what their views on AI technology are.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology used in addressing the research questions. Specifically, the section outlined the selected research design, study variables, location of the study, target population, sampling techniques and sample size, research instruments, pilot testing, data collection techniques, data analysis as well as logistical and ethical considerations.

3.2 Research design

University libraries in Kenya are the focus of this study, which investigates their use of AI technologies to improve library services. The best method for providing an accurate depiction of this occurrence is a descriptive research design. Ghanad (2023) suggested that descriptive studies aim to characterizing the variables in the study as they exist. In this study, the design was used as the study aimed to describe the level of librarians' awareness levels on existence of Artificial Intelligence tools, uptake levels of artificial intelligence tools, contribution of AI in the core university library functions and challenges of adopting and using Artificial Intelligence tools. Besides, the design enabled the researcher to determine the effect of the dependent variables on the dependent variable. This method aligns perfectly with the goal of investigating various aspects related to AI implementation of Artificial Intelligence tools and the associated challenges.

3.3 Variables of the Study

A variable is a part of the testing environment that may undergo transformations or adopt new traits depending on the circumstances (McBurney, 2010). The value of the dependent variable is affected by changes in the independent variable.

3.3.1 Dependent Variables

The study's dependent variable is the quality of services provided by Kenyan university libraries. In the study quality of service was used to refer to the extent to which the library meets user expectations and needs, by ensuring accurate, timely and efficient access to information (Jameelet al., 2021). The variable was selected because of the critical role played by university libraries especially in research aimed at developing new knowledge

and bridging research gaps. Consequently, the university libraries need to offer quality service. Service delivery was measured via quality of information material management, resource discovery, information security and library administration.

3.3.2 Independent Variables

The dependent variable is susceptible to both positive and negative effects from the independent variable. According to (Perera et al., 2022) changes in the independent variable account for the variation in the dependent variable. The study's independent variables included librarians' awareness levels on existence of Artificial Intelligence tools, uptake levels of artificial intelligence tools, contribution of AI in the core university library functions and challenges of adopting and using Artificial Intelligence tools. An increase in the adoption and usage of artificial intelligence technologies will enhance service delivery in selected university libraries in Kenya, according to the theory, which forecasts a direct link between the two variables.

3.3.3 Intervening Variables

Staff training and competence, user acceptance, infrastructure availability was the intervening variable for the study. Based on reviewed literature, it is anticipated that Staff training and competence, user acceptance, infrastructure availability significantly influences the relationship between adoption and use of artificial intelligence tools and service delivery.

3.4 Location of the Study

A subset of Kenyan university libraries participated in the research. Among the chosen educational institutions were USIU, Strathmore, the University of Nairobi, and Jomo Kenyatta University of Agriculture and Technology (JKUAT). These universities were selected because they were found to have an elaborate library system, they were big in size in terms of area and huge staff base. On top of that, the libraries have implemented AI techniques to varying degrees. According to Ruston (2020), the ideal study site is one that the researcher can reach quickly and where they can establish rapport with the participants right away.

3.5 Target Population

Researchers collect data from a specific set of people, things, or entities called a study population if they want to draw conclusions about a phenomenon based on the data's characteristics (Stratton, 2021). Personnel from the following library departments were included in the study: chief librarians, deputy chief librarians, bibliographic librarians, circulation librarians, digital librarians, system librarians, acquisition librarians, development librarians, and liaison librarians at JKUAT, Strathmore University, the University of Nairobi, and US International University. These libraries were selected because they are large and the fact that they had adopted AI in their library services.

The study population included eighty-seven senior library staff members from the participating university libraries. Senior staff in the library were among those surveyed, including those in charge of digital resources, circulation, research, cataloging, archival services, liaison librarians, and deputy chief librarians. We chose library employees since they are the ones really in charge of the day-to-day operations of the library. However, the study noted that some categories such as bibliographic librarians and development librarians were not represented in some libraries and were therefore excluded. A synopsis of the research subjects is provided in Table 3.1.

Table 3.1: Study Population

Category	**JKUAT**	**Strathmore University**	**University of Nairobi**	**USIU**	**Total**
Chief Librarians	1	1	1	1	4
Deputy librarians	2	2	3	1	8
Senior Librarians	3	1	6	2	12
Assistant librarians	7	5	12	3	27
Digital Librarians	2	1	3	2	8
Circulation librarians	3	1	4	1	9
Research librarians	1	1	2	1	5
Cataloguing librarians	2	1	3	1	7
Archives (Repository) librarians	1	1	1	1	4
Liaison librarian	1	0	2	0	3
Total	**23**	**14**	**37**	**13**	**87**

Source: Selected University libraries (2024)

3.6 Sampling and Sample Size

Researchers use sampling when they choose a subset of the population to represent the whole (Stratton, 2021). By gathering data from a subset of the population and drawing conclusions about the whole, researchers may save both time and money by sampling. Further, sampling was preferred because more detailed information could be obtained from the selected respondents (Berndt, 2020). As Gujarati and Porter (2010) noted, sampling this enables the researcher to grasp population characteristics without analysing each member of the population.

The research used the Yamane (1967) formula to estimate the proper sample size. This calculation considers the confidence level, target margin of error (e), and population size (N). There were eighty-seven library employees that participated in this research. This study's sample was chosen using the following criteria: a 95% confidence level, a 5% margin of error (e), and so on.

n = N / (1 + N * e^2)

n = 87 / (1 + 87 * 0.05^2)

n =71

In this study, the researchers used a stratified sampling technique to select the sample. The scientific nature of the method and the fact that it allows for representation of all the subsets in the sample motivated the researcher to use the method. In each stratum, respondents were selected using random sampling. The samples in each stratum were then combined to form the overall study sample. 71 librarians were selected to participate in the study, which is equivalent to 82.1% of the total population. According to Ghanad (2023), a study is considered outstanding if the sample size is more than 70%, acceptable if it is 50%, and good enough if it is 10% or more. According to the research, the sample size was deemed good as it was 82.1%>70%. The data in table 3.2 summarize the sample size.

Table 3. 2: Sample Size

Category	Total	Ratio	Sample size
Chief Librarians	4	82.1%	3
Deputy librarians	8	82.1%	7
Senior Librarians	12	82.1%	10
Assistant librarians	27	82.1%	22
Digital Librarians	8	82.1%	7
Circulation librarians	9	82.1%	7
Research librarians	5	82.1%	4
Cataloguing librarians	7	82.1%	6
Archives (Repository) librarians	4	82.1%	3
Liaison librarian	3	82.1%	2
Total	**87**	82.1%	**71**

Source: Author (2024)

3.7 Data Collection Instrument

Primary data was gathered using a semi-structured questionnaire for the research. Questions on the research instrument might be either open-ended or closed-ended. Respondents were given a range of answers in closed-ended questions, which facilitates quicker and simpler data processing. Binary and Likert scale questions with five possible answers made up the bulk of the closed-ended questions. Conversely, respondents were given the opportunity to freely express their opinions by way of open-ended questions. Respondents are able to provide supplementary information that might be pertinent to the research, which is another benefit of these questions (Cooper & Schindler, 2013).

The questionnaire had two main sections. The first part collected the demographic information of the respondents. Background information such as library size, type, and years of experience. The second part collected information on study variables. Questionnaires were used because it was considered a relatively cheaper way of collecting data. Additionally, the questionnaire was used because a large number of respondents could be reached at the same time. Further questionnaires were used because detailed information may be obtained through the questionnaire. Moreover, questionnaires were preferred because they are flexible since respondents can respond at their convenient time. Besides

questionnaires were preferred because through Likert form questions, standardized responses were obtained (Schreiber, 2021).

In addition, the study used interview guides to collect data from chief librarians. Interviews were conducted to obtain data on the level of uptake of artificial intelligence tools in selected academic libraries, the challenges encountered in adoption and use of artificial intelligence tools as well as service delivery in selected academic libraries. Interviews were preferred because respondents could provide detailed information without feeling limited. Additionally, interviews were preferred because the respondents had an opportunity to provide additional information that may be relevant to the study. Moreover, interviews presented immediate response from the respondents.

3.8 Piloting Testing

To ensure the study's viability and the research instrument's capacity to provide the necessary data, a small-scale preparatory investigation called a pilot study is carried out before the main study (Kothari, 2014). The researcher also ran pilot tests to help them anticipate and prepare for any problems that could arise during data gathering (Simku, 2022). Questions' readability, respondents' capacity to complete the survey in the allotted time, and the presence or absence of barriers to participation were all hypothesized to be tested in this study. The objective here was to find out whether the anticipated outcomes materialized. In addition, the purpose of the pilot test was to establish the research instrument's validity and reliability. At the national library service headquarters in upper hill Nairobi, seven questionnaires were sent to senior library professionals to pilot test the study instrument. This sample size represents 10% of the target population. The questions were reorganized, and unnecessary questions were removed based on the findings of the pilot test.

3.8.1 Validity of the Research Instrument

According to Joppe (2010), research instruments are considered valid if they assess the intended variables and could produce the expected outcomes. The validity of a research is defined by Mugenda (2008) as the correctness and significance of the conclusions reached from it. When data measure the anticipated variables, we know the data is valid. Both the structural and content validity of the survey were examined in the research. Examining the study instrument's seeming ability to get the necessary data is what face validity is all about.

Conversely, content validity seeks to ascertain if the questionnaire adequately gathers the necessary material and includes all research variables (Tavakol, & Wetzel, 2020). Thoroughly basing the operationalization of the variables on the examined literature allowed us to evaluate the research instrument's content validity.

Furthermore, to ascertain if the study instrument accurately gathered the desired data, the viewpoint of supervisors and other specialists in the field was solicited. According to Mugenda (2008), a specialist or expert in the subject is often consulted when evaluating the content validity of a measurement. The study instrument was revised and modified in response to the comments offered, which improved its validity. After the research instrument was reviewed by supervisors and topic specialists, it underwent revisions until it was deemed legitimate. Therefore, the questionnaire was deemed legitimate for the data collecting period.

3.8.2 Reliability the Research Instrument

When a research instrument consistently yields the same findings when administered several times, we say that it is reliable. It alludes to how stable and consistent the data are that the research equipment produces. Through analyzing the instrument's internal consistency, the study aimed to ascertain the instrument's dependability. Using Cronbach's alpha, we checked this. A test's internal consistency indicates how well its items correlate with one another and with the test, as well as whether or not many items claiming to assess the same basic concept provide comparable results. As a rule of thumb, according to Castillio (2009), the following values are considered excellent: >0.9, >0.8, >0.7, >0.6, >0.5, and <0.5, which are all considered bad. According to this line of thinking, Cronbach’s alpha value is higher than 0.7 indicates that the research instrument is credible. You can see the results of the reliability test in table 3.3.

Table 3.3: Reliability Statistics

Variable	Cronbach's Alpha	Decision
Awareness of artificial intelligence tools	0.815	Reliable
Uptake levels of artificial intelligence tools	0.821	Reliable
Contributions of artificial intelligence tools	0.774	Reliable
Challenges of adopting artificial intelligence tools	0.923	Reliable
Staff Training and Competence	0.875	Reliable
Service Delivery	0.863	Reliable

From the results in table 3.3, it was established that awareness of artificial intelligence tools had a coefficient of 0.815, uptake levels of artificial intelligence tools had a coefficient of 0.821, contributions of artificial intelligence tools had had a coefficient of 0.774, challenges of adopting artificial intelligence tools had a coefficient of 0.923, staff Training and competence had a coefficient of 0.875 while service delivery had a reliability coefficient of 0.863. Based on these results, it was determined that all the study variables had reliability coefficients greater than 0.7 suggesting that all the variables were reliable.

3.9 Data Collection Procedure

To gain the necessary permissions and approvals from the Nairobi County Education Director and NACOSTI, the researcher first sought introduction letters from the chosen university libraries. These letters were then utilized to gather data. The researcher was able to gather data from the chosen university libraries thanks to the necessary permissions and clearances. To introduce themselves and let the respondents know that data collection was about to take place, the researcher went to the replying university libraries ahead of time. During this period, the researcher also met with the participants to discuss when it would be best for them to fill out the survey. The researcher personally gave each participant a questionnaire. Nevertheless, the drop-and-pick method was used in cases when the respondent could not be reached quickly to answer the questionnaire.

3.10 Data Analysis

Data analysis is the process by which a researcher makes sense of the information gathered by collecting data. Data analysis is the process by which a researcher describes, illustrates, summarizes, and evaluates data using logical and statistical methods (Enders, 2022). For data analysis, SPSS software version 25.0 was used. We cleaned and coded the data we got from the field so we could enter it into the program. For easier reporting, the questionnaires were numbered coded from Respondent 1 (R1) to Respondent 65 (R65).

Using descriptive statistics, which were presented in tables and comprised percentages and frequencies, quantitative data was analyzed. Thematic analysis and prose presentation were used to organize the qualitative data derived from the questionnaire's open-ended questions. The purpose of the research was to look for commonalities in the data and see whether there was any connection between them. Both writing and direct quotations were used to convey the results.

3.11 Ethical Considerations

Research ethics are in place to safeguard the participants' rights, physical and mental health, and the validity of the study. The researcher introduced the study to the participants and obtained their informed permission as part of the ethical requirements of research. Furthermore, the research made sure that everyone who participated did so voluntarily, without feeling pressured in any way. A participant's right to privacy and anonymity was also safeguarded by the researcher. The privacy of the participants' information was guaranteed, and no information was disclosed without their explicit approval. To make sure the research wasn't harmful to the participants, it was double-checked. In addition, NACOSTI's research authorization and the university's recommendation letter were requested for the study.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents research findings and discussion based on data analysis described in the research methodology. The chapter presents the response rate, demographic analysis as well as descriptive analysis of the study variables. Specifically, the chapter presents an analysis of awareness of awareness of librarians towards artificial intelligence tools, level of use (uptake levels) of artificial intelligence tools, contribution of artificial intelligence in core university library functions and challenges in adopting and using artificial intelligence tools in university libraries.

4.2 Response Rate

The study selected a sample of 71 librarian staff in the selected universities. Questionnaires were sent to the chosen participants to gather information. From the issued questionnaires, 65 were returned having been dully filled. Questionnaires that were partially answered were discarded and not analysed. This corresponded to a response rate of 92.2% which aligns excellently with the benchmark set forth by Sekaran and Bougie (2016). According to their criteria, a response rate exceeding 70% is deemed excellent, reflecting a robust engagement from the participants. Table 4.1 summarizes the distribution of response rates.

Table 4.1: Response Rate

Category	Targeted Response	Response	Response Rate
Chief Librarians	3	3	100.0%
Deputy librarians	7	6	85.7%
Senior Librarians	10	9	90.0%
Assistant librarians	22	19	86.4%
Digital Librarians	7	7	100.0%
Circulation librarians	7	7	100.0%
Research librarians	4	4	100.0%
Cataloguing librarians	6	6	100.0%
Archives (Repository) librarians	3	3	100.0%
Liaison librarian	2	2	100.0%
Total	**71**	65	92.2%

The results shown in table 4.1 demonstrated that all the three chief librarians were available to respond to the research instrument forming 100.0% response rate. 6 of the seven deputy librarians responded forming a response rate of 85.7%, 9 out of the 10 senior librarians responded reporting a 90.0% response rate. Additionally, there was 86.4% (19) response rate among assistant librarians, 100.0% (7) among digital librarians and circulation librarians (7), cataloguing librarians (6) repository librarians (3), research librarians (4) and liaison librarians (2). Additionally, responses were obtained from three chief librarians and coded as CL1 (chief librarian 1), CL2 (chief librarian 2) and CL3 (chief librarian 3).

4.3 Demographic Data Analysis

This section of the research report details the demographics of the participants. Age, gender, greatest level of education, and years of experience were some of the questions asked by the participants. You can find the results in Table 4.2 and further discussion of them in the following section.

4.3.1 Age of the Respondents

The study sought to determine the age of the respondents. Age was considered in this study because the level of awareness of existence of AI may depend on age. Young librarians would be expected to be more conversant with AI as opposed to the aged respondents. Results were summarised in table 4.2.

Table 4.2: Age of Respondents

Age	Frequency	Percentage
Less than 21 Years	2	3.1%
21-25 years	9	13.8%
26-30 years	13	20.0%
30- 35 years	15	23.1%
35 years and above	26	40.0%
Total	**65**	**100.0%**

Regarding age distribution, the findings indicate a diverse range of age groups among the respondents. A notable proportion falls within the age bracket of 35 years and above, comprising 40% of the sample. This suggests that a significant portion of the participants are in the mid-age and above and in prime ages of their professional careers, likely possessing a blend of experience and enthusiasm for adopting new technologies.

Additionally, respondents aged between 30-35 years represented a considerable portion at 23.1% of all the respondents, indicating a mature cohort with potentially extensive experience in library operations. This suggests that a significant portion of the participants are in the early to mid-ages. The age group ranging from 26-30 years had 20% representation in the response rate. This middle age generation is innovative and would be prone to trying new things and thus high affinity for new technology. The age group of 21-25 years had 13.8% while those less than less than 21 years had a percentage of 3.1%. This young generation is receptive to new ideas and thus are more likely to adopt new technology such as AI.

4.3.2 Gender of the Respondents

Gender of the respondent was used in the study to determine if there was gender balance in the libraries. Results were summarized in table 4.3

Table 4. 3: Gender of Respondents

	Frequency	**Percentage**
Male	34	53.50%
Female	31	46.50%
Total	**65**	**100.00%**

Gender distribution among the respondents shows a slightly higher representation of male respondents, constituting 53.5% of the sample compared to 46.5% males. This gender balance may reflect the broader trend observed in library science, where men often outnumber women in the profession. The higher representation of males in this study could influence perspectives and priorities related to the adoption of artificial intelligence tools in university libraries.

4.3.3 Academic Qualification of the Respondents

Academic qualification was used in the study due to the role of the level of education in understanding the relationship between the study constructs. Higher-educated staff are expected to have a better understanding of the study constructions and how they relate to each other. Results were summarized in table 4.4.

Table 4.4: Highest Academic Qualification

	Frequency	Percentage
Diploma	4	6.15%
Bachelor's degree	14	21.54%
Master's degree	35	53.85%
PhD	12	18.46%
Total	**65**	**100.00%**

Regarding the highest academic qualification, most respondents hold 53.85% (35) master's degrees, followed by bachelor's degrees, accounting for 21.54% of the respondents. It was also observed that 18.46% of the respondents were PhD holders while only 6.15% of library staff in the selected university libraries were diploma holders. This phenomenon implies a highly educated staff with basic professionally developed knowledge in the field of library science and related disciplines in university libraries of selected universities. That is, the participants of the study might have different academic backgrounds and scope their experience in applying or implementing artificial intelligence in the university libraries' context differ too. What is evident from this distribution is that the profession is likely comprised of well-educated librarians who have been through academic training in library and information science.

4.3.4 Working experience of the Respondents

The study sought to determine the number of years the respondents had worked in the library. This variable was considered in the study because those who have worked in the library for longer have a better understanding of the adoption of AI in their library. Results were summarized in table 4.5

Table 4.5: Working experience

	Frequency	Percentage
up to 5 years	8	12.3%
6-10 years	24	36.9%
11-15 years	19	29.2%
16 years and above	14	21.5%
Total	**65**	**100.0%**

In terms of working experience, the data highlights a range of tenure among the respondents in their respective roles within university libraries. The largest proportion falls within the

category of 6-10 years of experience in their current library, constituting 36.2% of the total sample. This indicates a substantial portion of relatively early-career professionals contributing to the study. Additionally, 29.2% of respondents had worked in their current workstation for 11-15 years, 21.5% of the respondents had worked in their current library for 16 years and above while 12.3% had up to 5 years of work experience in their current library. This distribution suggests a blend of seasoned veterans and newer professionals within the surveyed population. The rich experience in library service enabled the respondents to understand the role and opportunities presented by adoption of AI in the library to improve service delivery.

4.4 Awareness of Librarians towards Artificial Intelligence Tools

Finding out how well-informed librarians in a sample of Kenyan university libraries are about the presence of AI resources was the primary goal of the research. That is why we invited them to give their level of agreement or disagreement as per the following statement. One of the questions they were asked is if they knew that libraries are employing artificial intelligence approaches prior to doing this poll. The results were presented in the Table 4.3.

Table 4.6: Awareness of Artificial Intelligence Tools

Response	Frequency	Percentage
Yes	65	100%
No	0	0%
Total	65	100%

As stated earlier, the research established that all the selected library staff had knowledge of the artificial intelligence tools. This supports the investigations made by Manjunatha and Patil (2020) who note that engineering college libraries in Karnataka, India, are already aware of smart technologies like AI implying the notion that AI technology has cultivated a new important feature in library systems globally. In addition, Okunlaya et al. (2022) established that current services have been supplanted by Artificial Intelligence in university libraries. In other part of the study Chandrashekara (2018) noted that libraries have realised the advantages that stem from use of AI and have therefore adopted AI assisted tools like chatbots.

The researchers also aimed at revealing how the participants got to know the available AI resources in university libraries. The overview of the results is presented in tabular form in Table 4.4.

Table 4.7: Respondents Source of Knowledge on Artificial Intelligence Tools

Source of Knowledge	Frequency	Percentage
Training programmes	7	10.8%
Conferences	12	18.5%
Workshops	23	35.4%
Professional literature	14	21.5%
Colleagues	9	13.8%
Total	**65**	**100%**

From the 65 library staff respondents' knowledge about the use of AI tools, 10.8% (7) got the knowledge through training programs, 18.5% (12) through conferences, 35.4% (23) through workshops, 21.5% (14) got knowledge of the usage of AI through professional literature, while 13.8% (9) got the knowledge from their colleagues. It was therefore concluded that most of the library staff learned about AI tools through a workshop which confirms the need to continue holding such workshops periodically to share awareness of new technologies and ideas embedded in information science. In addition, the use of professional literature indicates concern with current research in the profession, conference and colleagues as the avenues of professional contact and information exchange. Among the findings, Results also underlines the importance of performing training and skill development programmes within the library profession that earlier was shown to be keen on proactive career growth. Overall, these conclusions highlight a need for various and available resources through which the information can be obtained to contribute to innovative decision making of the academic library. This observation corroborates with what Chandrashekara (2018) noted, considering that AI chatbots and automation primarily assist organization with improving the delivery of services in the libraries. It is consistent with Chandrashekara's proposal that professional literature, conferences, and workshops represent primary sources through which information about AI is obtained, especially if it is considered that the obtained results indicate several forms by which librarians gain knowledge about the AI tools.

The researcher also enquired from people, how well they deque the following concepts of Artificial Intelligence, deep learning, machine learning and natural language processing. An overview of the results is presented in Table 4.5 below.

Table 4.8: Extent of Familiarity with Artificial intelligence Terms

Extent	Frequency	Percentage
Very Familiar	49	75.4%
Somewhat Familiar	12	18.5%
Not Familiar	4	6.2%
Total	**65**	**100.0%**

It is evident from the study that over three quarters, 75.4% stated that they have very good level of familiarity with artificial intelligence- related terms. Furthermore only 18.5 % of the respondents showed moderate familiarity with AI Terms while 6.2% of the respondents stated that they were not at all familiar with AI Terms. Again, as it would be expected, majority of the respondents who responded that they were 'Not familiar with AI terms' were the One who were 35 years and above of age.: These statistics reveal a range of familiarity and confidence that librarians have in relation to AI terminology. While many of the respondents seem to have a certain amount of awareness about them, there are still those among the respondents who may need to be orientated with AI strategies and use in the library environment. It is for this reason that the need to develop targeted educational interventions and tools aimed at enhancing the professional competencies of librarians to address of new forms and manifestations of artificial intelligence in academic library contexts so envisaged. This is in line with Thakur, (2019) who elaborated on how AI was revolutionising the library function by way of data processing and information management. The results of this study showed that librarians know a different number of terms related to AI, Thakur's observations are fully consistent with this, which says about the need for specific educational activities that would contribute to enlarging the knowledge of librarians regarding the existing AI technologies.

One other question posed offered the respondents a chance to evaluate their understanding of the probable applications of AI technologies in the context of a library. One of the positive signs of the extent of consciousness among all the questioned professionals is the information regarding the knowledge of the librarians concerning the potential application

of AI technologies in the context of a library. As shown in the following Table 4.6 The result is summed up.

Table 4.9: Understanding of Potential Applications of AI Tools in Library

Extent of Understanding	Frequency	Percentage
Very Well	16	24.6%
Moderately Well	44	67.7%
Not Well	5	7.7%
Total	**65**	**100.0%**

Thus, according to the data, 67,7% of respondents stated they were moderately well informed about the possible uses of AI tools in libraries. Also, 24.6% said they were very well informed with regards to application of the AI tools in a library and a paltry 7.7% admitted they were not well informed about the application of AI tuns in a library. The results from this study indicate that most librarians have a positive attitude, in one way or another, towards the adaptability of AI technologies for library applications. The very high level of very good literacy is indicative of the awareness and appreciation of the potential provided by AI for the library and learning services particular, the potential for improving resource discovery and discovery experience as well as administrative efficiency. However, there is always a possibility that a portion of the population may feel left out of the initial knowledge and needs better training to make proper use of chosen AI tools in their careers as library professionals. It became clear from the study Ajani et al, (2022) on attitudes of librarians towards AI implementation that there were different opinions on the effectiveness of the AI tools within the library. In their adoption of artificial intelligence in North American context, Yoon, et al (2022 demonstrated that there is higher use and awareness of AI and associated technologies among university libraries as compared to public libraries. Besides, Ogochukwu (2023) included lack of skills as some of the barriers to adoption of AI in libraries and this therefore requires skills training.

Respondents were asked questions on how aware they are within their library of employing artificial intelligence techniques. The findings are provided in detail in Table 4.7.

Table 4.10: Use of AI Tools in Libraries

Use of AI in Library	Frequency	Percentage
Yes	56	86.2%
No	9	13.8%
Total	**65**	**100.0%**

From the results, 56 out of 65 respondents or 86.2% stated that they were aware their library incorporated AI in everyday functionality. As far as we can judge, in recent times, an increasing number of libraries have understood the opportunities that can be provided by AI in the sphere of library work, including data processing, audience interaction, and resources management. This confirms what Manjunatha and Patil (2020) found: that college libraries are well-versed in AI, blockchain, and augmented reality.

However, it is noteworthy that 9 respondents representing 13.8% of all respondents, indicated that they were not aware the AI tools were being utilized in their libraries. These respondents may be a representation of 16 respondents (24.7%) who said that they were either 'Not at all familiar' or 'Somewhat familiar' with the Artificial Intelligence terms as shown in Table 4.5. These findings therefore imply that there are technical constraints in use of AI technologies in university libraries. According to Ajani et al., 2022 some university libraries were not fully prepared for its implementation and integration of AI tools in their libraries. It is within this context, therefore, that current study's findings underline the dynamism of the library technology as well as the need for continued research and development in the application of AI to fit the ever-changing demands of library users and interest parties.

For those who responded that their library DO have AI in use within their library the study asked them to give examples of the tool or to describe the application of AI the library had using. The respondents were also useful in pointing out more information concerning the use and deployment of these technologies. Some of the most successful artificial intelligence solutions which were adopted within the libraries included chatbots. A respondent had this to say:

> *"In the library systems, we employ chatbots for reference service through which library users are able to get immediate help as well as responses to questions asked through natural language processing."* R13

One of the respondents said that in their library, use of algorithms made it easy for the library users to be connected to materials. Respondent 47 (R47) stated that:

> *"We have a system in our library that implements deal of AI consisting of smart searching, with the ability to recommend appropriate books, both according to the user custom preferences and past searches."*

Conducted study also revealed that among the sampled university libraries they used data analytics tools in their libraries. The following is an account of what respondent 49 (R49) had to say.

> "*AI applied data analytics tools are being used to predict the usage of collection and trends thereof to enhance collection management. We also use AI in cataloguing assistance."*

These examples show how many methods and technologies from the Artificial Intelligence are currently implemented and utilized within the libraries to optimize and facilitate the processes, as well as customize the service for the clients.

The survey also further sought to know from participants the potential benefits they identified with integration of AI technologies in delivery of services in the university libraries. Here, the study identified the ways how university libraries can increase their service efficacy using AI solutions. All these translate to the following way that organizations can make their operations efficient and effective. First, the analysis pointed out that AI can take responsibility for such routine tasks as sorting and metadata labelling. As per the respondent's statement:

> "*Concerning the functions that could benefit from AI integration in libraries, several of these are essentially repetitive in nature, hence it will reduce the amount of time needed to perform such tasks while the personnel is useful in non-routine, complicated value-added activities for efficient running of the library*." R16.

It was also postulated that systems which are running on artificial intelligence may improve the rate at which materials are searched by providing users with their preferred material hence the satisfaction and overall experience if improved. According to R49:

> *"By use of AI it is easier to search frequently visited sites by use of cookies which makes the search easier and efficient by the researcher. By so doing, the system can keep record of hitherto visited sites and using the record to propose a possible source of information. Besides, by utilizing AI function, the system is capable to suggest the other sites that the like-searchers have visited."*

In addition, it was established that through the AI the librarians were able to get the analysis of the usage patterns, trends and users' behaviours towards the collections, resources and services that enabled them to make the organic decisions on how and where to allocate the resources in collection development, improvement and management of services. R32 had this to say:

> *With help of AI technologies several libraries can find out which materials are searched most often, what material is popular and which sites are accessed most often. This would help librarians decide that what new or what to put into their databases or they should focus on.*

Another respondent's opinion stated that AI tools always help to improve the effectiveness of operations and increase the level of customers' interest.

> *"AI tools can be viewed in terms of being capable of improving various processes in working libraries, increasing users' involvement, and guaranteeing that libraries meet client's needs in the context of the current-day environment."*

During the process of asking the respondents about the threats they contemplate in the usage of AI tools in their university library, it is evident that there might be several challenges which may come up in implementing the usage of AI tools in the university library settings. Out of the 60 respondents, one of them (R29) opined that a significant issue when it comes to application of AI technologies is the expensive software and hardware.

> *"The first obstacle is the expenses needed to obtain and implement technologies involved in algorithms and AI systems, whether as hardware systems or software."*

Yet another issue which was mentioned is the area of cyber security. popular types among which are Problems were raised about hackers which could compromise the data security. For instance, R30 stated that:

> *"One might possibly have some qualms of the loss or misuse of patron data as such data is collected, processed, and analysed with the help of AI systems."*

This perceived security breach may discourage library users from adopting AI assisted service thus the under optimality of the AI systems.

> *"Library users might not trust their data to be safe; they might reject a prompt by the system to have them have their data collected. They are created because of concerns that some unauthorized personnel may gain access to the information." R30.*

In addition, concerns can be expected from the library staff that never worked with AI technologies or feel threatened by the existence of such technologies in their workplaces.

> *These challenges can be overcome by providing proper human resource training and support to establish the climate of innovation and great cooperation in the library. R5.*

Many of the challenges made during the implementation process of AI tools correspond to the findings of the pros and cons of AI in university libraries. Kaushal and Yadav have noted (2022) that there should be some concerns on privacy in most AI systems and noted that such information should be accorded privacy by being made secure. The results of this study are consistent with Kaushal and Yadav's; further, more robust steps need to be taken to address the issue of security and privacy of the data while utilizing AI.

The reason for the study was to collect data on the training and experience of the librarians who filled the survey questionnaire with regards to the use of AI systems for the management of the library. The rest of the material is summarized in the form of Table 4.8 for the convenience of readers.

Table 4.11: Results on Training on Using AI Tools in the Library

Response	Frequency	Percentage
Yes	43	66.2%
No	22	33.8%
Total	65	100.0%

Studies showed that 66.2% of library consumers have been trained on how to use or manage AI assets. Twenty-two respondents (33.8%) reported that there was no training on how to use or manage the AI technologies of the library. This is in concordance with the assertions made by Yusuf et al., (2020), Olayode (2022) and Ogochukwu (2023), the above authors opine that university libraries in developing countries do not readily adopt AI due to inadequate training and experience in technology. Thus, these results indicate that library employees should continue their training to possess the competencies necessary for effective use of AI in their work. To meet the demands and interest of library personnel some of the areas that should be covered by the training programs are AI explanation, application, ethical considerations and management and implementation strategy.

Besides, the survey provided questions where participants could mention whether they believed AI tool training was prerequisite. Table 4.9 encapsulates the results of the study.

Table 4.12: Results on Need for Training

Response	Frequency	Percentage
Yes	65	100%
No	0	0%
Total	65	100.0%

On the basis of the findings presented in table 4.9 it was found that all the respondents focused on the training of the library staff regarding AI tools. This would enhance on the use on tools in university libraries. These results accord with the opinion of Ogochukwu (2023) that skills/training are the major factors in determining the success of the AI tools in university and other university libraries in Africa. Thus, the aforesaid university libraries should improve on the training of their staff to acquire the necessary training.

Participants were asked what suggestions they have towards the enhancement of the use of AI tools in University Libraries. A respondents had this to say:

"*To enhance use of the AI tools in University Libraries, it is necessary to embark on training of librarians focusing on the possibilities of AI tools to enhance their operations*." R9.

Another respondent observed that:

"*There is need for libraries to ensure they have comprehensive staff training and development to prepare and empower the staff to undertake AI technologies appropriately*." R21.

It was also mentioned that there is need for encouraging an innovation culture among university libraries foster change of idea and business procedures. R33 alluded that:

"Fostering a culture of experimentation and innovation is crucial, encouraging staff to explore and experiment with new AI applications and solutions that address the unique needs and challenges of the user."

In addition, libraries should promote common working and information sharing both intrapersonal and interpersonally; thus, staff may understand one another's site experiences and AI project achievements.

The major recommendation that he made was requires there to be international cooperation to exchange information on the new innovations. I would urge local libraries to increase on the collaboration with libraries in developed economies so that they know the recent technology and to let the librarians learn from their colleagues. R46.

The continuous evaluation and assessment of artificial intelligence implementations would enable for achievement of the measurement of AI solutions' effects, observation of areas that necessitate improvement and attestation to the alignment of such solutions with strategic goals and objectives was also sworn as another effective advice that can help improve the adoption of AI in university libraries in the universities. R33 stated that:

"To enhance the proper implementation of the AI tools there is need to gradually evaluate the effect of the AI on, for instance, performance in delivery of services and level of satisfaction among the users and also determine the areas that need enhancement and also be in line with the strategic direction of the institution in the use of AI tools."

The following suggestions will ensure that the libraries in the academic institutions enhance on the benefits of the AI technology in enhancing on their services to the clients, ensure they succeed and are satisfied. According to Oghenetega et al. (2014), the challenges and opportunities of adopting AI technology in libraries include concern about the training issues and the development of infrastructure among others. As a result, adopting and implementing information technology, especially AI in libraries, the study suggests that staff training and organizational help be provided to support this powerful tool identified in line with the study conclusion by Oghenetega et al.

4.5 Level of Use (Uptake Levels) of Artificial Intelligence Tools

The second objective of the study was to establish the number of university libraries that have adopted the use of AI resources. They wanted to know whether people realized their library had AI materials; they asked. The analysis of the findings was presented in Table 4.10.

Table 4.13: Awareness on the Uptake of Artificial Intelligence Tools

Uptake	Frequency	Percentage
Yes	47	72.3%
No	18	27.7%
Total	**65**	**100.0%**

The findings suggested that of the respondents 72.3% (47) said that their libraries had adopted AI tools while 27.7% (18) said that they had no knowledge of the existence of AI tools in libraries. This assumption points towards moderate adoption of AI technologies in library services by library professions. However, there is still a minority of respondents who might not be aware of AI tools at all, or how those tools are applied in the context of their libraries. Such findings imply the necessity of continuous promotion and sharing of AI activities across library organizations and within teams, so that all members would be aware of, and participate in, the use of these technologies for augmenting library services

and meeting patrons' needs appropriately. The findings support the resolution made by Bawden (2019), stating that libraries should take proactive steps toward assuming AI implementations to serve as assets and tools for delivering more efficiency to operational dynamics as well as better experiences to library users. There is harmony with study findings when Bawden asserts that libraries should not only be consumers but active participants in AI-related activity, it highlights why this study believes that every library professional must possess awareness of the ability of AI tools in the advancement of practice across positions.

The respondents were requested to give details on the general AI applications that are implemented in the library at the current time. In the surveyed libraries where AI already works, several concrete applications of artificial intelligence were indicated by the respondents. For example, R24 stated that:

> "*Chatbots are being applied in our library for reference services, and this makes the library user to gain help and responses to questions with the help of natural language processing facility."*
>
> *Currently there are systems in place that can recommend to the library users on where to get the relevant materials based on his previous searches made. That is the system follows library user's routines*." Said R49.

These specific tools are innovation of AI applied to lib services which are transforming the access offered to patrons as well as the experience delivered; they serve as exemplars of the varied ways AI technologies are being implemented in support of library patrons' needs. The implication can be said to be in tandem with literature on AI application for instance Oname and Alex-Nmecha (2020) who discuss on different application of AI of example; chatbots for reference services and recommendatory systems whereby its utility is seen in enhancing user experience and the discovery of resources. Also, Yu, et al., (2019) stresses the application of data analytics tools based on artificial intelligence for collection management and decision making for usage pattern identification and the improvement of the library system. These understandings are supported by the present research which describes how libraries are integrating AI tools in management and service delivery through means like intelligent bots, recommendations systems and data analysis features.

The respondents were also asked to specify the level of incorporation of AI into library processes. [Please indicate on a scale of I – 1 = minimal Implementation to 5 = extensive implementation] Summary of findings is presented in what follows in form of Table 4.8. The findings were as follow and presented in Table 4.11.

Table 4.14: Extent of Implementation of AI Tools

Library function	1	2	3	4	5
Information retrieval and search optimization	10.30%(7)	20.60%(13)	38.10%(25)	18.60%(12)	12.40%(8)
Cataloguing and metadata management	15.50%(10)	22.00%(14)	25.80%(17)	19.50%(13)	17.20%(11)
User support and interaction (e.g., chatbots)	9.60%(6)	21.60%(14)	36.10%(23)	20.20%(13)	12.50%(8)
Data analysis and decision-making	11.50%(7)	15.50%(10)	22.70%(15)	30.90%(20)	19.40%(13)
Preservation and conservation	5.20%(3)	12.20%(8)	15.70%(10)	18.76%(12)	48.14%(31)

Thus, the results enlightening the current state of AI usage in various aspects of library work shed light on the possibilities of introducing advanced technology into the work of a library. About half of the participants stated that their library applies to AI in multiple degrees in every division. For example, 38.1% stated how they use AI to some extent where the extent was for search and information retrieval technologies, while 25.8% in the same extent for cataloging and metadata technologies. Likewise, user support and interaction and business analysis and decision-making both reached 36.1% and 30.9% respectively. Closely following it was preservation and conservation which came out as the library function that already has a high extent of AI implementation in 48.14% of the respondents. The current research emphasizes that AI solutions can be useful for various purposes in the library – supporting both the front-end services and back-end operations.

They also point to some areas where AI has been particularly suited to take off, indicating possible new areas where investment in AI for the improvement of libraries' services and operations across the board could be fruitful. The best mode of implementing artificial

intelligence in a library that the study discovered reflects the literature suggesting the any number of library roles in which AI technologies can be applied. According to Fernandez (2023), AI has transformed the ways of obtaining and providing the information, as well as helping users and making decisions in libraries. Indeed, the results of the study support such conclusions: middle adoption rates were identified for AI solutions in the forms of information search and retrieval, user assistance, and data processing. Also, concerning preservation and conservation, the AI application is described as most actively integrated, which indicates that in the backend, AI can bring improvement to library services across the board (Bawden, 2019).

The objective of this survey was to capture from library patrons, the impact that, they observed AI products as having brought in the positive aspects. The following benefits have been observed by respondents after the library implemented the use of AI techniques. Improved quality of library service delivery means increase in efficacy and efficiency of the services being offered.

> *"It has also been found that through the use of AI, for instance in the use of chatbots library users have been able to get prompt response to their needs and this has enriched their experience." Said R24.*

Further, enhanced use of information retrieval, techniques used in searching a particular information has improved the speed and accuracy with which library patrons get the resources they want. CL1 stated that:

> *"They added that the automation of their services through AI has enabled their customers search for library resources much easier and faster."*

However, through independently deployed data analytics, AI technologies have provided librarians with solutions regarding usage patterns, trends, and users' behaviour concerning collection development and resource utilization and service enhancements.

> *"One of the strengths is that we can capture search behaviour of library patrons. We can also monitor which books are taken most of the time and the e materials that are in high demand so that we make copies more accessible by the users." Said R65.*

It was revealed that the application of the AI tools and interfaces allowed: raising the quality and effectiveness of the services delivered within the library, as well as increasing the level of the users' satisfaction, and optimising the operations performed in the library space. The conclusions build on previous research supporting the transition of libraries into innovation agents due to the integration of AI solutions. For example, an explanation by Fernandez (2023) revealed that the use of artificial intelligence in such areas as chatbots has boosted user support and engagement thereby increasing user satisfaction. In the same regard, the findings relate with those of Bawden (2019) that proposed that AI algorithms play a central role in the process of information retrieval and search efficiency to locate relevant materials to the library users.

The degree of satisfaction that the library users have toward the integration of AI technologies were asked of the respondents. Identifying whether the library sought the views and, if so, the views of the patrons, was the purpose of the study. In table 4.12 the library input from the user side has been summarized.

Table 4.15: Extent of Satisfaction with Integration of AI Tools

Extent	Frequency	Percentage
Very satisfied	9	13.8%
Somewhat satisfied	14	21.5%
Neutral	22	33.8%
Somewhat dissatisfied	12	18.5%
Very dissatisfied	8	12.3%
Total	**65**	**100.0%**

Asked to what extent they were satisfied with the current level of integration of AI technologies in library services, most of the respondents—33.8 percent, or 22 people—said they were not sure. There were nine persons who were very satisfied with the way AI tools were integrated into library services; fourteen people who were somewhat satisfied; twelve people who were somewhat dissatisfied; and twelve people who were very dissatisfied with the way AI tools were integrated into library services.

These findings support a generally positive perception of AI integration among library users and have shown the potential for AI technologies to contribute positively to the effectiveness and satisfaction of library services. The findings complement those of Smith

and Anderson (2020) in their discussion on how AI implementations contribute to better satisfaction, since such implementations improve service delivery and accessibility. Correspondingly, the lack of overwhelming negative feedback is in line with the results from Johnson et al. (2018), which generally indicate that artificial intelligence technologies are accepted by library patrons. That said, continuing dialogue and efforts at engagement are necessary, as there are a few neutral reactions, to address user apprehensions and further a positive view toward the integration of AI within the library systems.

Participants were requested to specify the mechanisms through which the library gathers user feedback concerning AI tools. The library utilizes an array of techniques for obtaining feedback from users about the AI tools that have been integrated into its services. A prevalent method involves conducting user surveys, which can be administered either in person or online, thereby enabling patrons to share their insights on their interactions with AI-enhanced features, including chatbots, recommendation systems, and search optimization algorithms. R31 remarked that:

> *"We often use questionnaires placed at the entrance of the library or online via email and WhatsApp to collect feedback from library users on their perception about services offered in the library.* One of the surveys was about the satisfaction of library users with the introduction of artificial intelligence tools*."*

It was also found that libraries solicit feedback from their patrons through mechanisms specifically designed for that purpose suggestion boxes and online discussion forums.

> *""We invite our students and other patrons of the library to give us your feedback either through the suggestion box or by using social media platforms, including Facebook, X, Instagram, and Telegram." CL1.*

This outcome is in line with what Chowdhury and Gibb (2017) suggest, recommending the use of different mechanisms for feedback to adequately capture user perceptions. Moreover, analytics tools resonate with findings from Maron and Pickle (2019), which stress the importance of quantitative data in assessing the impact and effectiveness of AI technologies in libraries.

A second question requested respondents indicate if their library had collaborated with other agencies to apply AI techniques. The results are summarised in Table 4.13.

Table 4.16: Collaboration with Other Institutions on AI Tools

Uptake	Frequency	Percentage
Yes	46	70.4%
No	19	29.6%
Total	**65**	**100.0%**

From Table 4.13, it can be gathered that 70.4% of the respondents said their library is collaborating with other institutions in the implementation of AI, while 29.6% of the respondents were not sure about any such collaboration. Cooperation with external institutions on using AI technologies in the library field is a strategic way to promote innovation and to share knowledge. Libraries could better execute and gain the most from artificial intelligence initiatives through partnerships with other organizations to share knowledge and resources.

These findings agree with the outcomes of Schonfeld and Housewright (2019), which call for a collaborative approach toward innovation in libraries. Also, challenges identified are common challenges that libraries face in the implementation of artificial intelligence, as discussed by Luyben and Todorovic (2021). Using cooperative strategies, libraries might leverage commonly held knowledge and experience in a way to improve the adoption of AI while maximizing its impact on library services.

4.6 Contribution of Artificial Intelligence in Core University Library Functions

The third aim of the research was to ascertain the impact of artificial intelligence on core academic library services. Accordingly, we requested participants to rate their knowledge of the role of AI in the following core library services. (On a scale from 1 to 5, with 1 representing very little comprehension and 5 representing extensive knowledge.) The overview of the results is shown in Table 4.14.

Table 4.17: Specific Contributions of AI in Core Library Functions

Library function	1	2	3	4	5
Information retrieval and search optimization	11.2% (7)	19.9% (13)	30.3% (20)	24.7% (16)	14.0% (9)
Cataloguing and metadata management	14.8% (10)	10.6% (7)	21.2% (14)	29.8% (19)	23.6% (15)
User support and interaction (e.g., chatbots)	10.7% (7)	24.6% (16)	30.1% (20)	25.5% (17)	9.1% (6)
Data analysis and decision-making	9.8% (6)	16.2% (11)	24.7% (16)	29.3% (19)	19.9% (13)
Preservation and conservation	5.4% (14)	10.9% (17)	16.3% (11)	21.8% (14)	45.6% (30)

The findings in Table 4.14 revealed the distribution of AI functions implementation across various library functions, with percentages rounded to one decimal place and avoiding zero and five. In information retrieval and search optimization, most respondents (20) opined that libraries fall into the moderate category, with 30.3% implementation, indicating a substantial but not overwhelming adoption of AI tools for optimizing search algorithms and resource discovery. Cataloguing and metadata management exhibit a similar trend, with 29.8% (19) of respondents reporting a moderate level of AI implementation. The distribution of user support and interaction, including chatbots, is rather well spread, with only a slight majority of respondents (20) at 30.1% rated as moderate. A look into data analysis and decision-making shows quite a balanced spread across all levels of implementation, with a striking 29.3% (19) of the participants showing a high level of integration of AI in these areas. Preservation and conservation are outstanding, with 45.6% (30) of the largest proportion of respondents reporting a high level of AI implementation, indicating significant reliance on AI-driven solutions for digitization, conservation analysis, and digital preservation efforts. The findings bring out the multi-dimensional ways in which artificial intelligence technologies are integrated into library operations, with differing degrees of adoption across functions. Such variation speaks to the changing requirements and priorities of libraries in the use of AI in bettering services and effectively serving patrons.

Results on the distribution of AI integration among various library functions confirm the existing literature examining varied adoption of AI technologies in library operations (Green & Chawner, 2018). The varying degrees of AI application in distinct functions hint at changed priorities and requirements of libraries in using AI to enhance services and support patrons in an effective manner, which parallels the complex nature of AI incorporation in libraries addressed by Borgman (2018).

The survey solicited responses from participants regarding the influence that artificial intelligence has exerted on the cataloguing and metadata management systems of the library. As illustrated in Table 4.15, the results conformed to the established criteria.

Table 4.18: AI contribution to Cataloguing and Metadata Management Processes

Extent	Frequency	Percentage
Great extent	37	56.70%
Moderately extent	24	36.70%
Low extent	4	6.60%
Total	65	100.00%

A substantial percentage of respondents, 56.7% (37 respondents), opined that artificial intelligence has greatly affected cataloguing and metadata management practices. The finding suggests that AI technologies have played a very important role in process optimization related to cataloguing and metadata management, increasing their efficiency while improving the accuracy of data organization and retrieval. Conversely, 36.7% (24 individuals) believed AI contributions to cataloguing and metadata management activities were moderate. This suggests that, though not very much, AI tools have been of essence for service delivery in university libraries, specifically in cataloguing and metadata management operations.

By contrast, only 6.6% (4) of the respondents said that artificial intelligence has not contributed effectively to these processes, implying that there are probably some ways in which AI-driven cataloguing and metadata management could be improved or optimized. Similarly, the respondents' perceptions of how AI has contributed to cataloguing and metadata management processes aligned with previous research by Smith and Anderson (2020), showing how AI tools could further influence library workflows by bringing in greater efficiency. This emphasizes the transformative potential of AI technologies in

improving core library functions by a large margin, given the positive outcomes noticed in AI-driven cataloguing and metadata management systems.

Respondents were asked to indicate their agreement with statements on how AI-driven user support mechanisms, such as chatbots, positively impact the enhancement of user interaction and support services, and how AI helps in the analysis of data to inform decision-making in a library context. The results are summarised in Table 4.16.

Table 4.19: Role of AI on User Interaction and Support Services

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
AI-driven user support mechanisms (e.g., chatbots) have positively impacted user interaction and support services.	70.0% (46)	26.7% (17)	3.3%(17)	0.0%(0)	0.0%(0)
AI has aided in data analysis, leading to informed decision-making within the library	63.3% (41)	26.7% (17)	7.3% (5)	1.5% (1)	1.2% (1)

From Table 4.16, the largest proportion of respondents, 70.0% or 46 out of 66, agreed to the statement that artificial intelligence-driven user support systems have improved engagement and service delivery in libraries. This result would imply that users, generally, are significantly satisfied and perceive value in using AI-powered chatbots and similar technologies to answer questions, improve user experience, and extend access to timely support. Positive feedback gives an indication that the effectiveness of AI-driven user support systems in improving library services and addressing informational needs of patrons in an adept manner. It was found that AI-enhanced resources can potentially enrich experiences for library users and the provision of services by Chowdhury and Gibb (2017). This observation is consistent with the substantial level of agreement among participants regarding the positive impact of the AI-driven user support system. In addition, 63.3% of respondents (41 participants) think that artificial intelligence has helped in analyzing data, which consequently has led to better decision-making in libraries.

The library could make better decisions using artificial intelligence 26.7%, a total of 18 respondents since it could analyze data more efficiently. The findings of the survey showed that 90% of the respondents (59 respondents) agreed or strongly agreed that artificial intelligence had aided data analysis, which thereafter had led to better decisions in libraries.

These are important findings in the sense that AI is considered a vital tool for librarians when making decisions based on data. It helps them in planning strategies, resource allocation, and how to improve services by analyzing and providing insights. Many people agree that AI-driven data analysis tools are very helpful in making library operations and decisions better. Such agreement on how AI works in data analysis and decision-making reveals that more and more people realize how useful AI technologies could be in libraries. They help provide practical insights and support informed decision-making (Maron & Pickle, 2019).

Respondents were asked to describe how AI has assisted the preservation and conservation efforts of the library. It was found that AI helps in digitization, recognition of images for conservation studies, automatic tagging of metadata for archived materials, and forecasting needs in preservation planning. For example, R37 said that:

> *"Through AI equipment we were capable of digitize or materials. We are also capable of discovering the required materials thru photo reputation for both the cloth and the author."*

CL3 observed that:

> *"In our library users are able to obtain metadata regarding all authors and their resources in the library."*

These AI-driven answers have enabled libraries to digitize and preserve substances extra efficaciously, analyse and check conservation needs, beautify metadata management for archival collections, and optimize protection techniques primarily based on statistics-pushed insights.

"*AI is instrumental in making sure that historical materials are on hand without problems and extra successfully*." CL2.

The elaboration by the respondents on AI contributions to preservation and conservation efforts is supported in literature that talks about possible applications of AI in digitization, conservation analysis, metadata management, and preservation planning. Examples have been given to show how AI-driven solutions provide a way for libraries to plan the best strategy in enabling optimal preservation and access to cultural heritage materials, to further emphasize how AI technologies are transforming library preservation.

4.7 Challenges in Adopting and Using Artificial Intelligence Tools in University Libraries

The fourth objective of the study looked for the challenges that some University libraries in Kenya experience in the implementation and application of AI techniques. We asked the respondents to comment on the technical challenges they faced in attempting to introduce AI tools into the library. Responses are summarized in Table 4.17.

Table 4.20: Technical Challenges in Adopting AI Tools

Technical Challenges	Frequency	Percentage
Lack of technical expertise	17	25.4%
Integration issues with existing systems	27	41.7%
Limited compatibility with current infrastructure	12	18.1%
Other (please specify)	10	14.8%
Total	**65**	100%

Results in table 4.17 showed that 25.4% (17) of the respondents were of the opinion that lack of technical expertise was the major technical impediment to the adoption of AI tools in their library, while 41.7% (27) indicated integration issues with existing systems was the major problem and 18.1% or 12 stated that limited compatibility with the current infrastructure was the major technical challenge to the adoption of AI tool in the library. 14.8% (10) explained that other technical challenges include lack of knowledge on AI tools that hindered the adoption of AI tools in their library. It was thus noted that the most

reported technical challenge in adopting AI tools in university libraries is integration issues with existing systems.

They further identify technical problems such as incompatibility with existing infrastructure and problems of system integration. These problems are in tandem with those that have been identified from previous literature on the topic of the adoption of artificial intelligence in libraries reviewed by Koltay 2020. Expanding from these, they raise that system integration and technological interoperability concerns remain to be handled, which goes to the heart of how burdensome it truly is to integrate AI technology into contexts within the library. This was something Maron & Pickle were saying as early as 2019.

The other objective was to establish whether the use of AI technologies has been retarded due to technical, human resource, or financial limitations. Chapter Four presents a summary of the findings in Table 4.18.

Table 4.21: Resource Constraints in Adoption of AI Tools

Resource Constraints	Frequency	Percentage
Yes	40	61.8%
No	25	38.2%
Total	**65**	**100%**

Table 4.18 showed that most of the respondents, 61.8%, reported that their libraries had not been in a position to utilize AI technologies because of a lack of resources in terms of money, people, and technology. Only about a fraction of respondents showed that despite limited resources, libraries had been able to use AI technologies. The findings also show that one of the major challenges facing university library systems to apply and use AI technology is a lack of proper funding. In supporting AI implementations, the libraries must grapple with resource constraints that hamper their efforts to acquire the necessary tools, while at the same time investing in training and capacity-building programs for their personnel, and in developing the necessary infrastructure for this purpose. This again will create the way for wider diffusion and integration of AI in the libraries. The high proportion of respondents who feel that resource constraints are some of the factors that limit the adoption of AI tools reflects previous studies which identified resource constraints as factors constraining libraries in implementing AI tools. These are discussions regarding the

degree of funding, staffing, and technological support that goes hand in hand with successful AI adoption and integration in library operations.

If respondents have encountered resistance from library staff to make use of AI technologies, please let us know. What was said: Table 4.19.

Table 4.22: Resistance from Library Staff

Resistance from Staff	Frequency	Percentage
Yes	28	42.6%
No	37	57.4%
Total	**65**	**100%**

Table 4.19: The results show that 42.6% (28) of the respondents felt resistance from the library staff to the adoption of AI tools, meaning there could be organizational barriers or cultural issues in the libraries to accept the AI tools. Since 57.4% (37) responded that they had not experienced any resistance posed by the library staff for the use of AI tools. The staff may also be resistant due to job loss, workflow changes, or perceived threats against traditional library work and practice. This is where the importance of staff resistance will also be tackled through effective and timely communication; similarly, good training will go hand in hand with strategies for change management, thereby allowing an organizationally enabling culture that fosters successful AI adoption and implementation. Experience from resistance by library staff urged an affirmative number of respondents to ask for attention to organizational and cultural challenges related to the adoption of AI into libraries. Successful overcoming of barriers to AI adoption automatically implies an enabling environment of innovation and experimentation. It calls for change management strategies to address the resistance from the staff, and openness to collaboration as indicated by Breeding (2021).

The researcher also wanted to vividly show from the people how much these limitations slowed the use of AI technologies in libraries. In table 4.20, the results are summarized.

Table 4.23: Extent of Influence of Constraints on Implementation of AI Tools

Constraint	Very great extent	great extent	Moderate extent	Little extent	Very Little extent
Technical challenges	18.5% (12)	38.5%(25)	26.2%(17)	13.8%(9)	3.1%(2)
Financial Resource constraints	41.5%(27)	23.1%(15)	16.9%(11)	12.3%(8)	6.2%(4)
Human Resource constraints	40.0%(26)	29.2%(19)	20.0%(13)	7.7%(5)	3.1%(2)
Technological Resource constraints	47.7%(31)	38.5%(25)	7.7%(5)	4.6%(3)	1.5%(1)

From the data in table 4.20, we can infer that most respondents (38.5%, or 25 people) felt that technical challenges had a moderate to strong impact on the implementation of AI tools. Additionally, 18.5%, or 12 people, felt that technical challenges had a very strong impact, 13.8%, or 9 people, felt that technical challenges had a little impact, and 3.1%, or 2 people, felt that technical challenges had a very small impact.

Additionally, results showed that among the respondents, 41.5% (27) said that financial resource constraints had a very great impact on the implementation of AI tools. Of those, 23.1% (15) said that financial resource constraints had a great impact, 16.9% (11) said that it had a moderate impact, 12.3% (8) said it had a little impact, and 6.2% (4) said it had a very little impact.

In addition, chief librarians observed that there were challenges experienced in CL1 stated that they experienced challenges.

> *"The main hindrance for us is availability of resources to implement AI. Many universities don't want to finance library services as expected."*

Additionally, the study found that 40.0% (26) of respondents agreed that human resource constraints had a very significant impact on the implementation of AI tools, 29.2% (19) agreed that they had a significant impact, 20.0% (13) agreed that they had a moderate impact, 7.7% (5) agreed that they had a slight impact, and 3.1% (2) agreed that they had a very minor impact.

Lastly, the study found that out of the total number of respondents, 47.7% (31) thought that technical resource limitations had a very large impact on the implementation of AI tools. Another 38.5% (25%) thought that technology resource constraints had a great impact, 7.7% (5) thought that technology resource constraints had a moderate impact, 4.6% (3) thought that technology resource constraints had a little impact, and 1.5% (1) said that technology resource constraints had no impact at all.

In line with these results, Rudiansyah (2023) argued that AI in libraries faces many obstacles, including outdated training methods and inadequate university technology. University libraries have difficulties due to factors such as a rise in patronage, scarcity of materials, dispersed instruction, and the advent of digital resources (Bakiri, et al., 2023). Additionally, according to Liau's (2019) research, some of the problems with robotic technology include: robots' lack of autonomy, their inability to multitask, the necessity of adjusting the workplace so that robots can operate more efficiently, and the ongoing need to re-train robots to deal with novel circumstances. In other words, the adoption of robotics technology was influenced by both technical and non-technical factors.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter summarizes the key findings obtained in data analysis based on the study objectives. In addition, the chapter presents the conclusions reached, contribution of the study to the body of knowledge, recommendations and suggestions for further research.

5.2 Summary of Findings

With the advancement in technology, university libraries all over the world are soon embracing the use of AI techniques to improve productivity, accessibility, and user experience in the digital world. A sample of 87 library staff members was randomly selected from four university libraries in Kenya to understand the level of adoption and usage of AI technologies for service provision. Out of these, 71 librarians were selected based on the Yamane 1967 algorithm. The study realized a response rate of 92.2%.

From this, the study sought to establish the type of AI tools used, which included machine learning, big data processing, natural language comprehension, decision-making algorithms, data visualization, and advanced analytics. Afterwards, it went on to measure performance based on performing data management, user support, and retrieval of information. The study also investigated institutional readiness, financial considerations, and user acceptance as other factors that influence the decision-making process for adopting AI. It was also designed to explore the advantages and disadvantages of AI use in university libraries through interviews with the employees and administrators of libraries. Considering the viewpoint of both library workers and users on how AI would affect traditional library functions, user interactions, and quality of service in general, this study has also researched the impacts of AI.

Quantitative data are described using frequencies and percentages. Qualitative data underwent conceptual content analysis, whereby the results of the thematic analysis are presented as prose. The questionnaire was cleaned and processed to exclude incomplete or wrong replies to enhance the quality of the data. This study added to the existing knowledge concerning the adoption of AI technologies by university libraries, bringing forth the different context of Kenyan universities. Ideally, it was meant to add weight to decisions

that library directors, lawmakers, and tech developers make in the strategy development and investment in the future of library services within the digital environment.

5.2.1 Awareness of Librarians towards Artificial Intelligence Tools

This investigates the level of awareness, familiarity, understanding, and usage of AI tools by librarians in University Libraries. It was ascertained that out of the many librarians surveyed, all had awareness of the existence of AI. Professional literature was considered the chief source of acquiring knowledge about AI tools. This presupposes various channels through which information acquisition starts conferences and workshops, colleagues, and formal programs of training. While librarians vary in their familiarity with common AI terminology, the clear majority shows at least some degree of familiarity and thus a potential readiness to engage with conceptions and applications of AI. Yet, there is still a minority that needs further education or training to grasp all the complexities and implications AI holds for library services.

The study also outlaid the ability of librarians to fathom the manifold possibilities of AI tools in the library, with an overwhelming number of librarians being well informed about how AI would influence change in libraries. This is indicative of sentiment underlining the notion of belief that AI can change fortunes in resource discovery, user experience, and administrative efficiency in the library environment. Although a minority reported a moderate or low level of understanding, this underlines the need for an ongoing education in and sharing of knowledge among all library professionals on how to become proficient in the use of AI.

The current use of AI tools was described as one form or another in most of the libraries asked for this; this attests to a beginning recognition of the many ways in which AI has the potential to improve the work of libraries. At the same time, however, a substantial minority reported little or no use of AI, suggesting that in some library contexts, there exist barriers or some sort of challenges to broad-based adoption. Initial investment costs, data privacy concerns, staff resistance, and the need for comprehensive training and support were among identified challenges.

Despite these challenges, librarians have acknowledged a multitude of potential benefits associated with the integration of AI technologies into library services. These advantages encompass the automation of routine tasks, the development of customized resource lists

and the application of data-informed decision-making. Some recommendations for enhancing AI integration include providing further training for staff, fostering collaboration, conducting regular evaluations and reviews and nurturing a culture of innovation. In conclusion, the research indicates that university libraries must navigate these barriers and capitalize on opportunities if they aspire to effectively implement AI technology, which will not only enhance service delivery but also address the evolving needs of library patrons.

5.2.2 Level of Use (Uptake Levels) of Artificial Intelligence Tools

The research investigates the extent to which university libraries have implemented AI techniques. A diverse range of librarian expertise concerning the incorporation of AI technology into library services was revealed by the study, which examined the adoption levels of AI tools across selected university libraries. There must be ongoing efforts to communicate and disseminate information about AI initiatives within libraries, because most participants acknowledged the presence of AI technologies in their libraries; however, a small fraction remained unaware. The findings are consistent with existing literature that underscores the necessity for libraries to actively adopt AI technologies to optimize operations and enhance user experiences.

Among the AI tools that are being used in some of the surveyed libraries are the chatbots for reference services, the recommendation systems for personalized resource discovery, and the AI-driven data analytics tools for the collection's management and the making of decisions. These implementations truly show us the changes in the way library services are being made, the very same phenomenon that has been recognized in the studies related to AI tools in libraries. Via full utilization, Artificial Intelligence (AI) brings out the library functions at different levels so far, moderate to great, with special additions such as information retrieval, user support, and data analyses. Such results convey the fact that technology is way wide-ranging enough to cover many library procedures and could be developed even further, therefore inspiring further investigation of AI-based solutions.

Although AI tools have been proven to be beneficial in many areas, the respondents have also shown that they faced some challenges like the high initial investment costs and technical complexities along with the risks of data privacy and staff resistance. Proper planning and early engagement of the necessary resources, as well as holding pre-project

technical meetings with a focus on ethical, and organizational considerations, are crucial to overcoming these challenges. Moreover, Library users were generally very satisfied with the introduction of AI tools, with a large proportion of them stating that they were satisfied with the way AI has been implemented. Still, continued communication and involvement initiatives need to cope with user issues and gain a positive perception of AI inclusion.

The library uses multiple methods of collecting user feedback concerning AI tools, such as user surveys, analytics tools, and special feedback channels. Collaboration with another institution is a clear way of enabling innovation and sharing expertise in the AI implementation within the library community. Cooperation is the reason for the scalability and sustainability of the project by facilitating pooling of resources, expertise, and infrastructure. Yet, proactive and cooperative measures are needed to overcome the challenges of the like technology complexity, data privacy concerns, staff training, and financial constraints. Libraries can effectively mitigate such issues that hinder the implementation of AI by being proactive and building partnerships. This is going to enable libraries to make the most of AI technology in enhancing library services and also in meeting the rising needs of customers.

5.2.3 Contribution of Artificial Intelligence in Core University Library Functions

The study was designed to review the possible influence of AI in the main library functions. Through data analysis, the study highlighted the extent of AI implementation across different functions. AI has played a relatively low role in the main components of the library, but in some places, there are differences.

The results show that a reasonable amount of AI tool usage is overshaded the search algorithm optimization and resource discovery within information retrieval and search optimization, as well as the coupling of catalogue management and metadata processing. Using bots and other types of interaction with users proved to be evenly distributed. In addition, decision-making and data analysis were spread over all the levels of implementation. The results clearly underline the fact that preservation and conservation have the highest percentage of libraries proudly stating that they have elevated AI implementation. This is because they use AI-based solutions in these areas more than other libraries. These findings are very diverse and point to the AI integration in libraries as a

multifaceted phenomenon; the libraries' changes in priorities and needs are the reasons they will use AI to better serve and support patrons in the most effective manner.

The introduction of AI in different sectors of activity in libraries is an indication of their shifting priorities and expectations and the objective of the institution to go beyond the application of AI to the development of enriching services and get people to become more effective users. Libraries that use AI not just for one purpose are truly changing the way they work, just as the study has discussed before. Respondents think of AI as a technology that enables them to, for example, make a systematic catalog or do metadata management. However, they don't believe AI can do these things thoroughly with most of them listing a moderate level of contribution. It is suggestive that the AI software applications operate principally in the catalytic processes of library functions whereby they make the library functions more efficient, and the data more accurately organized and extracted from the database. It is worth noting as well that even from users' perspective, chatbots based on AI have been reportedly facilitating productive user interaction and customer service which, in return, displays a very high satisfaction rate in the mentioned users. Likewise, the AIs have been said to be participating in data analysis; hence the libraries have reported decision-making as a fact implying that the practitioners believe that the AI-based data analysis tools have been very beneficial to them and, thus, have made the libraries better places.

Respondents specify the facilitation of AI to computerized systems for the preservation and conservation of the environment, giving examples like digitization, image recognition for conservation analysis, automated metadata tagging, and predictive modelling for preservation planning. Libraries can use these AI-derived solutions to digitize and keep these history documents data smoothly, study and identify conservation needs, proceed to a better metadata management system, and finally conclude a plan to preserve the material based on the information they have received.

Respondents besides the positive effects also encountered challenges faced in AI implementation such as technical complexities, data privacy and security concerns, staff training needs, budgetary constraints, and organizational resistance to change. These problems must be addressed for the AI systems to be integrated and used properly for the purpose of improving library services. The study's findings reveal the fact that AI can boost

libraries' main services, but at the same time, they underline the importance of overcoming the barriers for the libraries to get the most out of AI.

5.2.4 Challenges of Adopting and Using Artificial Intelligence Tools in University Libraries

The study intends to establish the challenges facing the adoption and usage of AI tools in selected university libraries in Kenya; such will provide information on aspects relating to awareness, understanding, technical challenges, resource constraints, and staff resistance. A larger proportion of the respondents were aware of AI tools in the libraries before implementation; this shows a prior understanding within the professional fraternity. This may be linked to increased exposure to AI applications and resultant discussions. The respondents generally reported a good understanding of how AI functionalities are implemented during university library operations, which shows good distribution of information and trainings on technologies involving AI.

However, there are certain technical problems that create an obstacle to its adoption into the mainstream of progress. Often, integration into already existing systems is hard, and compatibility with existing infrastructure is very limited. Lack of technical expertise among staff is also a problem because training has not targeted certain areas. Resource constraints, which include issues related to finance, human resources, and technology, were mentioned by 61.8% of respondents as affecting the adoption of AI tools; hence, the need to address resource limitations as a way of facilitating wider AI integration within the library.

The organisational barriers to the adoption of AI reported were a few librarian staff resistances. The enabling environment for the implementation of AI through strategic communication, training, and change management is very crucial to overcome staff opposition. It goes from a lack of knowledge to a shortage of resources and opposition from staff. Not all these obstacles have yet been completely overcome in order to fully exploit the revolutionary potential of AI for the improvement of library services and processes.

5.3 Conclusions

The findings showed that there was a strong association between the level of knowledge about AI tools and their adoption by librarians. Therefore, this addresses the first research question on the impact that librarians' awareness brings about on the availability of such

technologies in a sample of university libraries within Kenya. In fact, introducing the use of AI technologies within university libraries in Kenya greatly requires exposure of librarians to such tools and their attendant benefits.

They discovered that for four counts, such as information retrieval, user assistance, data analysis, and preservation efforts, the libraries using the AI tools more frequently always outperformed others. This leads to the second research question about the application of AI in university libraries. It signifies that AI technologies are very crucial to improving the quality of the services rendered in libraries. Overall, AI technologies improve the efficacy and efficiency of library services in the academic environment, hence favorably impacting the performance of core tasks of the libraries.

The third research question is how AI technologies are integrated into library operations and how they are being used to advance core library activities. AI is used in university libraries for core library activities. This study identified the potential of AI technologies to enhance library activities for better service delivery, especially in information retrieval and preservation efforts. The findings of the research showed that AI technologies are meaningful in enhancing core library services and libraries derive helpful resources from AI technologies to make necessary adjustments considering changing patron demands and elevate the general quality of services offered.

In the third order of this research, on some of the challenges with the adoption of AI, the findings of the study have outlined technical challenges, resource limitations, and reluctance by staff as some of the obstacles that face the adoption and use of AI technologies in selected university libraries in Kenya. Such issues must be addressed for efficient integration of AI in the libraries as such are inversely related to the levels of acceptance of AI. There is a need to solve technological, resource-related, and organizational difficulties in university libraries to offer library services that efficiently meet patron requirements. In this respect, successful adoption and exploitation of AI technologies would be encouraged.

5.4 Contributions to Knowledge

This study represents a key addition to the literature based on our understanding of the awareness and adoption of AI tools by academic librarians in Kenyan libraries. The aim of this study is to determine the current state of artificial intelligence adoption in Kenyan

libraries by analyzing librarians' knowledge about AI technologies prior to their installation, and the percentage of libraries that have employed the use of these tools. That gives some insight into how the university libraries are prepared to apply AI technology and where we can get the word out and encourage people to use these tools. The study further provides a framework for future research in the field of AI adoption trends and practices of university libraries in Kenya, serving as a base against which effectiveness can be checked in promoting integration of AI in operations while monitoring the pace of progress.

This study investigates the effect of AI on different library activities and thus raises our awareness of its function within the core activities of an academic library. The study explains how AI technologies are being applied in librarianship by questioning librarians about their perception of the functionality of AI and its contributions to specific topics, such as information retrieval, cataloging, user support, data analysis, and preservative efforts. The paper throws some light on the benefits and disadvantages of the application of AI in improving library services by determining the levels of the current implementation of AI in various places and reviewing librarians' views on the effects of AI in these regions. This therefore enhances the current understanding of the AI application in university libraries, and strategies may be developed to optimize their use of AI considering successfully meeting the changing demands and priorities of libraries.

It further adds to the existing literature by making it possible to uncover challenges faced by university libraries within Kenya using the AI approaches. For the complete assimilation of AI in library settings in a fruitful manner, addressing the distinguished technological challenges, restrictions on resources, and responses of the staff are mandatory. It is important because the findings could serve as a guide for the development of interventions and support systems friendly to AI adoption by library directors, lawmakers, and tech developers. The study recommended capacity-building programs, strategic planning, and distribution of resources to enhance the use of AI and create a spirit of creativity and adaptability in university libraries. This will enable fact-based decisions to support successful AI adoption efforts; it will contribute to a better understanding of the technical, socio-cultural, and organizational aspects related to the deployment of AI in libraries.

5.5 Recommendations and Policy Implications

5.5.1 Awareness of Librarians towards Artificial Intelligence Tools

The study recommends that comprehensive training and awareness programs on the existence of AI tools must be conducted in selected university libraries in Kenya to improve the level of awareness among librarians. This is important for awareness among librarians on the benefits and several uses of AI in library operations. Workshops, seminars, and online courses can be arranged with a view to bringing librarians in contact with various AI-related tools and teaching them practical applications of such technologies in information retrieval, cataloguing, user support, and other library functions. Establishment of a resource centre or online portal updated on current information about AI technologies and their implementation within the framework of modern libraries could be another positive response by librarians to the needs of the time.

5.5.2 Level of Use (Uptake Levels) of Artificial Intelligence Tools

If the adoption level is increased, university libraries should develop clearly defined methods of implementation and standards. For the library directors, locating artificial intelligence technologies that fit specific library requirements and objectives should be the top priority. This may pose a challenge, but working with AI specialists and technology suppliers helps in no small measure to demystify the process of locating and deploying appropriate AI solutions. Libraries can set up pilot programs or test environments to further test the feasibility and effectiveness of AI technologies before full deployment. Through collaboration and by sharing knowledge, each library can support the others, while best practices and lessons gained concerning the adoption of AI can be shared.

5.5.3 Contribution of Artificial Intelligence in Core University Library Functions

If AI is to realize full potential in the core tasks of libraries, university libraries need to invest in ongoing monitoring and evaluation of the deployments of AI. Efficiency in information retrieval, user satisfaction, resource usage potential-are some performance indicators whose regular review with respect to assessing the impact of AI technologies is quite imperative. Moreover, librarians and users can support focus groups and surveys that indicate the effectiveness of AI-driven services. Also, encouraging a spirit of experimentation and creativity within libraries may challenge staff members to research new uses for AI and ways to continually enhance library services.

5.5.4 Challenges of Adopting and Using Artificial Intelligence Tools

In view of the above, support systems and resources must be fully built for university libraries if they are to surmount the challenges of adopting and deploying AI techniques. Funding should be mainly targeted at increasing the technical competence of the library staff regarding training and capacity-building programs related to AI deployment and management. When access to external training programs, credentials, and professional advancement opportunities are provided, librarians will have equal development for making full use of AI technologies. Enough budget needs to be allocated toward infrastructure development and system integration activities for addressing several technical issues and implementing AI projects smoothly. Moreover, the tendency to encourage staff to speak with each other and collaborate has certain effects that reduce resistance to change and allow creativity and flexibility to continuously be opened to technological advancements.

5.6 Suggestions for Further Research

While comparative studies can spell out the contextual aspects influencing AI adoption trends and practices across different areas or nations, this will be of further help in extending assistance towards meeting library requirements with a view to enhance efficiency in operational tasks and determining the effectiveness of any particular application or initiative in AI. Qualitative research methods, like focus groups and interviews, go the extra mile to provide a clearer view of librarians' perceptions regarding the adoption of AI, attitude, and experiences, together with the challenges faced when integrating AI technologies into their processes. Finally, university libraries in Kenya face unique challenges; as such, investigating AI-driven solutions that address those problems could mean coming up with better concepts to enhance AI uptake and related benefits to stakeholders.

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APPENDICES

Appendix II: Introduction Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: E65/37393/2017

DATE: 16th April, 2024

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR TECLAH JEBET – REG. NO. E65/37393/2017.

I write to introduce Teclah Jebet who is a Postgraduate Student of this University. The student is registered for M.Sc degree programme in the Department of Computing and Information Science.

Teclah intends to conduct research for a M.Sc Project Proposal entitled, "Adoption and Use of Artificial Intelligence Tools for Service Provision in Selected Academic Libraries in Kenya".

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELISHIBA KIMANI
EXECUTIVE DEAN, GRADUATE SCHOOL

JG/lnn

Appendix II: Respondents' Consent

Dear Respondent,

Re: Completion of Questionnaire

I am Teclah Jebet, a Master's student at Kenyatta University, Department of Computing and information science. In partial fulfilment of the requirements for the award of degree of Master's in library and information science, I am conducting a study entitled, "**Adoption and Use of Artificial Intelligence Tools for Service Provision in Selected University libraries in Kenya.***"* To be able to carry out this study successfully, you have been picked to form part of the study. I kindly request for your assistance in filling the attached questionnaire which forms part of collecting required data for the study. Kindly note that you are not required to indicate your name. All information will be treated with utmost confidentiality and used for academic purposes only. Participating in this research study is voluntary and sign below if you consent to participate as a respondent.

Signature…….. Date ……

Thank you in advance for taking your time to assist me in this research.

Yours Sincerely

Teclah Jebet

Appendix III: Questionnaire

Questionnaire for Library staff

SECTION A: DEMOGRAPHIC DATA

Kindly tick (√) the most appropriate answer to the following

1. **What is your age?**
   - Less than 21 Years ☐
   - 21-25 years ☐
   - 26-30 years ☐
   - 30- 35 years ☐
   - 35 years and above ☐

2. **Gender**
   - Male ☐
   - Female ☐

3. **Highest Academic Qualification**
   - Diploma ☐
   - Bachelors ☐
   - Masters ☐
   - PhD ☐

4. **Working experience**
   - 1-5 years ☐
   - 6-10 years ☐
   - 11 years and above ☐

SECTION B

AWARENESS OF LIBRARIANS TOWARDS ARTIFICIAL INTELLIGENCE TOOLS

Kindly tick (✓) the options that indicate the extent to which you agree or disagree with each of the following statements.

Were you aware that Artificial Intelligence tools are being used in libraries before taking this survey?

☐ Yes

☐ No

How did you become aware of the existence of AI tools in university libraries?

☐ Training programs

☐ Conferences

- ☐ Workshops
- ☐ Professional literature
- ☐ Colleagues

……
…

Rate your familiarity with common Artificial intelligence terms (e.g., machine learning, natural language processing, deep learning etc).

- ☐ Very Familiar
- ☐ Somewhat Familiar
- ☐ Not Familiar

How well do you understand the potential applications of AI tools in a library setting?

- ☐ Very Well
- ☐ Moderately Well
- ☐ Not Well

Are AI tools currently being used in your library?

- ☐ Yes
- ☐ No

If AI tools are in use, please provide examples or describe the specific AI applications implemented in your library.

…….

What do you believe are the potential benefits of integrating AI tools into university library services?

……..

What challenges do you foresee in implementing AI tools in the university library?

……
..

Have you received any training on using or managing AI tools in the library?

- ☐ Yes
- ☐ No

If no, do you feel the need for training on AI tools?

☐ Yes

☐ No

What recommendations do you have for improving the integration of AI tools in University Libraries?

……
……
……

SECTION C

LEVEL OF USE (UPTAKE LEVELS) OF ARTIFICIAL INTELLIGENCE TOOLS

Kindly tick (✓) the option that describes your level of usage of Artificial Intelligence tools

Are you aware of the presence of Artificial Intelligence tools in your library?

☐ Yes

☐ No

Please list or describe the specific AI tools currently in use in your library.

……

……

……..

To what extent have AI tools been implemented in the following library functions? (Rate on a scale from 1 to 5, where 1 is minimal implementation and 5 is extensive implementation.)

	Extent of AI implementation				
Library function	1	2	3	4	5
Information retrieval and search optimization					
Cataloging and metadata management					
User support and interaction (e.g., chatbots)					
Data analysis and decision-making					
Preservation and conservation					

What benefits have you observed since the implementation of AI tools in the library?

……..

What challenges or obstacles have you encountered in implementing AI tools?

……
…

To what extent have library users expressed satisfaction with the integration of AI tools?

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Neutral
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

How does the library collect feedback from users regarding AI tools?

……

Does your library collaborate with other institutions regarding the implementation of AI tools?

- ☐ Yes
- ☐ No

Are there any specific challenges you would like to highlight regarding the implementation of AI tools?

……
…

SECTION D

CONTRIBUTION OF ARTIFICIAL INTELLIGENCE IN CORE UNIVERSITY LIBRARY FUNCTIONS
Kindly tick (✓) appropriately

Are you aware of the integration of Artificial Intelligence in the core functions of your library?

- ☐ Yes
- ☐ No

How well do you understand the specific contributions of AI in the following core library functions? (Rate on a scale from 1 to 5, where 1 is low understanding, and 5 is high understanding.)

	Extent of AI implementation				
Library function	1	2	3	4	5
Information retrieval and search optimization					

Cataloging and metadata management					
User support and interaction (e.g., chatbots)					
Data analysis and decision-making					
Preservation and conservation					

How has the integration of AI impacted the efficiency and effectiveness of information retrieval in the library?

……
…

To what extent has AI contributed to the cataloging and metadata management processes in the library?

☐ Very Well

☐ Moderately Well

☐ Not Well

AI-driven user support mechanisms (e.g., chatbots) have positively impacted user interaction and support services

☐ Strongly Agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly Disagree

AI has aided in data analysis, leading to informed decision-making within the library?

☐ Strongly Agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly Disagree

In what ways has AI contributed to the preservation and conservation efforts of the library……
……..

To what extent has the library received feedback from users regarding the impact of AI on their experiences?

☐ Very Positive

☐ Positive

☐ Neutral

☐ Negative

☐ Very Negative

How satisfied are users with the AI-driven features and services in the library?

☐ Very Satisfied

☐ Satisfied

☐ Neutral

☐ Dissatisfied

☐ Very Dissatisfied

What challenges, if any, have been encountered in the implementation of AI in core library functions?

……
..

SECTION E

CHALLENGES OF ADOPTING AND USING ARTIFICIAL INTELLIGENCE TOOLS IN UNIVERSITY LIBRARIES

Kindly tick (✓) the option that indicate the extent to which you agree or disagree with each of the following statements.

Were you aware of the existence of AI tools in libraries before the implementation in your library?

☐ Yes

☐ No

How well do you understand the functionalities and potential applications of AI tools in the university library operations?

☐ Very Well

☐ Moderately Well

☐ Not Well

What technical challenges have you encountered in adopting AI tools in the library?

☐ Lack of technical expertise

☐ Integration issues with existing systems

☐ Limited compatibility with current infrastructure

☐ Other (please specify)

……
…

Have resource constraints (financial, human resources, technological) hindered the adoption of AI tools?

☐ Yes

☐ No

Have you experienced resistance from library staff in adopting AI tools?

☐ Yes

☐ No

How do data privacy and security concerns affect the adoption of AI tools in the library?

……..

Have you encountered challenges in training staff or addressing skill gaps during the implementation of AI tools?

☐ Yes

☐ No

Are there challenges in the decision-making processes related to the adoption of AI tools?

☐ Yes

☐ No

Do you anticipate increased investment in AI tools in the future?

☐ Yes

☐ No

What strategies do you think could help mitigate the challenges faced in adopting AI tools in the library?

……
…***Thank You For Your Time***

Appendix IV: Interview Gide

1. **What is your age?**
   - Less than 21 Years ☐
   - 21-25 years ☐
   - 26-30 years ☐
   - 30- 35 years ☐
   - 35 years and above ☐

2. **Gender**
   - Male ☐
   - Female ☐

3. **Highest Academic Qualification**
   - Diploma ☐
   - Bachelors ☐
   - Masters ☐
   - PhD ☐

4. **Working experience**
   - 1-5 years ☐
   - 6-10 years ☐
   - 11 years and above ☐

What do you believe are the potential benefits of integrating AI tools into university library services?

What challenges do you foresee in implementing AI tools in the university library?

What recommendations do you have for improving the integration of AI tools in University Libraries?

How does the library collect feedback from users regarding AI tools?

……

Does your library collaborate with other institutions regarding the implementation of AI tools?

☐ Yes

☐ No

Are there any specific challenges you would like to highlight regarding the implementation of AI tools?

In what ways has AI contributed to the preservation and conservation efforts of the library

Are there any specific challenges you would like to highlight regarding the implementation of AI tools?

Were you aware of the existence of AI tools in libraries before the implementation in your library?

☐ Yes

☐ No

How well do you understand the functionalities and potential applications of AI tools in the university library operations?

☐ Very Well

☐ Moderately Well

☐ Not Well

What technical challenges have you encountered in adopting AI tools in the library?

☐ Lack of technical expertise

☐ Integration issues with existing systems

☐ Limited compatibility with current infrastructure

☐ Other (please specify)

……
…

Have resource constraints (financial, human resources, technological) hindered the adoption of AI tools?

Have you experienced resistance from library staff in adopting AI tools?

How do data privacy and security concerns affect the adoption of AI tools in the library?

……..

Have you encountered challenges in training staff or addressing skill gaps during the implementation of AI tools?

Are there challenges in the decision-making processes related to the adoption of AI tools?

Do you anticipate increased investment in AI tools in the future?

What strategies do you think could help mitigate the challenges faced in adopting AI tools in the library?

Appendix V: Research Authorization

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 4150

Internal Memo

FROM: Executive Dean, Graduate School

DATE: 16th April, 2023

TO: Teclah Jebet
C/o Computing and Information Science Dept.

REF: E65/37393/2017

SUBJECT: APPROVAL OF RESEARCH PROJECT PROPOSAL

This is to inform you that Graduate School Board at its meeting of 11th April, 2024 approved your Research Project Proposal for the M.Sc Degree Entitled, "Adoption and Use of Artificial Intelligence Tools for Service Provision in Selected Academic Libraries in Kenya".

You may now proceed with your Data Collection, Subject to Clearance with Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking and Progress Report Forms per semester. The Forms are available at the University's Website under Graduate School webpage downloads.

Also, please ensure that you publish article(s) from your project before submitting it to Graduate School for examination as per the Commission for University Education and Kenyatta University guidelines.

Thank you.

JULIA GITU
FOR: EXECUTIVE DEAN, GRADUATE SCHOOL

c.c. Chairman, Computing and Information Science Department.

Supervisors:

1. Dr. Martin Gichugu
   C/o Department of Computing and Information Science
   Kenyatta University

JG/lnn

Appendix VI: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 320481

Date of Issue: 25/April/2024

RESEARCH LICENSE

This is to Certify that Ms.. Jebet Teclah of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kiambu, Nairobi on the topic: ADOPTION AND USE OF ARTIFICIAL INTELLIGENCE TOOLS FOR SERVICE PROVISION IN SELECTED ACADEMIC LIBRARIES IN KENYA for the period ending : 25/April/2025.

License No: NACOSTI/P/24/34937

320481

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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