AWARENESS AND USE OF ARTIFICIAL INTELLIGENCE AS CORRELATES OF EFFECTIVE LIBRARY SERVICES DELIVERY IN KWARA STATE, NIGERIA

BY

ADEYI GRACE TITILAYO

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CERTIFICATION

This is to certify that this project titled **"*Awareness and Use of Artificial Intelligence as Correlates of Effective Library Services Delivery in Kwara State, Nigeria*"** has been read and approved as meeting the requirements of the Department of Library and Information Science, Kwara State Polytechnic, Ilorin, for the Award of National Diploma in Library and Information Science.

_____	_____
A. O. Isiaka (Supervisor)	Date
_____	_____
A. O. Isiaka (Head of Department)	Date
_____	_____
S. A. Sulyman (Project Coordinator)	Date
_____	_____
External Examiner	Date

DEDICATION

This research is dedicated to Almighty God.

DECLARATION

I, ADEYI, Grace Titilayo an ND student in the Department of Library and Information Science, Kwara State Polytechnic, Ilorin, hereby declare that this research project titled *"Awareness and Use of Artificial Intelligence as Correlates of Effective Library Services Delivery in Kwara State, Nigeria"*, submitted by me is based on my actual and original work. Any materials obtained from other sources or work done by any other persons or institutions have been duly acknowledged.

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ADEYI, Grace Titilayo
(ND/23/LIS/FT/0048)

Date

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Abstract

The use of Artificial Intelligent (AI) for academic libraries services delivery will drastically promote the service of libraries to users. The study examined the awareness and use of AI for effective library services delivery in selected academic libraries in South-west, Nigeria. Descriptive survey design was adopted for the study and purposive sampling technique was

adopted to determine the population for the study which consists of 80 academic librarians in six selected university libraries in South-west, Nigeria. The study employed total enumeration technique and questionnaire was used to collect data from the selected population. The data collected was analysed and presented with frequency and percentages. The findings of the study revealed that biomertric technology, AI drone, AI Chatbots, virtual references and AI robots are the AI the respondents were aware of. The study also revealed the potential use of AI for effective library services delivery such as robotic for book delivery systems, humanoid robots as an assistant to librarians, AI drone surveillance for library security and AI for cataloguing and classification. Furthermore, the study findings also revealed the challenges of AI for library services delivery to includes lack of funds from the parent institution, low speed of internet, insufficient AI tools and equipment and inadequate facilities for AI technologies. The study concludes that the librarians in university libraries in South-west, Nigeria are aware of AI and also positively perceived the usefulness of its incorporation for effective library services delivery. The study also recommends that university libraries should apply for grants from government and other agencies to incorporate AI for library services.

Keywords: Artificial Intelligence, Library Services, Awareness, Effective, Correlates, Services Delivery, Use, Kwara State.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

In an era marked by unprecedented advancements in technology, the integration of ICT in library services and operations has revolutionized traditional practices, enabling libraries to adapt to the evolving needs of users in the digital age. Adeniran; Nwalo and Ajani (2020) concluded that provision of adequate ICT facilities in academic libraries will revolutionize effective information service delivery and the advancement in the use of ICT in day-to-day operations in academic libraries will dramatically enhanced information provision to the library users. Adamu; Udoudoh; Babalola and Yusuf (2021) opine that ICT skills acquisition by library and information professionals can be done through conference attendance, seminars and workshops which, in turn, enhance information service delivery. Agbo and Eyinnah (2022) affirm the relevance of ICT embedded services and their application among librarians to make them more effective in the delivery of various library operations.

Artificial intelligence (AI) is a branch of computer science and engineering that focuses on developing intelligent machines that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI systems are designed to learn from experience, adapt to new situations, and improve performance over time without being explicitly programmed. The ultimate goal of AI is to create machines that can simulate human intelligence, including reasoning, problemsolving, and creativity. AI is a machine's ability to perform cognitive functions as humans do, such as perceiving, learning, reasoning, and solving problems. The benchmark for AI is the human level concerning in teams of reasoning, speech, and vision.

The integration of Artificial Intelligence (AI) stands out as a transformative force across various sectors. University libraries, as essential hubs of information and knowledge, have not remained untouched by this wave of innovation. The intersection of AI and library services delivery heralds a new chapter in the evolution of these vital institutions, promising enhanced efficiency, accessibility, and user experiences. Tella (2020) stressed the need for academic libraries to re-position themselves to take the relative advantages of artificial intelligence's potentials by refining the quality of library services in this era of the information explosive age. Artificial intelligence (AI) as defined by Frankenfield (2021) is the simulation of human intelligence in computers that are trained to think and act like humans. The phrase can also refer to any machine that demonstrates human-like characteristics like learning and problemsolving.

Traditionally, libraries have been repositories of human knowledge, meticulously curated and managed by librarians. However, the digital age has ushered in a paradigm shift, demanding libraries to adapt and embrace cutting-edge technologies to meet the evolving needs of their patrons. The application of AI in academic libraries will influence connectivity of information technology and actively support information usage as well as easing clients' search and immediately address their needs. Academic libraries have begun to use robots instead of humans in a variety of procedures, particularly those that are hazardous and time-consuming (Vysakh & Rajendra, 2020). Tella (2020) reported that it is no longer news that humanoid robots with artificial intelligence (AI) are now available in libraries in both rich and developing nations.

The overarching objective in the use of AI for library services delivery is to augment and streamline various facets of library operations. From the automation of routine tasks such as cataloguing and classification to the facilitation of sophisticated search capabilities and the provision of personalized recommendations, AI holds the promise of revolutionizing the way library function. Moreover, the integration of AI is not merely a technological upgrade; it represents a strategic response to the changing expectations and behaviors of library users in the digital age. Tella (2020) stresses that libraries in the developed countries have accepted and use AI technologies virtually in all spheres of life whereas those in developing countries are still struggling to find their feet.

The use AI in academic libraries will make the library more relevant in the academic community. Patrons would be more excited to come to the library and see the library as a real center of knowledge (Owolabi et al., 2021). Artificial intelligence has the ability to streamline library operations, increase librarian productivity, and encourage the provision of high-quality services to the next generation of library patrons (Olusegun et al., 2023). Corrado (2021) indicated that artificial intelligence can be applied in many areas of technical service, such as assigning and creating subject headings, taxonomies, and metadata descriptions. AI robot adoption and use in libraries can enhance library services and give users with reliable information that can foster growth and development in the information age (Oladokun et al., 2023).

The awareness of AI by university librarians cannot be overlooked, because it has become evident that this dynamic intersection goes beyond mere technological adoption. It encompasses a reimagining of the role of libraries in the digital landscape, emphasizing responsiveness, inclusivity, and the seamless integration of technology to create a more enriching experience for diverse user communities. Owolabi et al., (2021) revealed that

academic librarians are aware of AI technologies, particularly in library operations. Sambo and Oyovwe-Tinuoye (2023) in their study, they discovered that the majority of licenced librarians were averagely aware of AI robotic technologies in libraries.

Artificial intelligence integration in academic libraries offers numerous benefits and advantages. Yusuf et al., (2022) concludes that in spite of the benefits associated with the adoption of AI in libraries, some challenges such as financial uncertainty, emerging skill gaps, job loss, lack of adequate infrastructure and erratic power supply still hinder the smooth adoption of AI in many academic libraries in Africa. Nevertheless, researchers testified that the benefits of AI to its users significantly outweigh its disadvantages (Ali et al., 2020). Yakubu et al., (2023) in their research, they provide a blue print that can be used and simplify the processes of approaching the use of AI in the academic libraries of North-eastern Nigeria and beyond. Owolabi et al., (2021) highlighted various advantages of using AI in library operations. Such as AI innovations in the library will increase academic librarians' job performance and better user satisfaction.

However, having observed the developing trends in artificial intelligence technology and its application and use for university libraries all around the globe, there is the need for such innovations in Nigeria, especially university libraries so as to reap the overwhelming merits of artificial intelligence for effective university library services. Therefore, this study examined the awareness and use of artificial intelligence as correlates for effective library services delivery in university libraries in Nigeria.

1.2 Statement of Problem

University libraries are seen as the heart of the knowledge repository that play major roles of acquiring, organizing, preserving and disseminating information and knowledge resources to support teaching, learning and other research works to University Community. There are enormous tasks which require the application and use of Artificial Intelligence into Library Operation in other to provide effective Library Services. Despite all these AI potentials in libraries, academic libraries in Nigeria are yet to adopt and implement AI into their libraries. Tella (2020) observes that while libraries, particularly in developed countries have accepted and use AI technologies; those in developing countries are still struggling to find their feet.

This might be due to low level of awareness and perception of artificial intelligent relevance in libraries, as research connecting artificial intelligence (AI) to librarianship remains relatively low. It is to this end this research tends to focus on the awareness and use of artificial intelligence as correlates for effective library services delivery in university libraries in Nigeria. The study will strive to provide helpful and useful information on the use of artificial intelligence in university libraries and other types libraries in general.

1.3 Research Objectives

The main objective of the study is to investigate the awareness and use of artificial intelligence as correlates for effective library services delivery in university libraries in Kwara State,

Nigeria. The specific objectives are to;

i. Establish the awareness of artificial intelligence for effective library service delivery in university libraries in Kwara State, Nigeria; ii. Examine the use of artificial intelligence for effective library services delivery in university libraries in Kwara State, Nigeria; and

iii. Identify the challenges associated with the use of artificial intelligence for effective library services delivery in university libraries in Kwara State, Nigeria.

1.4 Research Questions

The study will answer the following research questions:

iv. Is there the awareness of artificial intelligence for effective library service delivery in university libraries in Kwara State, Nigeria?

v. What is the use of artificial intelligence for effective library services delivery in university libraries in Kwara State, Nigeria? and vi. What are the challenges associated with the use of artificial intelligence for effective library services delivery in university libraries in Kwara State, Nigeria?

1.5 Scope of the Study

This study focused on awareness and use of artificial intelligence as correlates of effective library services delivery in university libraries in Kwara State, Nigeria. The variables of interest were limited to awareness of AI, use of AI and effective library services delivery. The study will cover five selected university libraries from the Kwara State, Nigeria. The study will adopt a descriptive survey method of a correctional type; questionnaire will be used to collect data from the librarians which reflected individuals' opinion on the awareness and use of artificial intelligence for effective university library services. IBM SPSS V26.0 will be used to carry out both descriptive statistics such as frequencies and percentages counts.

1.6 Significance of the Study

The findings of this study would be of benefit to the management of libraries, librarians, students, lecturers, society and to expand the existing literature. It would also be of immense benefits to policy makers, practitioners, stakeholders and the society at large. To the policy makers: it would expose them on the inherent benefits embedded in the artificial intelligence and the deployment of its associated technologies in effective university library services provision to the patrons. To the practicing librarians in specific terms, the result of findings would expose academic librarians on the roles expected of them in provision of effective information service to library patrons; it will also improve the performance of their operations. To the stakeholders, it would enable the management to embrace the usefulness and benefits of the cloud computing.

The general motivation behind this research is to take activities which are educative in order to contribute more interest towards the improvement in study of artificial intelligence in academic level. The study will help the universities libraries management to recognize the factors that control the use of artificial intelligence for effective university library services by library staff and users, it will also provide practical solutions to harness the strategies and recommendations to improve the use and purpose of artificial intelligence technologies. The result of the study will supplement the rising experimental literature on integration of artificial intelligence and effective services delivery in universities libraries in Nigeria.

1.7 Operational Definition of Terms

Artificial Intelligence: Is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision making and translation of languages.

University Libraries: Are the libraries found in universities whose sole responsibility is to support the teaching, learning and research and acquire information materials for the curriculum of the universities and the immediate community at large.

Library Services: is the performance of all activities of a library relating to the collection and organization of library materials and to making the materials and information of a available to the users.

Awareness: refers to the understanding and familiarity of library staff with Artificial Intelligence for Library Operations.

Library Services Delivery: Is the ability of a university library to provide the information need of users at the time of request in order to satisfy the expectation of users and improve their experience.

Effective: It is the adequate to accomplish a purpose; producing the intended or expected results.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter focused on extensive review of related and relevant literature on awareness and use of artificial intelligence as correlates for effective library services delivery in university libraries. Review of related literature gives an evaluation of previous literature to the researcher's area of study. Literature plays a very important role in research activities, as it

forms the very first step of a research pursuit. Review of literature happens to be an important segment of the concerned topic. The literature review should be conducted in a systematic way to achieve optimum results. In this study an attempt has been made to cover few works which have been undertaken in Nigeria and abroad. The literature review of this study is guided by the following research outlines/sub-heading:

2.2 Concept of Artificial Intelligence.

2.3 The awareness of artificial intelligence in university libraries.

2.4 The use of artificial intelligence for effective library services delivery.

2.5 The challenges of using artificial intelligence in university libraries.

2.6 Appraisal of Reviewed Related Literature.

2.2 Concept of Artificial Intelligence

The term “Artificial Intelligence” was coined from the combination of two independent terms, and it has dominated the academic world of technological growth over the years. Artificial is defined as “anything manufactured out of imitation, something not natural, lacking spontaneity, assumed and not sincere,” according to the online edition of the British Dictionary (2012). The Webster’s New World Dictionary goes on to define artificial as something created by humans and not naturally occurring. In other terms, it refers to something that is artificial or arbitrary and does not arise from natural or essential reasons.

According to Merriam-Webster Online Dictionary (2022), intelligence is “the ability to learn, understand, or deal with new or difficult situations through the skilled application of reason, the ability to apply knowledge to manipulate one’s environment, or the ability to think abstractly as measured by objective criteria (as tests)”. It is not a single mental process, but a combination of many mental processes directed toward effective adaptation to the environment (Encyclopedia Britannica, 2006).

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. The goal of AI is to develop systems that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. Artificial intelligence (AI) is defined by Frankenfield (2021) as the simulation of human intelligence in computers that are trained to think and act like humans. The phrase can also refer to any machine that demonstrates human-like characteristics like learning and problem-solving. Artificial intelligence, according to Merriam-Webster (2019), is a branch of computer science that works with providing machines the ability to appear to have natural human intelligence.

Artificial intelligence, as described by Kok, et al. (2018), is a branch of computer science concerned with the creation of computers capable of human-like mental processes such as learning, reasoning, and self-correction. Asemi and Asemi (2018) define artificial intelligence as a branch of computer science that focuses on creating machines that can engage in behaviors that humans consider intelligent. As an aspect of computer science, AI comprises an expert system, fuzzy logic, artificial neural network, evolutionary algorithms, case-based reasoning, image processing, natural language processing, speech recognition, and robotic (Koushal et al., 2012).

AI can play a significant role in enhancing the efficiency, accessibility, and user experience in university libraries. The notion has been used by libraries and librarians in the Western world for decades, it is relatively new to the Nigerian academic library system. Artificial intelligence and its relation to library services have been defined and discussed by a variety of academic experts from across the world. Having a single entity definition for artificial intelligence will be difficult and time-consuming, as various authors and researchers have stated that its use implies a technological transition. Also, AI is the technology that enables robots to plan, learn, reason, solve problems, move, and to some extent be creative (Heath, 2018).

2.2.1 Subsets of AI

Machine Learning is a subset of AI that focuses on the development of algorithms and statistical models that enable computers to improve their performance on a task through experience. Instead of being explicitly programmed, these systems learn from data. While the enormous amount of data generated every day would require a long time to be processed, AI technologies that use machine learning can swiftly transform large data into useful knowledge

(Ajani et al., 2022). Reinforcement learning is a type of machine learning where an agent learns to make decisions by interacting with its environment. The agent receives feedback in the form of rewards or penalties, allowing it to learn optimal strategies over time.

Deep Learning is a type of machine learning that uses artificial neural networks to simulate the way the human brain works. Deep learning algorithms attempt to model high-level abstractions in data by using multiple layers of neural networks. Computer vision enables machines to interpret and make decisions based on visual data. This includes tasks such as image and video recognition, object detection, and facial recognition. Expert systems are AI

programs that mimic the decision-making ability of a human expert in a particular domain. These systems use a knowledge base of human expertise and an inference engine to solve specific problems.

Natural Language Processing (NLP) is a branch of AI that enables machines to understand, interpret, and generate human language. It involves the interaction between computers and humans using natural language. NLP is the study of extracting information from natural human language in order to communicate with robots and grow enterprises (Zulaikha, 2020). NLP may be utilized in libraries to create intelligent expert information retrieval systems that users can engage with directly using natural language. The computer receives natural language as input, analyzes and processes it, and then responds with the information required (Omame & Alex-Nmecha, 2020). Poelmans (2020) describes NLP as a type of artificial intelligence (AI) that allows computers to read, understand, and interpret human language. It aids computers in determining the importance of certain aspects of human language.

2.2.2 Types of AI

AI can be categorized into different types based on its capabilities, functions, and level of autonomy. The main types of AI are as follows according to Johnson (2023):

Narrow or Weak AI: Weak AI is designed and trained for a specific task or a narrow set of tasks. It operates within a limited context and cannot perform tasks beyond its predefined scope. Example is virtual personal assistants like Siri or Alexa, image recognition software, and recommendation algorithms.

General or Strong AI: Strong AI refers to artificial intelligence that possesses the ability to understand, learn, and apply knowledge across a broad range of tasks at a human-like level. It can handle any intellectual task that a human being can. Strong AI is more of a theoretical concept and has not been fully realized as of now.

Artificial Narrow Intelligence (ANI): ANI is another term for Weak AI. It describes systems that are designed and trained for a specific task and cannot perform tasks outside their narrow scope.

Artificial General Intelligence (AGI): AGI is another term for Strong AI. It refers to a type of artificial intelligence that has the ability to understand, learn, and apply knowledge in a manner similar to human intelligence across a wide range of tasks.

Artificial Super-intelligence (ASI): ASI is an advanced form of artificial intelligence that surpasses human intelligence in virtually every aspect. It represents a level of intelligence that is beyond human capabilities. ASI is a theoretical concept and has not been achieved yet. It raises ethical and existential concerns due to its potential to outperform humans in all intellectual tasks.

Reactive Machines: Reactive machines are AI systems designed to perform specific tasks based on predefined rules and patterns. They don't have the ability to learn or adapt beyond their original programming. Example is Chess-playing programs that follow a set of rules to make moves.

Limited Memory: Limited memory AI systems have the ability to learn from historical data to some extent. They can make predictions or decisions based on past experiences. Example is self-driving cars that use historical data to anticipate and react to road conditions.

Theory of Mind: This represents a hypothetical level of AI that can understand, interpret, and respond to the mental states of others, including beliefs, intentions, and emotions. This is more of a long-term goal and has not been achieved in practice.

These classifications help to understand the varying degrees of AI capabilities, from systems designed for specific tasks to the theoretical concept of machines surpassing human intelligence across all domains. Currently, most AI applications fall under the category of Narrow AI or Weak AI.

2.2.3 Components of AI

Artificial Intelligence (AI) systems consist of various components that work together to enable machines to perform intelligent tasks. The key components of AI include according to Chojnowska (2023):

Data: Data is the raw information that AI systems use to learn and make decisions. It can include text, images, videos, sensor inputs, and more. High-quality, diverse, and relevant data is crucial for training AI models and ensuring their accuracy and effectiveness.

Algorithms: Algorithms are sets of rules and instructions that AI systems follow to perform a specific task or make decisions. Machine learning algorithms, in particular, enable systems to learn patterns and make predictions. There are various types of algorithms, including supervised learning, unsupervised learning, and reinforcement learning.

Models: Models are representations of the patterns and relationships learned from data by AI algorithms. They are the trained systems that can make predictions or decisions when presented with new input. Models are trained using labeled data in supervised learning or learn patterns without explicit labels in unsupervised learning.

Training Data: Training data is a subset of data used to train AI models. It consists of inputoutput pairs for supervised learning, where the model learns to map inputs to corresponding outputs. The quality and quantity of training data significantly impact the performance of AI models.

Feature Extraction: Feature extraction involves identifying and selecting relevant features (attributes or characteristics) from the input data. It helps reduce the complexity of the data and improve model performance. Proper feature extraction is crucial for training models that can generalize well to new, unseen data.

Neural Networks: Neural networks are computational models inspired by the structure and function of the human brain. They consist of interconnected nodes (neurons) organized in layers, including input, hidden, and output layers. Deep neural networks, or deep learning, involve networks with multiple hidden layers, enabling them to learn hierarchical representations of data.

Natural Language Processing (NLP): NLP is a sub-field of AI that focuses on the interaction between computers and human language. It enables machines to understand, interpret, and generate human language. NLP is used in applications like language translation, sentiment analysis, chatbots, and text summarization.

Computer Vision: Computer vision enables machines to interpret and make decisions based on visual data. It involves tasks such as image recognition, object detection, and facial recognition. Computer vision is widely used in fields like healthcare, autonomous vehicles, and surveillance.

Expert Systems: Expert systems are AI programs that mimic the decision-making ability of a human expert in a specific domain. They use a knowledge base and an inference engine to solve problems. Expert systems are used in fields like medicine, finance, and engineering for decision support.

Reinforcement Learning: Reinforcement learning involves training AI models to make sequential decisions by receiving feedback in the form of rewards or penalties based on their actions. Reinforcement learning is used in robotics, game playing, and autonomous systems.

These components collectively contribute to the development and functioning of AI systems, enabling them to perform a wide range of tasks and adapt to new information. The integration and synergy of these components are critical for the success of AI applications.

2.3 The Awareness of Artificial Intelligence in University Libraries

The awareness and use of AI by university libraries have been increasing, but the extent varies among institutions. Many universities and other academic libraries recognize the potential benefits of AI in improving efficiency, enhancing user services, and supporting research activities. Owolabi et al. (2021) who indicate in their study that the majority of respondents were aware of artificially intelligent technologies in library operations. Sunanthini and Amees (2023) claimed that LIS professionals in Zambia were aware of the skills required to adopt AI technologies. This spurred their eagerness and preparedness to take the lead role in adopting AI in libraries. Owolabi et al., (2021) stated in their study that it is noteworthy that all the ICT librarians were aware of the relevance of AI in library operations.

University libraries often leverage AI tools and technologies to support research activities. This includes using AI for text and data mining, citation analysis, and assisting researchers in literature reviews. Some institutions are adopting AI solutions for automating cataloging processes and managing metadata. AI can assist in classifying and organizing resources efficiently. Tunde et al. (2022), stated that University of Lagos is currently the only institution in Nigeria that has adopted the use of artificial intelligence in some library services and operations.

Subaveerapandiyan, Sunanthini and Amees (2023) studied the knowledge and perception of artificial intelligence by librarians in Zambia. They found that LIS professionals were aware of the skills required to adopt AI technologies, hence their eagerness and preparedness to take the lead role. Recommendation systems powered by AI algorithms are being implemented to enhance the user experience in university libraries. These systems provide personalized suggestions for books, articles, and other resources based on users' preferences and borrowing history. Chatbots and virtual assistants equipped with AI capabilities are increasingly being used to provide instant assistance to library users. They can answer queries, guide users through library resources, and offer support in real-time. AI is a rapidly evolving field, changing how librarians interact with technology. It involves the development of intelligent computers that can perceive, think and behave like humans (Goralski and Tan, 2020; Hassani et al., 2020; Popenici and Kerr, 2017).

Some libraries use predictive analytics and AI tools to analyze usage patterns and predict future demands for certain resources. This helps in making informed decisions regarding collection development and resource allocation. AI is also being utilized to improve accessibility, such as implementing language translation tools, voice recognition systems, and other technologies to cater to diverse user needs. Mahmoud (2023) asserted that it has become necessary for academic libraries to introduce and exploit artificial intelligence in their operations and services. Tang and Zhang (2023) noted that the application of AI in libraries is not only the result of the development of technology, but also the choice of libraries to improve their service.

As awareness of AI grows, libraries are also paying attention to the ethical considerations associated with AI adoption. Eiriemiokhale and Sulyman (2023) states that Chatbots and Dynamed are the types of AI the librarians were aware of. This affirms the notion that

chatbots is gaining prominence in Library and Information Science landscape. This includes issues related to privacy, bias in algorithms, and transparency in AI decision-making processes. AI has ensured multiple and specific upload of tasks can also be integrated with other system solutions for super results (Konfuzio, 2022). Libraries are investing in professional development programs to ensure that librarians and library staff are equipped with the necessary skills to understand, implement, and manage AI technologies effectively. Currently, the wide evolution of AI in academic libraries with its clear-cut, sophisticated and overwhelming proficiency (Omigie, Krubu & Anthony, 2023)

Collaboration between libraries and other departments within universities, as well as partnerships with external organizations and technology providers, is becoming more common. This collaborative approach helps in the successful integration of AI solutions. Libraries are focusing on educating users about AI applications and encouraging engagement. Workshops, training sessions, and informational materials are being used to help users understand how AI enhances library services. According to some studies, libraries should create a continuing education strategy to equip staff and patrons with the knowledge and abilities necessary for RT awareness, adoption, and implementation (Arlitsch & Newell, 2017).

It’s essential to note that the adoption of AI in university libraries is a dynamic and evolving process. The pace of adoption may vary depending on the institution’s awareness, resources, priorities, and the specific needs of the user community. Massis (2018), many academic librarians perceive the adoption of RT as a danger since they think it will execute the tasks that should be carried out by them. It should be noted, nonetheless, that the adoption and application of AI in libraries will improve the quality of the services offered by libraries.

Similarly, Pinfield et al. (2017) asserted that library managers will be ready to adopt the use of robot technologies in libraries if they are well aware of the importance of providing routine services through the application of RT. Furthermore, Cox et al. (2019) examine the impacts of AI on search and retrieval methods and resources delivery in the USA's academic libraries. The findings revealed that AI has roles to play in academic libraries. Hence, there is a need to change academic librarians' perceptions to see AI technologies as partners-in-progress.

In a contrary study by Cox et al. (2019) maintain that a few librarians have the skills needed to promote AI's practical use. The adoption of AI technologies in library operations promotes human thinking and augment practical library usage. Also, Nakhoda and Tajik (2017) indicate that academic librarians in Tehran University demonstrated a high reluctance to use AI technologies in the university library. This was due to poor awareness and education on the relevance of technologies to library operations. Wheatley and Hervieux (2019) revealed a lack of response by the librarians to the application of AI in the libraries. They revealed that lack of sufficient knowledge and awareness regarding the benefits and cost-saving effect that AI could bring to the library made it difficult for librarians and library administrators to implement this technology into existing library systems.

2.4 The Use of Artificial Intelligence for Effective Library Services Delivery

The use of Artificial Intelligence (AI) in university libraries has the potential to transform traditional library services, making them more efficient, user-friendly, and responsive to the evolving needs of academic communities. Eiriemiokhale and Sulyman (2023) state that librarians perceived that AI is a positive technological advancement that can be used to perform some tasks initially perform by librarians. This may make AI a replacement for librarians in the future. Accordingly, it is imperative for university libraries to acquire, process, store, preserve and disseminate information resources that meet users' community

needs. In other to be able to provide user-satisfactory services, libraries must evolve by responding to changes from time to time with the use AI (Ilori & Owolabi, 2020).

AI-powered recommendation systems analyze user behavior, borrowing history, and preferences to suggest relevant resources. These systems enhance the discovery of materials and support personalized learning. Owolabi et al. (2021) revealed that many academic librarians see the introduction of AI as an excellent innovation to library practices. AI-driven chatbots and virtual assistants provide instant support to library users. They can answer queries, assist with navigation, and offer information about library resources and services. This is supported by Moustapha and Yusuf (2023), robots, humans, facial recognition software, drones, chatbots, thumb recognition, and other types of artificial intelligence (AI) are becoming more popular and can be used in library services.

AI is used to automate cataloguing processes and manage metadata. This includes automatically assigning tags, categories, and classifications to resources, streamlining the organization of the library's collection. Similarly, Asefeh and Asemi (2018) list various ways in which AI technologies can be used to improve library services to include the followings: circulation services, shelving of books, cataloguing of library materials, among others. AI technology can also be used to assign metadata and to assist in the non-textual search. Also, Owolabi et al. (2021) revealed that circulation and reference services were rated highest as the two library units that need AI more. Librarians are aware of Dynamed, a not too common AI in Nigeria, this indicates that the they are keeping themselves up-to-date with technological advancements that can help them in providing quality and reliable information to users (Eiriemiokhale & Sulyman, 2023).

AI technologies facilitate text and data mining, helping researchers and students extract valuable insights from large volumes of academic literature. This can support various

research activities and aid in knowledge discovery. Talley (2016) also emphasized the need for university librarians to embrace AI technologies to provide better services to researchers and other library users. Some university libraries use facial recognition technology to enhance access control and security. Authorized personnel and users can gain access without the need for physical cards, improving convenience and security. Similarly, researchers in the literature have often argued that AI can be used in the field of library security, with university libraries now deploying AI-based facial recognition technology to track and monitor users, particularly in areas of service (Datagen, 2022; American Library Association, 2022).

Sivarajah et al. (2017) note that using AI in university libraries allows for better analysis of datasets, especially large datasets used for analysis across multiple datasets. It also helps to eliminate repetitive and tedious tasks. The implication of this is that applying AI in library operations helps libraries develop capabilities that can exceed the human mind. Ali et al. (2020) assessed librarians' sense of university and their use of AI tools. According to the study, university libraries may use the following AI systems: Google Chat for chat reference, Google Drive, Drive One, big data cloud computing, RFID, 3M Gates, thumb Google Translator for translation services, among other things. Corrado (2021) indicated that artificial intelligence can be applied in many areas of technical service, such as assigning and creating subject headings, taxonomies, and metadata descriptions. Librarians act as moderators and controllers of metadata ethics and privacy in these applications.

Predictive analytics, powered by AI, assist in collection development by analyzing usage patterns and predicting future demands for specific resources. Librarians can make informed decisions regarding acquisitions and resource allocation. Mughali (2019) researched how AI can be used in libraries. The results show that artificial intelligence can be used for expert systems in libraries, such as Refsearch, indexes, online reference help, and Plexus Expert,

which have also proven useful in performing tasks related to acquisition, cataloging, classification, cataloging, and other library procedures. AI analytics are utilized to optimize resource allocation by identifying the most popular resources, peak usage times, and predicting future demand. This information guides decisions on resource acquisition and distribution.

AI-driven voice recognition systems enable users to interact with library services using voice commands. This hands-free approach can simplify tasks such as searching for resources or checking account status. According to Omame and Alex-Nmecha (2020), NLP may be utilized in libraries to create intelligent expert information retrieval systems that users can engage with directly using natural language. AI systems can send automated alerts and notifications to users about due dates, holds, and the availability of requested materials. This helps users stay informed and engaged with library services. AI is one of the most recent digital transformations that academic libraries can unlock its potentials to provide patrons with varying library service alternatives more conveniently (Arlitsch & Newell, 2017).

AI can function as virtual research assistants, assisting users in literature reviews, summarizing articles, and providing relevant information for research projects. Eiriemiokhale and Sulyman, (2023) revealed that the librarians have the perceptions that AI technologies can be adopted in university libraries, capable of replacing human librarians in future and is a positive development for librarians. It is no longer news that humanoid robots with artificial intelligence

(AI) are now available in libraries in both rich and developing nations, as reported by Tella (2020). Grant and Camp (2018) observed that many academic libraries particularly in developed countries have adopted AI for various library operations, such as circulation and

reference services. Kim (2017) claims that humanoid robots can welcome guests and give directions in libraries. Libby, a robot at the University of Pretoria Libraries in South Africa, already performs such tasks.

AI-powered language translation tools enhance accessibility by making library resources available in multiple languages. This is particularly beneficial for international students and researchers. According to Tella (2020), academic libraries must reposition themselves to take use of the potentials of artificial intelligence by improving the quality of library services in this information age. Yusuf et al. (2022) concluded that using artificial intelligence in libraries and information centers is setting new benchmarks for providing effective and efficient services in libraries. Neural networks, according to Mohaiminul, Guorong, and Shangzhu (2019), are a sort of artificial intelligence that tries to mimic the way the human brain operates.

Saldin (2020) investigated artificial intelligence technologies for library resources and services. According to the study, the use of artificial intelligence can help with a variety of library services. However, AI can be used for user identification in speech or typing recognition, monitoring users as they use library resources and services, chatbots for reference services, bot assistants, monitoring drones for library security, and AI alarms to remind users when it's their time of scheduled appointments with a librarian, and AI-based tutorials to keep users abreast of the latest discoveries in their field. Yu et al. (2019) on the use of smart libraries for artificial intelligence. The study cites some applications of artificial intelligence that could be used in smart libraries, including facial recognition, chatbots, and self-service AI systems.

AI, including image recognition and analysis, aids in the preservation and conservation of rare or deteriorating materials. It can identify issues and recommend appropriate conservation

measures. Vysakh and Rajendra (2020) stated that libraries have begun to use robots instead of humans in a variety of procedures, particularly those that are hazardous and time-consuming. However, Olayode (2022) looked at the use of AI and technical improvements in the provision of library services with respect to the types of AI that can be applied in academic libraries. According to the report, the University of Calabar is already using bots and robots to handle part of its service needs. AI technologies are employed to enhance data security and privacy in library systems, ensuring the protection of user information and sensitive data.

Talley (2016) indicates that university students in the United States of America responded positively to AI adoption and use in university libraries. This may be attributed to the facilitating nature of the technology. For instance, a robot at the PESIST central library assists in filing, classifying, and replacing volumes on the shelf, and libraries with large collections are now adopting robots for inventory purposes (Manoj, 2016). Luckin et al. (2016) maintain that there are three ways librarians can develop themselves to use AI. They are: through personal learning; engaging in intelligent support for collaborative learning; and lastly, intelligent virtual reality. This is becoming necessary because learning involves social interaction, and effective collaboration is part of the learning process.

From the public libraries angle, Xie (2023) explores the application of artificial intelligence technology in public library information retrieval. The paper argues that the public library as an important place in the society to provide mass education for the masses should fully seize the development opportunity with artificial intelligence technology as the core idea in the operation and development, carry out intelligent, automatic and digital reform and innovation of the library, and optimize the links of information retrieval, book borrowing, information service and access to the library. There are three primary ways in which AI can change the

library operations. These include intelligent automation of libraries, drive innovation to libraries, and enhanced librarians' productivity and library users (Woods & Evans, 2018). Bourg (2017) remarks that librarians already have skills and expertise for the data sets needed to use AI. AI is characterised as the technology that enables machines to be able to have the abilities to plan, learn, reason, solve problems, move and be creative to some extent (Mamela, 2023; Subaveerapandiyan, Sunanthini & Amees, 2023).

The adoption of AI in university libraries is driven by a desire to improve user experiences, streamline operations, and stay current with technological advancements. It's important for libraries to carefully consider ethical considerations, user privacy, and the ongoing training of library staff when implementing AI solutions. In some contrary study, Nakhoda and Tajik (2017) states issues leading to low adoption of such technology include lack of interest, as a result of poor attitude toward it, lack of awareness about the technology, lack of self-efficacy on the part of the users and many more.

Similarly, Wheatley and Hervieux (2019) states that despite the benefits that AI offers to users across different sectors, contexts and countries, researchers revealed that integrating AI in academic libraries of developed countries is very low and still not clear. Ajani et al. (2022) also states that the situation is even worse in Nigerian academic libraries which indeed causes library services somehow inefficient, cumbersome and difficult to properly handle. Massis (2018) observe that many academic librarians see AI adoption as a threat because they believe AI will perform the functions meant for them. However, it will be of note that the

acceptance and use of AI in libraries will bring better enhancement to the provision of library services.

2.5 The Challenges of Using Artificial Intelligence in University Libraries

While the use of Artificial Intelligence (AI) in university library operations offers numerous benefits, there are also several challenges hindering the use of AI for library operations and that need to be addressed. AI models heavily depend on the quality and diversity of data used for training. If the training data is biased, the AI system may exhibit biases and reinforce existing inequalities. Ensuring the quality and fairness of training data is a significant challenge. Oniovoghai et al. (2023) states that Nigeria, in particular, continues to struggle with automation and digital information resource conventions, to say nothing of artificial intelligence.

The use of AI often involves the collection and analysis of user data. Maintaining user privacy and complying with data protection regulations can be challenging. Libraries must establish robust policies to address these concerns. Subaveerapandiyan, Sunanthini and Amees (2023) opined that AI is still in its early stages of development, and many challenges need to be addressed before it can be fully integrated into libraries and information services. These challenges include privacy, security and ethical considerations. Ethical considerations, such as the responsible and transparent use of AI, are crucial. Decisions made by AI systems should be understandable, explainable, and accountable. Ensuring ethical use requires careful planning and ongoing scrutiny. Kaushal and Yadav (2022) found that despite the huge advantages of chatbots for improving reference services in libraries, their major drawback, a major intrusion on privacy, has to be removed by software designers during the development phase.

Users may be skeptical or hesitant to embrace AI in library services. Building trust and acceptance requires effective communication about how AI is used, addressing concerns about privacy, and demonstrating the benefits of AI-enhanced services. Huang (2022) posited that the advent of AI has made the functions of libraries more complicated in which future librarians might need more complex, critical, innovative, and imaginative thinking, as well as emotional involvement to design and execute effective library services.

Implementing AI technologies often requires staff with specialized skills. Libraries may face challenges in training existing staff or recruiting individuals with the necessary expertise to manage and maintain AI systems. Obiano et al. (2022) investigated aiding the exploration of artificial intelligence (AI) in Nigeria academic libraries. The study revealed that institutional support for adoption of AI is low, but the level of ICT competence of library staff is high. It was also revealed that there is perceived usefulness of AI to the librarians and the factors militating against the adoption of AI is high, consisting of factors such as lack of needed AI tools and inadequate planning.

The initial costs associated with implementing AI, including acquiring technology, training staff, and integrating systems, can be substantial. Libraries may need to carefully assess the cost-benefit ratio and allocate resources accordingly. Sambo and Oyovwe-Tinuoye (2023) states that the use of AI-Robots in libraries also ran into several challenges for licensed librarians, including layoffs, a lack of funding, unstable electricity, a lack of service providers, a poor ICT infrastructure, a lack of operating expertise, mechanical problems, a high risk of maintenance, and a lack of robot equipment. Yusuf et al. (2022) also addressed the challenges library management faces when implementing AI, including: insufficient funding, technological hurdles, job loss, etc. Unfortunately, due to the issues previously

mentioned, there is a poor utilization of AI technology in academic libraries in developing nations.

Asim, Arif, Rafiq and Ahmad (2023) itemized highly integrated technological infrastructure, funding/cost associated with AI, collaboration between AI experts and professionals, library users' feedback, requirement of a highly networked and integrated environment, lack of budget, high cost of AI technologies, and lack of staff expertise as some key factors influencing AI's adoption and application in academic libraries. Libraries are expected to show value for money and demonstrate cost-effective practices, but they can't do that without integrating new technologies to upgrade their physical spaces, offer new services, and improve the user experience for today's patrons – all of which requires additional funding (Tella, 2020).

Some library staff and users may have limited understanding of AI, leading to a gap in awareness and effective utilization. Comprehensive training and educational programs are essential to bridge this knowledge gap. According to Nakhoda and Tajik (2017), academic librarians at Tehran University showed a strong aversion to implementing AI robot technology in the library. This was brought on by a lack of knowledge and instruction regarding the application of technologies to library operations. According to Jasrotia (2018), because intelligent machines in libraries can read digitized resources, analyze them, and provide tailored insights, answers, and services faster than librarians, artificial intelligence can be a "threat" to librarians but not to the libraries' existence.

AI systems may encounter technical challenges, such as errors in predictions, system failures, or integration issues. Ensuring the reliability and robustness of AI solutions is critical to

maintaining smooth library operations. Qomariyah et al. (2020) in a study on Indonesian university libraries. Documents about policies and procedures, technical know-how, and organizational resources, such as human and technological resources, are among these challenges. According to Tait and Pierson (2022), the adoption of AI and robotics in libraries may be hindered by a lack of skills and the need for training prior to implementation. The field of AI is rapidly evolving, and libraries may face challenges in keeping up with new technologies and updates. Regular updates and ongoing support are necessary to adapt to changing technological landscapes.

AI systems can be complex and difficult to understand, especially for non-technical users. Simplifying the user interface and providing user-friendly documentation are important for effective utilization. Ali et al. (2020) findings showed that librarians did not react well to the use of technology in libraries. The study's findings also showed that it is challenging for librarians and library managers to incorporate this technology in library systems because of a lack of understanding and awareness about the advantages and cost savings that it could offer to the library.

Libraries must adhere to various legal and regulatory frameworks related to data protection, intellectual property, and privacy. Ensuring compliance with these regulations poses a challenge, particularly when dealing with sensitive user data. Sambo and Oyovwe-Tinuoye (2023) revealed that licenced librarians faced diverse challenges in the use of robotic technologies in the libraries such as employee retrenchment, inadequate funding, epileptic electricity, insufficient service provider, inadequate ICT facilities, lack of expertise to operate it, mechanical problems, high risk of maintenance, insufficiency robot equipment.

Libraries often use a variety of systems and platforms. Ensuring that AI systems can seamlessly integrate with existing library management systems and other technologies can be

a significant challenge. Eiriemiokhale and Sulyman (2023) revealed that poor internet connectivity, epileptic power supply, lack of expertise among librarians and low level of support from government and funding agencies as the major challenges of adopting AI in libraries of the respondents. Oghenetega, Umeji, and Obue (2014) stated a number of factors working against the adoption of these AIs in library operations, including poor maintenance ethics, inadequate staff training, high costs, communication issues, a lack of adequate facilities, and epileptic strength. Supply, economic, political, and technological issues.

Sambo, Imran and Akanbi (2022) in their study enumerated various obstacles faced by licenced librarians in Nigeria libraries such as power failure most time, lack of digital equipment, workload quite overwhelming/ cost of digital skills training, lack of basic digital literacy skills,

I am not computer literate, I had limited time in my offices due to other official assignments. International Labor Organization (2018) stressed that with the current trend in technological change based on the adoption of artificial intelligence in different organizations that include libraries, AI adoption has created widespread fear of job losses and a high rise in inequality. Korinek and Stiglitz (2017) maintained that advances in AI technologies could bring about job losses or job polarization. According to Frey and Osborne (2017), during the next 20 years, AI is expected to replace around 35% of workers in the UK and 47% of workers in the US. Other studies that report the adoption of AI intelligence and job loss include Acemoglu and Restrepo (2020) in the United States of America.

Similar studies by Stiglitz et al. (18) asserted that employment polarization or job losses may emerge from the growth of AI technology. As a result of automation, the use of AI may cause

inequality to significantly increase. According to the World Bank (2019) underdeveloped nations may be less willing to adopt technology since AI will bring a high rate of job losses. Méda (2016) maintain that advances in AI technologies could bring about job losses or job polarization. Cox et al. (2018) study also shows that LIS professionals were concerned that AI could threaten their jobs, with the fear that most of their roles could be replaced by intelligent machines. Korenke and Stiglitz (2017) emphasized that the use of AI poses a threat to the work of librarians and that caution must be taken before its widespread application in libraries.

Moustapha and Yusuf (2023) wrote a conceptual paper on the adoption of AI for effective library services in academic libraries in Nigeria. However, they noted that the challenges faced by library management towards adopting artificial intelligence include financial uncertainty, job loss, and technological defects and others. Youssef et al. (2022) focused primarily on the lack of awareness of librarians on how to use artificial intelligence to meet their service needs and the great disruption that artificial intelligence has caused to traditional library services, which still shocks most library professionals.

Moustapha and Yusuf (2023) noted that libraries in Nigeria are struggling to adopt AI because of paucity of fund and technological defects, while the fear of job loss, reliability on and authenticity of content and fear of privacy and confidentiality are the problems associated with the librarians' perceptions. Addressing these challenges requires a strategic and well-planned approach to the adoption of AI in university libraries. Collaboration with experts, ongoing training, and a commitment to ethical AI practices are essential for successful implementation and sustained benefits.

2.6 Appraisal of Reviewed Related Literature

The review of related literature highlights the research findings of other scholarly research that are in line with the objectives/aims of this study. The reviewed related literature revealed certain facts that directed the course of this research and covers: concept of artificial intelligence; the awareness of artificial intelligence in university libraries; the use of artificial intelligence for effective library services delivery; the benefits of artificial intelligence in university libraries; and the challenges of using artificial intelligence in university libraries.

From the reviewed literature, a number of scholars, such as Méda (2016) stated that AIpowered recommendation systems can analyze user behavior, preferences, and borrowing history to provide personalized recommendations for books, articles, or other resources. This enhances the user experience and promotes the discovery of relevant materials. Similar findings were observed by Acemoglu and Restrepo (2020) that implementing AI-driven chatbots or virtual assistants can provide instant assistance to library users. These systems can answer queries, help with navigation, provide information about library resources, and even assist with basic research inquiries.

CHAPTER THREE METHODOLOGY

3.1 Introduction

This chapter discusses the methodology that will be adopted for carrying out this study which includes: research design, population of the study, sample size and sampling technique, research instrument, validity of the instrument, reliability of the instrument, procedure for data collection, method of data analysis as well as ethical consideration.

3.2 Research Design

The study adopted descriptive survey design. Descriptive survey involves the systematic and comprehensive collection of information about the opinions, attitude, feelings, and beliefs and behavior of people through observation, interviewing, and administering of questionnaires to a relatively large and representative sample of the population of interest (Cresswell, 2015). This will be considered appropriate because the study is aiming at collecting information about librarians' opinions, feelings, attitude and beliefs towards artificial intelligence in libraries using questionnaire. Therefore, descriptive survey design is appropriate for this study because it will enable the researcher to provide a rich-details on the awareness and use of artificial intelligence as correlates of effective library services delivery in universities Kwara State, Nigeria.

3.3 Population of the Study

The population for this study was all the professional librarians in the five selected university libraries in Kwara State, Nigeria. It covered all the librarians in all the selected universities in Kwara State, Nigeria. The population of the librarians is presented in Table 3.1:

Table 3.1: Study Population of Librarians in Selected University Libraries in Kwara State, Nigeria.

S/N	University	Professional Librarian
1	University of Ilorin, Ilorin	38
2	Kwara State University, Malete	13
3	Al-Hikmah University, Ilorin	8
4	Landmark University, Omu Aran	11
5	Summit University, Offa	6
6	Ojaja University, Eiyenkorin	4
	Total	**80**

3.4 Sample Size and Sampling Technique

The study adopted total enumeration technique. A total enumeration technique is a study of every unit, everyone, or everything, in a study population. According to Kumar (2018), if a study population is small and less in number; it may be preferable to do a study of everyone in the population, rather than drawing out a sample. The researcher involved all the librarians in the five selected university libraries in Kwara State, Nigeria. The sample size obtained for this study was amount to Eighty (80) professional librarians.

3.5 Research Instrument(s)

The research instrument adopted for this study was questionnaire. The questionnaire titled: 'awareness and use of artificial intelligence as correlates for effective library services delivery in university libraries in Kwara State, Nigeria' was designed in a way that it elicits the needed information from the librarians used for the study. The survey questionnaire comprises a closed-ended questionnaire, and the questionnaire is mainly for librarians in the five selected university libraries in Kwara State, Nigeria. The questionnaire consists of five sections as analysed below:

Section A: Demographic profiles of the respondents: this section elicited information on the demographic characteristics of librarians in selected university libraries in Kwara State, Nigeria. The demographic variables of interest for the librarians included: name of institution, age, gender, marital status, educational qualification, year of work experience.

Section B: measured the awareness of artificial intelligence by the university libraries. This section consists of twelve (12) items on the level of awareness of artificial intelligence by the university libraries in Kwara State, Nigeria. It was measured on a four-point Likert scale of Highly Aware (HA=1); Aware (A=2); Rarely Aware (RA=3) and Not Aware (NA=4).

Section C: measured the use of artificial intelligence for effective library services delivery in university libraries. This section consists of eight (8) items on the intention to use artificial intelligence for effective library services delivery in university libraries in Kwara State, Nigeria. It was measured on a four-point Likert scale of Strongly Agree (SA=1); Agreed (A=2); Disagreed (D=3) and Strongly Disagree (SD=4).

Section E: measured the challenges associated with the use of artificial intelligence by university libraries. This section consists of nine (9) items on the challenges associated with the use of artificial intelligence by university libraries in Kwara State, Nigeria. It was measured on a four-point Likert scale of Strongly Agree (SA=1); Agreed (A=2); Disagreed (D=3) and Strongly Disagree (SD=4).

3.6 Validity and Reliability of the Instrument(s)

For face and content validation, the instrument was given to the researcher's supervisor. The correction and observation made were incorporated before final draft of the instrument. The researcher administered thirty (30) copies of the Questionnaire to thirty (30) professional librarians from Kwara State University for test and re-test reliability measurement. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure, the validity of an instrument is the degree to which an instrument measures what it intended to measure (Cresswell, 2015).

3.7 Method of Data Collection

The data collection instruments for the study were administered to the librarians in the five selected university libraries in Kwara State, Nigeria by the researcher and with the help of four (4) research assistants during the library opening hours. This was to avail the researcher to have physical contact with the respondents and be able to explain to them the areas where

they might find it difficult to understand in the questionnaire. A letter of introduction was obtained from the supervisor to facilitate access to librarians in Kwara State, Nigeria. A total of eighty (80) copies of the questionnaire were distributed to the librarians in the six selected university libraries in Kwara State, Nigeria.

3.8 Method of Data Analysis

The data collected for this study were collated and subjected to comprehensive data analysis using the IBM Statistical Product and Service Solution (SPSS) software version 26.0. The descriptive statistics includes the frequency counts, percentages, mean and standard deviation.

Tables will be used for results presentation and interpretation.

3.9 Ethical Considerations

The study employed the anonymity ethical consideration and follow all the ethics guiding scholarly writing by ensuring the work is original. According to Mugenda and Mugenda (2003), anonymity refers to keeping secret by not identifying the ethnic or cultural background of respondents, refrain from referring to them by their names or divulging any other sensitive information about a participant. This is why, during study, the researcher must promise to protect the information given in confidence by the respondent. But, if any information has to be revealed, then consent must be sought from the respondent(s).

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents and analyses the data presented through primary source. Data collected through questionnaires are presented in tables and analyzed using frequency counts and percentages. The results are presented based on the variables focused in the research objectives.

Also in this chapter, the major findings of the study are further highlighted.

4.2 Demographic Data of the Respondents

Table 4.1: Demographic Information of the Respondents

Age	**Frequency**	**Percentage**
30 years and below	22	27.5
31 – 40 years	26	32.5
41 – 50 years	20	25.0
51 – 60 years	8	10.0
61 years and above	4	5.0
Total	**80**	**100.0**
Gender	**Frequency**	**Percentage**
Male	58	72.5
Female	22	27.5
Total	**80**	**100.0**
Qualification	**Frequency**	**Percentage**
BSc	41	51.2
MSc	28	35.0
PhD	11	13.7
Total	**80**	**100.0**

Work Status	Frequency	Percentage
Assistant Librarian	20	25.0
Librarian II	12	15.0
Librarian I	13	16.2
Senior Librarian	11	13.7
Principal Librarian	9	11.2
Deputy University Librarian	9	11.2
University Librarian	6	7.5
Total	**80**	**100.0**
Work Experience	**Frequency**	**Percentage**
1 – 5 years	22	27.5
6 – 10 years	24	30.0
11 – 15 years	17	21.2
16 – 20 years	9	11.2
21 years and above	8	10.0
Total	**80**	**100.0**

Table 4.1 shows the age range of the respondents which are 26(32.5%) were 31-40 years, 22(27.5%) were 30 years and below, 20(25.0%) were 41-50 years, while 8(10.0%) were 51-60 years and 4(5.0%) were 60 years and above. The table also showed the gender of the respondents, 58(72.5%) were male and their female counterpart were 22(27.5%). In the qualification unit, 41(51.2%) of the respondents holds BSc, 28(35.0%) holds MSc, and 11(13.7%) holds PhD. Furthermore, majority of the respondents were Assistant Librarians with 20(25.0%), followed by 13(16.2%) were Librarian I, 12(15.0%) were Librarian II, 11(13.7%) were Senior Librarians, while 9(11.2%) were Principal Librarians and Deputy University Librarians respectively, and 6(7.5%) were University Librarians. And lastly, the table showed the years of work experience of the respondents, 24(30.0%) has 6-10 years of work experience,

22(27.5%) has 1-5 years of work experience, 17(21.2%) has 11-15 years of work experience, 9(11.2%) has 16-20 years of work experience and 8(10.0%) has 21 years and above of work experience.

4.3 Data Analysis and Results

Research Question 1: What is the awareness of artificial intelligence for effective library services delivery in Kwara State, Nigeria?

Table 4.2: The awareness of artificial intelligence for effective library services delivery.

Options	Highly Aware	Aware	Rarely Aware	Not Aware
I am aware of AI Robots	57(71.2%)	17(21.2%)	4(5.0%)	2(2.5%)
I am aware of AI Drone	63(78.7%)	12(15.0%)	5(6.2%)	1(1.2%)
I am aware of Humanoids	54(67.5%)	21(26.2%)	4(5.0%)	0(0.0
I am aware of thump recognition technology	47(58.7%)	31(38.7%)	1(1.2%)	1(1.2%)
I am aware of biometric technology	69(86.2%)	11(13.7%)	0(0.0%)	0(0.0%)
I am aware of virtual references	59(73.7%)	13(16.2%)	8(10.0%)	0(0.0%)
I am aware of AI Chatbots	61(76.2%)	11(13.7%)	8(10.0%)	0(0.0%)
I am aware of AI Expert Systems	51(63.7%)	21(26.2%)	6(7.5%)	2(2.5%)

Table 4.2 shows librarians' perceived awareness of AI for effective library services delivery. The majority of the respondents 69(86.2%) were aware of biometric technology, 63(78.7%) for AI drone, 61(76.2%) for AI Chatbots. Furthermore, the respondents 59(73.7%) were also aware of virtual references, 57(71.2%) for AI robots, 54(67.5%) for humanoids, 51(63.7%) for AI expert systems and 47(58.7%) for thump recognition technology. This implies that biometric technology, AI drone and AI Chatbots are the types AI that were majorly aware of by the respondents.

Research Question 2: What is the potential use of artificial intelligence for effective library services delivery in Kwara State, Nigeria?

Table 4.3: The potential use of artificial intelligence for effective library services delivery.

Options	Strongly Agreed	Agreed	Disagreed	Strongly Disagreed
Robotic Book Delivery Systems	61(76.2%)	11(13.7%)	6(7.5%)	2(2.5%)
AI expert search tools	51(63.7%)	21(26.2%)	4(5.0%)	4(5.0%)
AI chatbots for reference services	54(67.5%)	21(26.2%)	2(2.5%)	2(2.5%)
AI for cataloguing and classification	57(71.2%)	17(21.2%)	4(5.0%)	2(2.5%)
AI Drone surveillance for library security	59(73.7%)	10(12.5%)	9(11.2%)	2(2.5%)
Humanoid robots as an assistant to librarians	60(75.0%)	18(22.5%)	1(1.2%)	1(1.2%)
AI for book selection	47(58.7%)	31(38.7%)	1(1.2%)	1(1.2%)

Table 4.3 shows the librarians' perceived awareness of AI for effective library services delivery. The majority of the respondents perceived the usefulness of AI for library services delivery such as robotic book delivery systems 61(76.2%), humanoid robots as an assistant to librarians 60(75.0%), AI drone surveillance for library security 59(73.7%), AI for cataloguing and classification 57(71.2%), AI chatbots is for reference services 54(67.5%), AI expert search tools 51(63.7%) and AI for book selection 47(58.7%). This implies that robotic book delivery systems and humanoid robots as an assistant to librarians were the AI that perceived useful majorly by the respondents.

Research Question 3: What are the challenges associated with the adoption and use of artificial intelligence for effective library services delivery in Kwara State, Nigeria?

Table 4.4: The challenges associated with the adoption and use of artificial intelligence for effective library services delivery.

Options	Strongly Agreed	Agreed	Disagreed	Strongly Disagreed

Lack funds from the parent institution.	60(75.0%)	10(12.5%)	7(8.7%)	3(3.7%)
Insufficient AI tools and equipment.	58(72.5%)	13(16.2%)	8(10.0%)	1(1.2%)
Inadequate facilities for AI technologies.	54(67.5%)	18(22.5%)	5(6.2%)	3(3.7%)
Fear of job loss.	55(68.7%)	17(21.2%)	4(5.0%)	4(5.0%)
Technicality constraints.	51(63.7%)	20(25.0%)	9(11.2%)	0(0.0%)
Low level of power supply.	47(58.7%)	31(38.7%)	1(1.2%)	1(1.2%)
Low speed of internet.	60(75.0%)	18(22.5%)	2(2.5%)	0(0.0%)

Table 4.4 shows the challenges of using AI for effective library services delivery such as lack funds from the parent institution and low speed of internet with 60(75.0%) respectively, insufficient AI tools and equipment with 58(72.5%), fear of job loss with 55(68.7%), inadequate facilities for AI technologies with 54(67.5%), technicality constraints with 51(63.7%) and low level of power supply with 47(58.7%). This implies that lack funds from the parent institution and low speed of internet were the major challenges of using AI for effective library services delivery.

4.4 Discussion of Findings

Results revealed that biometric technology, AI drone, AI Chatbots, virtual references and AI robots were the AI the respondents were highly aware of. This is in line with a submission by Tella (2020) that "it is no longer news that humanoid robots are now available in libraries in both rich and developing nations". Owolabi *et al.* (2021) revealed in their study that majority of respondents were aware of artificially intelligent technologies in library operations. It has become necessary for academic libraries to introduce and exploit artificial intelligence in their operations and services (Mahmoud, 2023). Eiriemiokhale and Sulyman (2023) states in their study that Chatbots and Dynamed are the types of AI the librarians were aware of.

Furthermore, the study revealed the potential use of AI for effective library services delivery. These uses include robotic for book delivery systems, humanoid robots as an assistant to librarians, AI drone surveillance for library security and AI for cataloguing and classification. This is supported by the findings of Harisanty *et al.* (2023) states that AI could be easily incorporated into libraries for administrative functions like staffing, technical functions like cataloguing, and informational functions like reference and information literacy.

Lastly, the study revealed the challenges associated with the adoption and use of AI for effective library services delivery. These challenges include lack funds from the parent institution, low speed of internet, insufficient AI tools and equipment, fear of job loss and inadequate facilities for AI technologies. This is in line with the findings of Isiaka (2023) that lack of technical skills by library staffs, limited amount of AI experts of library automation vendors, replacing human jobs and no adequate funds among others are the major challenges associated with the application and use of AI for library services delivery. Also, Yusuf *et al.* (2022) states insufficient funding, technological hurdles, job loss, among others are the reason for poor utilization of AI technology in academic libraries in developing nations.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusions and recommendations of the study in line with the objectives of the study. Covered in this chapter are also conclusion and recommendations. Lastly, the chapter provides possible areas for further studies that were outside the scope of this study.

5.2 Summary

The invaluable effect of AI adoption and use for effective library services delivery is revealed in this study. The significance of this influence is motivated by the main need for aspects of the adoption and use of AI. The followings are the major findings of this study:

i. The study revealed that biometric technology, AI drone, AI Chatbots, virtual references and AI robots were the AI the respondents were highly aware of.

ii. The study revealed that robotic for book delivery systems, humanoid robots as an assistant to librarians, AI drone surveillance for library security and AI for cataloguing and classification as potential use of AI for effective library services delivery.

iii. The study revealed that lack funds from the parent institution, low speed of internet, insufficient AI tools and equipment, fear of job loss among others are challenges associated with the adoption and use of AI for effective library services delivery.

5.3 Conclusion

Artificial Intelligence is an ultimate technology trend that academic libraries are thriving to incorporate for their services. The study concluded that biometric technology, AI drone, AI Chatbots, virtual references and AI robots are the major AI the librarians were aware of in Kwara State, Nigeria. The study further concluded that the librarians in Kwara State, Nigeria perceived the usefulness of AI for effective library services delivery. These includes robotic for book delivery systems, humanoid robots as an assistant to librarians, AI drone surveillance for library security and AI for cataloguing and classification. However, there are

various challenges affecting the use of AI for library services delivery such as lack funds from the parent institution, low speed of internet, insufficient AI tools and equipment, fear of job loss and inadequate facilities for AI technologies among others.

5.4 Recommendations

The study provides the following recommendations:

i. Academic libraries in Kwara State, Nigeria should apply for grants from government and other agencies to incorporate AI for library services.

ii. Academic libraries in Kwara State, Nigeria should have mutual understanding with their internet service provider on the provision of a reliable internet connectivity.

iii. The parent institution of academic libraries in Kwara State, Nigeria should make available an alternative power source.

iv. Training on AI should be organized for the academic librarians in Kwara State, Nigeria.

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APPENDIX

QUESTIONNAIRE ON:

AWARENESS ANS USE OF ARTIFICIAL INTELLIGENCE AS CORRELATE OF EFFECTIVE LIBRARY SERVICES DELIVERY IN KWARA STATE, NIGERIA

Dear respondent,

I am a student in the Department of Library and Information Science, Institute of Information and Communication Technology, Kwara State Polytechnic, Ilorin. I am currently undertaking research project titled: “awareness and use of artificial intelligence as correlates for effective library services delivery in university libraries in Kwara State, Nigeria”. I therefore, request you to kindly provide your opinions to the questions as contained in the attached questionnaire. Information provided in this questionnaire will be held confidential and used for research purpose only.

Your quick response will be highly appreciated.

Thanks for your anticipated cooperation.

ADEYI, Grace Titilayo

Researcher

SECTION A: Demographic Data

Specify by ticking the right option

Please indicate your university library:

University of Ilorin, Ilorin [ ]

Kwara State University, Malete [ ]

Al-Hikmah University, Ilorin [ ]

Landmark University, Omu Aran [ ]

Summit University, Offa [ ]

Ojaja University, Eiyenkorin [ ]

Age: 30 below [ ]; 31-40 [ ]; 41-50 [ ]; 51-60 [ ]; 61 above [ ]

Gender: Male [ ]; Female [ ]

Qualification: BSc [ ]; MSc [ ]; PhD [ ]

Work Status: Assistant Librarian [ ]; Librarian II [ ]; Librarian I [ ]; Senior Librarian [ ]; Principal Librarian [ ]; Deputy University Librarian [ ]; University Librarian [ ]

Work Experience: 1-5 [ ]; 6-10 [ ]; 11-15 [ ]; 16-20 [ ]; 21 above [ ]

SECTION B: What is the awareness of artificial intelligence for effective library services delivery in Kwara State, Nigeria?

Keys: *HW=Highly Aware, A=Aware, RA=Rarely Aware, NA=Not Aware*

S/N	Options	HW	A	RA	NA
1	I am aware of AI Robots				

2	I am aware of AI Drone				
3	I am aware of Humanoids				
4	I am aware of thump recognition technology				
5	I am aware of biometric technology				
6	I am aware of virtual references				
7	I am aware of AI Chatbots				
8	I am aware of AI Expert Systems				

SECTION C: What is the potential use of artificial intelligence for effective library services delivery in Kwara State, Nigeria?

Keys: *SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree*

S/N	Options	SA	A	D	SD
1	Robotic Book Delivery Systems				
2	AI expert search tools				
3	AI chatbots for reference services				
4	AI for cataloguing and classification				
5	AI Drone surveillance for library security				
6	Humanoid robots as an assistant to librarians				
7	AI for book selection				

SECTION D: What are the challenges associated with the adoption and use of artificial intelligence for effective library services delivery in Kwara State, Nigeria?

Keys: SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree

S/N	Options	SA	A	D	SD
1	Lack funds from the parent institution.				
2	Insufficient AI tools and equipment.				
3	Inadequate facilities for AI technologies.				
4	Fear of job loss.				
5	Technicality constraints.				
6	Low level of power supply.				
7	Low speed of internet.				