

## Librarians' Preparedness Towards Robots' Usage in Nigerian Academic Libraries

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### Abstract

*The purpose of the article is to investigate librarians' preparedness towards the usage of robots in Nigerian academic libraries. The research is a survey that is based on the positivist paradigm. The questionnaire served as a tool for gathering data. From each of the university libraries, 20 academic librarians were chosen using the snowballing sample technique. The study's findings indicate university libraries in Nigeria are not particularly prepared to accept and employ robotic technologies. Notwithstanding the significant advantages this technology has to offer for library operations, it shows that university libraries across the nation are not yet ready to employ it. The study concludes that despite the significant advantages this technology has to offer in terms of library operations, university libraries across the nation are not yet ready to adopt its use. The study, among others, recommended that academic librarians should be made aware of the advantages of robotics adoption and application in library operations and the management of the libraries may offer an alternate power source for the libraries, such as solar electricity and generators. This would ease concerns about a lack of reliable power that might prevent academic libraries in Nigeria from adopting and using robotic technologies.*

**Keywords:** Preparedness, Academic librarians, Robotic technologies, University libraries, Nigeria

## Introduction

University libraries' fundamental duties include producing, organising, and facilitating simple access to timely and correct information for students, academic staff, and other library users. These activities assist teaching and learning in university environments. By gathering, preserving, and making information resources available to students, academic staff, and other users, university libraries are required to support research procedures and academic activities. Because they play a key role in the university system, university libraries are crucial to university education. By supporting the institution's teaching, learning, and research activities, they help the organisation realise its goals and objectives. University Libraries use robotic technologies to facilitate and enhance library operations, improve library services, and promote efficiency to efficiently carry out their mandate.

Robotics has been characterised by many academics in various ways. Robots are mechanical devices that automate tasks under direct human supervision or following a pre-established plan and a set of general rules (Talaviya et al., 2020). According to Abraham (2019), robotics refers to a class of machines that can be utilised to execute a variety of computer-programmed automated tasks. From these two definitions, it can be concluded that robotics is a branch of artificial intelligence that deals with motor and continual tasks as well as machine learning. The Fourth Industrial Revolution must be mentioned while discussing robotics (4IR).

Moreover, the CEO and Chairman of the World Economic Forum recognised the sociological and economic transformation at the Davos, Republic of Switzerland event and coined the term "Fourth Industrial Revolution" (Ocholla and Ocholla, 2020). They went on to explain that while the Second Industrial Revolution utilised electric power for mass manufacturing, the First Industrial Revolution used water and steam power to mechanise production. The Fourth Industrial Revolution, or the digital revolution that has been going on since the middle of the past century, is building on the Third Industrial Revolution, which used electronic and information technology to automate production (Ocholla and Ocholla, 2020).

Internet of Things (IoTs), big data analytics, cloud computing, augmented reality and robotic systems, simulation prototypes, and 3D printing are among the new 4.0 technologies listed by Kamble et al. (2018) as making up 4IR. This means that "a fusion of technology that is blurring the boundaries between the physical, digital, and biological domains, which is collectively known as cyber-physical systems," is what the Fourth Industrial Revolution is recognised for (Schwab, 2017). The Fourth Industrial Revolution has altered library operations in a variety of ways, especially with the employment of robotic technologies. According to Harada (2019), the word "robot" has been used in a variety of contexts, therefore there isn't a single definition that can be considered appropriate. Having stated this, he classifies a robot as "something that works on behalf of a human, which automatically and continuously performs particular processes or procedures". Robots can be categorised using several factors, such as their functions, missions, and forms (Harada, 2019). Robots are mechanical devices that automate operations under direct human supervision, a predetermined programme, and a set of basic rules using AI approaches (Talaviya et al., 2020). Additionally, Harada (2019) categorises robot functions into three

categories: industrial robots, which are robots that perform autonomous work automatically on behalf of a human in a production or industrial environment; robots used in a hazardous working environment, which are frequently used in accident sites, particularly where it is very challenging for people to work; and finally, robots for daily life support, which are robots that frequently provide human support. These robots carry out their tasks for organisations while mimicking human form and motion.

According to Tella (2020), robotics and AI are tightly related. This suggests that machine learning and perceptual and motor tasks are both important to robots. According to Wang and Siau (2019), a robot is a device that can perform complicated tasks through automation operations that are programmed by a computer. Since libraries offer an expanding range of digital library services and resources, which are relatively simple for robots to track, using robotics in libraries will be of significant advantage and open up prospects in library operations. Both in industrialised and developing nations, a large number of libraries, particularly university libraries, have embraced the use of robotic technologies to facilitate their job.

### **Statement of the problem**

Journals, magazines, books, CD-ROMs, e-resources, reference materials, and a wide variety of other informational resources are available at Nigerian university libraries. These materials, which cover a wide range of topics, are aimed at the academic communities. Automation is widely used in university libraries for a variety of library services, including acquisition, cataloguing, serials, and others. The use of robotic technologies, however, would reduce the need for human engagement in a variety of library tasks. Based on this, evaluating the readiness of robot deployment as an advancement in automation in Nigerian university libraries will undoubtedly reveal the state of such libraries' readiness for the use of robotic technology. According to Tella (2020), robots are frequently used in university libraries in developed nations as machines that carry out automatic activities. It was observed that Nigeria, as a developing country, is working on implementing the technology, notably in the university libraries.

There is, however, a dearth of empirical studies on academic librarians' preparation for and awareness of the use of robotic technologies in Nigerian university libraries. There were just three publications published on the aforementioned topic between the years 2010 and 2023, according to a search of Scopus, the largest database for the humanities and social sciences. These studies are mostly opinion pieces and none of them focused on university libraries. To the best of the researcher's knowledge, the literature at the time did not address whether academic libraries were prepared to adopt robotic technologies in the libraries of Nigerian universities. Existing research shows that robotic technology has been used in intelligent libraries in a variety of ways. Most applications are still in the theoretical stage, which is somewhat constrained and at the same time cannot be put into practice. There are several causes behind this, including the lack of funding for university research, particularly in poorer nations, the challenges associated with collecting large amounts of data, and the limitations of data mining. Also, there is a paucity of AI skill teams and AI thinking in the library industry. Based on this, this study seeks to ascertain the academic librarians' level of preparation for the use of robotic technology in university libraries in Nigeria.

### Research questions

The following research questions guided the study:

- 1) What are the levels of preparedness of university libraries towards robotic technologies in terms of technological infrastructure, policy framework and human development for the adoption and use of robotics in the libraries?
- 2) What available services that university libraries handle using robotic technologies?
- 3) Are librarians aware of the potential benefits of robot technologies to library operations?
- 4) What are the challenges that university libraries may face in the adoption and use of robotic technologies?

### Literature review

Similar to the Internet of Things, 3D printing, augmented reality, and virtual reality, robotic technologies are disruptive. Particularly in the industrialised world, these disruptive technologies have completely changed how libraries and information services are provided. Fundamentally, the automation of information storage and retrieval is made possible by robotic technology. Robots have been used in libraries, particularly in wealthy nations. Academic libraries use robotic technologies in a variety of ways, including autonomous shelf reading robots, telepresence, chatbots, and humanoid robots for maintaining circulation data and providing reference services (Tella, 2020).

Coleman (2017) asserts that by using scan radio frequency identification (RFID) tags, which are connected to books to generate reports on books, robots may also be utilised efficiently in academic libraries to scan shelves and for self-navigation, particularly at night. A robotics club, which may be utilised to teach kids how to code through robots, can also be beneficially hosted by a library makerspace. Asemi and Nowkarizi (2021) assert that robotic technologies are utilised in academic libraries for real-time browsing of printed documents via a web interface, which contributes to this. This suggests that patrons of the library will interact with computers and robots to have the requested materials automatically retrieved. Since computer algorithms and software simplify academic library operations and make librarians' jobs incredibly simple, the adoption of robotic technologies has had a significant impact on library operations, particularly in terms of giving users access to timely information and improving library efficiency.

In the United States, academic libraries were polled in 2017 by Wood and Evans (2018). 56.3% of academic librarians acknowledged that the introduction of robotics in academic libraries will change librarianship, according to the data. This suggests that the use of robotics in academic libraries will result in several improvements to user experience. This has been made possible, according to Cotera (2018), who claims that the use of robotic technologies in academic libraries in industrialised nations has completely revolutionised the user experience and made the material more approachable, logical, and amusing. According to Liau (2019), several libraries in Singapore employ robots to help library personnel with tasks including sorting returned books,

reading shelves, and transporting library resources. This suggests that the existence of robots in academic libraries affords librarians the chance to have enough time to concentrate on other pertinent and significant library information service delivery activities targeted at ensuring users are satisfied.

According to Tella (2020), robotic technology can be used in university libraries in Nigeria in several different ways, such as for security, user assistance, and shelving and cataloguing library resources. In addition, robotic technologies are particularly relevant in automated storage and retrieval systems (ASRSs), and this has aided in space management in library operations (Payne, 2007). From this, it can be concluded that robotics applications created the technical framework for the development of intelligent academic libraries. The adoption of robotic technology in academic libraries can be influenced by several aspects, including modular architecture, self-learning, and vivid language (Shivarama and Choukimath, 2019).

According to Tella (2020), who is exploring the advantages of AI in libraries, robotics increase the operational efficiency of libraries by optimising collection analysis, visualisation, preservation, and lowering costs related to service delivery. A strong foothold for libraries in the new scholarly information landscape is established by robots, according to the author, who also claims that it can be easily integrated with current workflows and infrastructure. Robotics also helps libraries and librarians achieve their new goals. Academic libraries would not be able to make use of these advantages of robots if they did not respond to its application. The reactions to the use of robotic technologies in academic libraries must therefore be investigated.

The role of robotic technologies in library operations and librarianship has been acknowledged by some professional bodies in the field, including the South African Library Association, the American Library Association, and the International Federation of Library Associations and Institutions (IFLA). According to an IFLA Trend Report, robotics is relevant for libraries and librarianship since it can be employed with the semantic web and search, as well as with translation and cloud computing advancements (Wang, 2014).

In academic libraries, robotic technology was investigated by Ali et al. (2020). The study's main objectives were to learn how libraries are coping with the use of technology and what part librarians would play in the future of robots. The writers looked at academic literature, strategic plans for university libraries, and library programming. The study's 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. Similarly, Adebayo et al. (2018) observed that library managers will exhibit trust in the adoption and deployment of AI when they are adequately aware of the necessity of providing routine services through the application of the technology.

The preparation for the use of robotic technologies in university libraries depends on several criteria, including the availability of appropriate data, the requirement for policy documentation, the deployment of necessary software and algorithms, and, finally, expert expertise (Martinez-

Plumed et al., 2021). The amenities required for the efficient use of robotic technology in university libraries are listed by Qomariyah et al. (2020) in a study on Indonesian university libraries. Documents outlining policies and procedures, technical know-how, and organisational resources, such as human and technological resources, are some examples. According to Decker (2015), adequate technological infrastructure, including a high WiFi connection zone, must be installed in libraries for the effective deployment of robotic technologies. He continues by stating that there needs to be a written policy in place. The use of robotic technologies would, however, result in less frequent human engagement with library operations.

**Methodology**

The research is a survey that is based on the positivist paradigm. The data-gathering tool was a questionnaire, which was utilised in research by Lund et al. (2020) and Owolabi et al. (2022). Purposive sampling was used to select six university libraries based on ownership. The selected university libraries were federal and state-owned in North Central Nigeria (See Figure 1). In addition, the six (6) chosen universities also possessed the infrastructure and personnel required to support ICT development in their university libraries.

Furthermore, among the six universities that were specifically chosen, 120 academic librarians were chosen. From each of the university libraries, six (6) academic librarians were chosen using the snowballing sample technique. Based on their understanding of IT and familiarity with robotic technology, this was done. The office of the leaders of the ICT/automation units was our first port of call, and they pointed us in the direction of the academic librarians who are knowledgeable about robotics. Before distributing the questionnaire, the respondents were asked for their informed consent.

**Table 1:** List of universities in North Central, Nigeria

| <b>Name of the university libraries</b> | <b>Type of Ownership</b> | <b>State</b>   |
|---|--------------------------|----------------|
| Kogi State University, Anyigba          | State                    | Kogi State     |
| Nasarawa State University, Keffi        | State                    | Nasarawa State |
| Benue State University, Makurdi         | State                    | Benue State    |
| University of Abuja                     | Federal                  | FCT            |
| University of Ilorin                    | Federal                  | Kwara State    |
| University of Jos                       | Federal                  | Plateau State  |

**Results and discussion**

This section presents the results of the findings based on the research questions as designed in the questionnaire.

**Research question 1: What are the levels of preparedness of university libraries towards robotic technologies in terms of technological infrastructure, policy framework and human development for the adoption and use of robotics in the libraries?**

The goal of the study was to determine the degree of robotic technology readiness among university libraries. The levels of readiness in terms of the digital infrastructure, policy

framework, and human capacity were determined using the following criteria. The majority of respondents (60%) acknowledged that the deployment of AI technologies is impacted by their lack of digital infrastructure. In all, 28% of those polled said they lacked a framework for a policy that would direct the introduction of robotic technologies into Nigerian university libraries, while 12% said they had enough staff to operate the equipment. The results of this study supported those of Tella (2020), who discovered that despite the presence of human resources that will enable resource usage, many African countries lack the facilities and legislation that will encourage access to and use of robotic technologies.

**Research question 2: What are the available services that university libraries handle using robotic technologies?**

The goal of the study was to determine which library tasks could benefit from robotic technology. Robotic technologies can be employed in a variety of library operations, including cataloguing, categorization, reference services, acquisition services, and a host of others, according to all of the respondents. According to Tella (2020), many academic libraries in developed nations use robotics for a variety of library tasks. This study supports her results. He also points out that humanoids and chatbots are frequently utilised in libraries to maintain circulation records. This study also supports the findings of Murphy (2015), who contends that the adoption of robots for shelving, finding library materials, cataloguing and classification, security, responding to repetitive reference queries, and ASRSs in many university libraries in the USA has aided in the provision of library services.

**Research question 3: Are librarians aware of the benefits of robot technologies to library operations?**

All of the respondents from the six (6) university libraries that were chosen acknowledged that they were aware of the potential advantages of robotics in library operations, such as library automation (43%), innovation in library operations (23%), efficient service delivery (15%), and lastly (13%), the admission that adopting robotics in libraries will raise their stature. This might be because their selection was based on their understanding of how ICT is used in library operations. This study validates the findings of Kushins (2018) who claimed that academic librarians at the Hunter Library of North Carolina State University in the USA admitted that they are aware of the utility and importance of AI technology in library operations. The research also supported Wheatley and Hervieux's (2019) assertion that academic librarians in the United States and Canada are aware of the use of AI in library activities. The results of this study also support those of Nakhoda and Tajik (2017), who discovered that academic librarians at the University of Tehran are aware of the potential benefits of AI technology for libraries. The research by Owolabi et al. (2022), Frey and Osborne (2017) and Choudhury et al. (2018) supported these findings.

**Research question 4: What are the challenges that university libraries may face in the adoption and use of robotic technologies?**

The study aimed to pinpoint different challenges that university libraries can experience when adopting and utilising robotic technologies. According to the respondents, the biggest obstacle to the adoption of robotic technologies in university libraries will likely be a lack of funding, which will be cited by 48% of them, followed by unstable power supplies (30%), fear of job loss (22%), and poor telecommunications facilities (3%) in that order. The results of this study are consistent with those of Odeyemii (2019), who claims that a lack of adequate power supply is a significant obstacle to the adoption of robotic technologies in Nigerian university libraries. The results of Oladokun et al. (2023) and Asogwa et al. (2015), who discovered that insufficient funding and intermittent power supply are some of the obstacles to the development of robotic technology in academic libraries in Nigeria, support the conclusions of this study.

**Conclusion**

It's not particularly impressive that university libraries in Nigeria are ready to adapt and deploy robotic technologies. It is an obvious sign that despite the significant advantages this technology has to offer in terms of library operations, university libraries across the nation are not yet ready to adopt its use. Yet, given that many nations around the world, particularly industrialised ones, have adopted the usage of technology, this research on readiness will be important for the adoption of the technology. It is imperative to inform librarians that the introduction of robotics in libraries will not result in job losses. This is essential since many librarians fear losing their jobs as a result of the adoption of new technologies. Also, several preparations must be made before robotic technologies relevant to libraries can be deployed.

**Recommendations**

From the findings of the study, the following suggestions were made:

- 1) The university libraries should provide the required guidelines for the use of these technologies, and staff members must participate in a variety of training sessions that will encourage their adoption and usage.
- 2) Academic librarians should be made aware of the advantages of robotics adoption and application in library operations. The administration of libraries should also provide cash for the purchase of the facilities that are required to support the efficient implementation of the technology.
- 3) The management of the libraries may offer an alternate power source for the libraries, such as solar electricity and generators. This would ease concerns about a lack of reliable power that might prevent academic libraries in Nigeria from adopting and using robotic technologies.

The study's limitations stem from the fact that just a small number of librarians from each of the chosen university libraries were chosen and that it only covers six (6) of the nation's university libraries. Thus, additional research is required that will cover more university libraries in various



parts of the nation and concentrate on both academic librarians and paraprofessional staff who work in libraries. There is also a need for additional research that will look at how prepared other higher education institutions, such as polytechnics and schools of education, are for robotic technologies. Despite its limits, this study adds to our understanding of the literature, policies, and practices in these fields. The study's conclusions are crucial for university library administration in determining the actions that must be performed for the successful adoption and usage of robotic technologies. They could use this research as a guide. The empirical analysis of this work also advances the field of social informatics in Nigeria. The study's conclusions are crucial to different library administrations in Nigerian university libraries because they offer a thorough examination of the infrastructure that must be taken into account for the deployment of robotics there. Finally, the study's conclusions led to the creation of a useful support document that can open up further possibilities for the deployment of robotic technologies in Nigerian university libraries.

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