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A Survey of Librarians' Perception and Readiness to Adopt Emerging Technologies for Service Delivery in Medical Libraries in Nigeria

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ABSTRACT

Objective: The purpose of the study was to examine the attitudes of librarians toward the potential use of emerging technologies in medical library environments.

Methods: An online questionnaire was developed by the researchers to collect data on librarians' perceptions and readiness to adopt emerging technologies in medical libraries within university settings in Nigeria. The questionnaire was emailed to 62 librarians working in various medical libraries at university libraries, beginning in June 2024. Data collection was completed by July 2024. In total, 56 librarians from 20 public universities with medical libraries in Nigeria responded to the survey.

Results: The study revealed that librarians are aware of some emerging technologies that can be adopted to provide services in medical libraries, such as cloud computing, the Internet of Things (IoT), virtual reality, blockchain, robots, and chatbots. However, they are not aware of other technologies that could also be used in medical libraries to render services. The study found that the majority of librarians believe that adopting emerging technologies will provide easier access to library resources and services from anywhere with an internet connection. They also feel that such adoption will advance library services. At the same time, some librarians believe that the lack of necessary facilities will hinder the adoption of certain emerging technologies. Moreover, many expressed concern that adopting technologies like robotics could lead to job losses.

Conclusion: Overall, the librarians indicated that they are moderately prepared to adopt emerging technologies. Several challenges that could hinder the adoption of these technologies in service delivery were identified. The study emphasizes the need for librarians to proactively engage with emerging technologies and acquire new competencies to remain relevant in the 21st century.

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Introduction

Libraries of the twenty-first century have transformed from physical place to an online learning space where printed resources and services are rapidly changing into a social space for librarians to communicate, access and contribute to satisfying specific information needs of users. This technology driven era of today have made universities to consistently strive to boost their academic productivity through the development and consented implementation of emerging technologies that are applicable in teaching, learning and research. Emerging technologies play a significant role in transforming services delivered to users and the work of the information professionals in the university libraries. According to Iwhiwhu and Okorodudu (2012; p. 12) "libraries may meet users' information needs by acquiring, organising, managing and making relevant information resources delivered through modern technologies". As noted by Raju (2014), the explosive growth of digital devices and related applications have collectively altered the traditional library beyond recognition. This dramatic change to modern digital environment have prompted several projects and initiatives such as developing digital libraries and institutional repositories, using cloud computing, and so on. Digital libraries appeared as a new mechanism for managing scholarly production, dissemination and preservation of records in both public and academic libraries. The information seeking behavior of library users and the nature of library operations have been transformed by the digitization of content and technologies that have revolutionized the way information is organized and accessed (Lee, 2020).

The ability to deal with rapid technological change and to use innovations more proactively is demanded (Liu & Shen, 2018; Buhalis et al., 2019). Consequently, it is essential that librarians consciously engage with emerging technologies that will shape both their professional lives and the experiences of their users. Emerging technologies are defined as technologies that are characterized by novelty, fast growth, prominent impact, uncertainty and ambiguity (Rotolo et al., 2015). Library service delivery involves certain processes and activities deployed by university libraries to deliver information services and resources to their clientele, with the aim of enhancing the activities and productivity of library users (Chudasma, Bhatt & Trivedi, 2019). In the realization of good library service delivery, the survival of libraries according to Ireona, Tijani and Bakare (2018) now solidly depend on their creative abilities to remain relevant in the 21st century and for this survival to subsist, libraries must repackage their services, enhance the skills of the staff and leverage on technology for improved services for them to reclaim the glory days.

Presently, the concern for librarians who work in academic environment sought to understand technologies that could enhance the services rendered in the libraries with a view to achieving the priorities of library users. With this, the need to be abreast with needed technological skills becomes necessary (Bhargava & Gupta, 2021). More so, library in academic environment serve as primary center where emerging technologies can be practically applied to meet global

technological delivery of library services. A critical task that faces libraries across the world is to be able to support its users through various media and the advent of information and communication technology (ICT) and use in library services has transformed their service delivery from traditional methods of ineffective means of creating and managing information to library users in this 21st century. This situation has made it a necessity to adopt and utilize other means of communication, information networking, and knowledge sharing as well as information storage. The advent of computers and other communication technologies therefore, has led to major transformations in the way library services are rendered and the profession practiced (Njoku & Agbiriogu, 2021). The emergence and application of emerging technologies in library services has made the role of librarians and other information professionals to be more practical and pragmatic to the service they provide to information users on daily basis (Ireona, Tijani & Bakare, 2018). The question is, how prepared are librarians and libraries in universities in Nigeria to embrace and implement these emerging technologies? What is already on ground and what is needed to implement the emerging technologies in medical libraries in Nigeria. To achieve this, the following research questions were formulated to guide the study.

Research questions

RQ1. What are some of the emerging technologies that can be adopted to render services in the medical libraries?

RQ2. What are the librarians' perception of adopting emerging technologies in the medical libraries?

RQ3. What is the level of the librarian's readiness to adopt emerging technologies into library services?

RQ4. What is the level of availability of infrastructure to use emerging technologies in the various medical libraries?

RQ5. What are the perceived challenges that can hinder the adoption of emerging technologies in the medical libraries in Nigeria?

Literature review

Emerging technologies that can be used in university libraries

A study conducted in 2018 analyzed the adoption and use of emerging technologies in Canadian libraries operated for academic sake. The findings indicated that information professionals were actively exploring and implementing emerging technologies, including artificial intelligence, data analytics, and mobile applications, to enhance library services and user engagement (Martin, 2018). Research has examined the implementation of virtual reality in library instruction and research support, the use of artificial intelligence in chatbot-based reference services, and the adoption of data analytics for collection management and user engagement (Groom & Mateen,

2019). According to Vysakh (2020), emerging technologies are used for service delivery in the library. Numerous technologies have emerged recently, and some of these technological facilities are used in the library. Artificially Intelligent Robots have penetrated almost all the fields of life including libraries, which can do things even humans are incapable of with higher efficiency. Bhargava and Gupta (2020) identified smart library, cloud computing, institutional repositories, RFID technologies, QR code, library automation, robotics, Virtual Reference Services (VRS) and semantics s some of the emerging technologies.

There are many examples of emerging technologies used by information professionals in academic libraries. Ahmad and Raza (2019); Xie and Li (2019) and Anderson (2021) identified few of them to include:

1. *Internet of Things (IoT):*

Smart library systems: IoT devices, such as RFID tags, beacons, and sensors, enable efficient management of library resources, including automated check-in/check-out, real-time inventory tracking, and smart shelving. Space utilization and management: IoT-based sensors can be utilized to monitor and optimize space utilization in libraries, helping to identify areas with high foot traffic and providing data for space planning.

2. *Data Analytics and Visualization:*

Data-driven decision-making: Information professionals use data analytics tools to analyze usage patterns, collection development, and user behavior, aiding in evidence-based decision making for library services and resource allocation. Visualizations for information discovery: Information professionals employ data visualization techniques to present complex data sets in a visually appealing and accessible manner, facilitating information discovery and exploration. Many libraries and information centers are leveraging on AI to harnessing "big data and data analytics both in their operational and service-oriented aspects" (Garoufallou & Gaitanou, 2021).

3. *Virtual Reality (VR) and Augmented Reality (AR):*

Virtual tours and simulations: VR and AR technologies offer immersive experiences, allowing library users to explore virtual collections, take virtual tours of libraries, or engage in interactive learning activities. AR for information access: Augmented reality applications can enhance information access by overlaying digital content onto physical books, manuscripts, or artefacts, providing additional context or supplementary information.

4. *Blockchain*

Blockchain is an innovative technology that has the capacity to transform the delivery of private and public services through new applications. Deloitte (2016) describes a blockchain as a distributed ledger of all transactions, which are recorded in discrete blocks and linked together in a chain, and each block contains private data and a public header that is used to link to the next block on the chain. Blockchain comprises data records or blocks, and once these blocks are

collected in a chain, they cannot be changed or deleted by a single actor. Instead, they are verified and managed using automation and shared governance protocols (Blockgeeks, 2016). The blocks are sequentially linked and cryptographically secured in such a way that only the owner of data in a block can unlock it using their private key (Straw, 2016). Shaw (2016) further describes blockchain technology as a shared electronic database in which the data records are immutable and encrypted, and these data records can be shared within a group of people, organizations or a community. The shared document is encrypted and verified to ensure that the data it stores is always correct and every record added to the blockchain ledger has a unique key associated with it that can be trusted (Shaw, 2016). The three main attributes of blockchain are decentralization, trust, and immutability, as explained below:

- *Decentralization* blockchain means that the network operates on a peer-to-peer basis and works by linking all participants in a marketplace without intermediaries in such a way that each transaction is transparent to all the participants in the network (Blockgeeks 2016).
- *Trust* blockchain has emerged as a new type of trust for global services, particularly financial services, and it relies on existing technology to solve an old problem; for example, how do two parties conduct a transaction without knowing or trusting each other and without a trusted third-party intermediary (Trautman 2016).
- *Immutability* means that once data or transactions are appended, accepted and confirmed by the nodes on the blockchain, it is not easy to change it. It is therefore an append only data store and no deletes or edits are allowed, hence this technology has its capability as an unimpeachable record keeper (Umeh, 2016). Blockchain technology has the potential to impact all records management processes and extend their capabilities, and it also has broad implications for securing and authenticating intellectual property at a lower cost and higher efficiency (Gartner 2016). Blockchain can thus help to trace people who accessed digital records and ensure that digital records in integrated systems are accurate and secure.

5. Cloud computing technology

Cloud computing is another emerging technology that can be used to manage library records and it consists of on-demand computing services delivered over the internet from a remote location or via an organization's servers (InterPARES 2016). Ajayi, (2023) defined "cloud computing as a kind of computing which is highly scalable and use virtualized resources that can be shared by the users. Users do not need any background knowledge of the services before using it. Moreover, a user on the internet can communicate with many servers at the same time and these servers exchange information with one another. Basically, data and adoption in the cloud are available through the internet; it can also be accessed from everywhere and from any device with internet connectivity. Cloud computing has the potential to reduce costs while increasing value by allowing the more efficient use of IT resources, and fewer staff, hardware and software resources are required to support the enterprise. As also noted by Liu and Cai (2013), shifting

library core applications to cloud-based services will reduce or eliminate most of or all the local technical needs in managing server hardware and operating systems that underlie the applications. Cloud computing has therefore been regarded as a powerful tool that offers great scalability and flexibility, making it possible for librarians and users to access file storage, databases and other library applications anywhere at any time. JISC (2011) also points out that cloud-based services are set to transform the way libraries work, unleashing librarians from the administrative burden to focus on services for users and researchers. Cloud computing technology is therefore enabling librarians to shift from the paradigm of ownership and maintenance of resources towards the provision of access to information maintained and controlled by others (Scale 2010).

6. Chatbots:

Chatbot refers to an artificial intelligence (AI) program or application that can replicate a discussion (or a chat) with somebody in natural language by using a messaging application, blogs, websites, mobile applications or by a smart device. Chatbots and voice assistants can be used for library services (Hopkins & Maccabee, 2018; Mckie & Narayan, 2019); Like it is currently being witnessed in other areas of life, AI technology has also permeated the core areas of library functions where chatbots can be used to provide answers to simple and frequently asked questions on a library web page or blog, alert users of new arrivals and when a book loan is due for return, and refer a patron to related materials.

7. Robots:

This is an automated or AI-enabled machine, which is programmed and designed to carry out specific tasks with or without human intervention. This may include the utilization of robotics for the retrieval of books (McCaffrey, 2021): such as the automatic arm or robots to pick books from library shelves.

8. RFID: (Radio Frequency Identification Device)

RFID: An effective instrument for collection management, RFID is a device that assists in the automatic tracking and identification of objects. An RFID system's transponder, often called a tag or microchip, is connected to an antenna. A user can get simple data like an identity number or detailed information (Waljat, 2018).

9. Drones:

Drones are part of research, transpiration and delivery, artistic production, news coverage and reporting, law enforcement and surveillance, and entertainment. It will provide new opportunities for content creation and research. Users may expect drones to be part of the technology resources available from libraries. Additionally, video or survey content produced by drones may become content collected and managed by libraries (ALA, Drones, 2018). Drones can be used for creating

content for the library, collecting data or as Piotr mentions in his article, the drone can be used for delivery service for the library users who don't have the possibility to go to the library; be it because of a disability, or because of the long distance to the library (ALA, Drones, 2018).

Using Emerging Technologies for Service Delivery in academic Libraries.

Numerous technologies have emerged recently, and some of these technological facilities are used in the library. According to Vysakh (2020) emerging technologies are used for service delivery in the library. Artificially Intelligent Robots have penetrated almost all the fields of life including libraries which can do things even humans are incapable of with higher efficiency. Robots can be used for a variety of operations within the library which include, filing, sorting, and replacing the books on the shelf, taking inventory, welcoming and directing guests and users to different locations in the library, and answering frequently asked questions among others. The study by Chingath (2020) reported the integration and seamless functioning of emerging technologies in libraries such as Robotics, Drones, Blockchain, Big Data and Mobile Apps as well as their use and application in libraries. Some studies have reported the adoption of mobile technologies for information access, the use of open-source software for library management, and the implementation of e-learning platforms to support teaching and learning (Ngulube & Ngulube, 2019; Ekere, et al, 2020). Other new technologies utilized by information professionals are video-based communication platforms like the Zoom and WebEx in the library and social network websites technologies but do not utilize digital reference robots, library automation SOUL software, Voice over Internet Protocols (VoIP) for sending voice in the form of digital packets over IP-based networks and webinar software (Ekere, et al, 2020).

Some studies have reported the adoption of IoT to render library services. For example, Pujar and Satyanarayana (2015) investigated the benefits of IoT for libraries and proposed innovative approaches such as a virtual library card, smart digital shelve, cloud services, and integrating Radio Frequency Identification (RFID) tags or member cards to access the library and its resources. Wojick (2016) also explored the potential impact of IoT on library services and proposed a theoretical model of IoT application in library service that librarians can use to improve library services through sharing information, tracking and tracing services and pushing notification services. Oyelude (2016) introduced an innovative application of IoT in Oracle Digital, delivering value added service through the cloud platform for library use. Massis (2016) explored the potential impact of IoT on the library from the security and privacy points of view and proposed the Security of Things and security management approaches. In Bangladeshi libraries, RFID technology is now in use (Rahman & Islam, 2019). An AI lab has been built at Rhodes Island public library (Princh Blogspot, 2020). In Canada, a team of librarians from the International Islamic University in Malaysia have developed an automated Reference service program called R-StaRS for the University of Windsor (Ryu, 2019). Big data can facilitate library

services by providing access to user mind otherwise called customer intelligence after user's consultation of large dataset storage. Augmented reality applications like 'librARi' that allow library patrons search for books and discover related content which is currently at Halton Libraries in the United Kingdom (Princh Blogspot, 2020).

Challenges in adopting emerging technologies in developing countries

The study by Ajayi (2023) concluded that though librarians perceived advantages of the technology to be enormous, yet there were concerns about the risks and challenges associated with cloud computing adoption, such as data security and privacy issues. The study recommended among others that libraries should develop adequate policies and strategies to mitigate these risks and enhance cloud computing adoption. Similarly, the study by Owate and Iroeze (2023) Enweani and Muokebe (2019) reported challenges encountered by information professionals to this effect are; lack of necessary skills and knowledge to effectively utilize emerging technologies, cyber security threats on the protection of sensitive information and library resources, lack of equitable access and usability of emerging technologies. According to Bichi (2021), the main barriers to the effective use of technology resources in Nigerian libraries include a lack of search skills, inadequate budget, epileptic power supplies, and insufficient management training and staff retraining. Adoption of new technologies has been hampered by insufficient funding, a lack of capacity, and erratic power supplies. According to Lubanga and Mumba (2021), there are a number of obstacles that prevent libraries from implementing high-end technologies, including a lack of well-established centers for research and innovation, the unpredictable nature of technological advancement in the twenty-first century, and university cultures that discourage research and innovation.

The study by Odeyemi (2019) reported that Nigerian libraries are fully prepared to accept emerging technologies like robotics into the library service delivery system even though a few factors like technophobia militate against this possibility whilst they await adoption of emerging technology. Otunla (2016) mentioned lack of funding, lack of ICT staff, and insufficient power supply as challenges with using emerging technologies like library management software. Several other challenges have been reported and they need to be examined and addressed for emerging technologies to be fully implemented in academic libraries in Nigeria. Funmilayo and Ayo (2020) recommended that librarians must continuously upgrade their skills in line with technological advancements in order to provide user-oriented services. They emphasized the importance of adopting the latest online technologies used globally in library services, warning that any librarian who remains unaware of current trends and emerging technologies risks becoming redundant and left behind.

Regarding IT adoption in developing nations, empirical studies show that individual factors of attitude, knowledge, skills, and self-efficacy of new technologies significantly affect electronic records management system adoption in educational institutions (Mohd & Chell, 2020). Hassall and Lewis, (2016) emphasized the importance of adopting technologies in institutions in spite of the countless barriers and challenges to implementing IT in the educational organizations. This means there is a clear need to examine the factors influencing the successful technology adoption. Technology is the software and hardware, people organizations use in their day-to-day tasks (Ammenwerth & Mahler, 2019). These technologies augment their ability to do their jobs while protecting their information and infrastructure. It is evident that technology is a fundamental issue where an electronic records management system is concerned (Dastan, Cicek, & Naralan, 2011).

Methods

The population for the study consists of all professional librarians working in public universities with medical libraries in Nigeria. A total of 23 federal and state universities running health sciences with medical libraries were identified and included in this study. A questionnaire designed by the researchers was used to collect data on Librarians' Perception and Readiness to Adopt Emerging Technologies in medical libraries in university libraries in Nigeria. It was administered using online method. The questionnaire was sent to 62 librarians in various medical libraries in university libraries via e-mail, which started in June 2024. Their e-mail addresses were collected from the various university sites. In order to increase the return rate, librarians were sent reminders by e-mail after two weeks. Data collection was completed by July, 2024. In total, 56 librarians working in medical libraries in 20 public universities with medical libraries in Nigeria responded to the survey. Data was analyzed and results presented in Tables.

Results

Of the 56 librarians working in medical libraries that participated in the survey, the breakdown by gender is as follows: 30 respondents indicated as males, while 26 indicated as females. The breakdown by designation is as follows: ten each indicated as Assistant Librarians and Librarian II, fifteen indicated as Librarian I, ten as Senior Librarians, eight as Principal Librarians and three indicated as Deputy University Librarians. According to the academic staff ranking in Nigeria, Assistant Librarian position is the least position in the academic ranking with a bachelor's degree in librarianship, followed by Librarian II, Librarian I and Senior Librarian with a master's degree in Librarianship, Principal Librarians and Deputy University Librarians are all PhD holders in librarianship.

Table 1. Medical libraries that responded to the study

S/N	Medical school	State	No of Respondents
1	College of Health Sciences, Abia State University Uturu	Abia State	3
2	College of Health Sciences, University of Uyo	Akwa Ibom	5
3	College of Health Sciences, Nnamdi Azikiwe University Nnewi	Anambra State	2
4	College of Medical Sciences, University of Calabar	Cross - Rivers State	4
5	College of Health Sciences, Delta State University, Abraka	Delta State	3
6	College of Health Sciences, Ebonyi State University Abakaliki	Ebonyi State	2
7	College of Medical Sciences, University of Benin, Benin-City	Edo State	4
8	College of Health Sciences, Igbinedion University Okada	Edo State	3
9	College of Medicine, Ambrose Alli University Ekpoma	Edo State	3
10	College of Medicine, University of Nigeria Enugu Campus	Enugu State	2
11	College of Medicine, Enugu State University of Science and Technology, Enugu	Enugu State	2
12	College of Medicine, Imo State University Owerri	Imo State	3
13	College of Health Sciences, Madonna University Elele	Rivers State	3
14	College of Health Sciences, University of Port-Harcourt	Rivers State	4
15	College of Health Sciences, Niger Delta University, Wilberforce Island	Bayelsa State	3
16	College of Medicine, Chukwuemeka Odumegwu Ojukwu University, Awka	Anambra State	2
17	College of Medicine, Edo University, Uzairue	Edo State	2
18	College of Medicine & Health Sciences, Gregory University, Uturu	Abia State	1
19	Pamo University of Medical Sciences, Port-Harcourt	Rivers State	2
20	College of Medical Sciences, Rivers State University	Rivers State	3
	Total		**56**

Some emerging technologies that can be adopted to render services in the medical libraries.

Respondents were asked to mention some emerging technologies that can be adopted to render services in the medical library. Out of the 56 respondents, 53 (94.6%) mentioned cloud computing, followed by 48 (85.7%) that mentioned Internet of Things (IoT), 44 (78.6%) mentioned virtual reality, 38 (67.9%) mentioned blockchain, 36 (64.3%) mentioned Robots, 29 (51.8%) mentioned chatbots, 25 (44.6%) mentioned Data analytics, 22 (39.3%) mentioned RFID, only 15 (26.8%) librarians mentioned drones.

The librarians' perception of adopting emerging technologies in the medical libraries.

Respondents were asked their perception of adopting emerging technologies in the medical libraries. The respondents were asked to select more than one option. The responses were ranked in order. The majority (54: 96.4%) are of the perception that adopting emerging technologies will give easy access to library resources and services from anywhere with an internet connection, followed by 52 (92.9%) who feel it will take the library services to the next level, the majority (50: 89.3%) perceive that absence of facilities will not let their library adopt some of the emerging technologies, the majority (48: 85.7%) are also of the view that adopting some of the

emerging technologies like robotics will lead to loss of job. The majority (47: 83.9%) also perceive that university management don't support the adoption because they feel finance will be involved, 40 (71.4%) are of the view that before we can adopt these technologies, librarians need to upgrade their skills, 33 (58.9%) are of the view that Management policies don't permit quick adoption of these technologies, and more than half (30: 53.6%) feels that if they can adopt these new technologies, they can render world class services (Table 2).

Table 2. Perceptions of librarians towards adoption of emerging technologies in Nigeria

Statements	No. of Respondents	Rank Order
It will give easy access to library resources and services from anywhere with an internet connection	54 (96.4%)	1st
Adopting emerging technologies will take the library services to the next level	52 (92.9%)	2nd
Absence of facilities will not let us adopt some of the emerging technologies.	50 (89.3%)	3rd
Adopting some of the emerging technologies like robotics will lead to loss of job	48 (85.7%)	4th
University Management do not support the adoption because they feel finance will be involved.	47 (83.9%)	5th
Before we can adopt these technologies, librarians need to upgrade their skills	40 (71.4%)	6th
Management policies don't permit quick adoption of these technologies	33 (58.9%)	7th
If we can adopt these new technologies, we will render world-class services.	30 (53.6%)	8th
One should be cautioned in replacing important people' tasks with technologies because new technologies are to a large extent not dependable or reliable.	17 (30.4%)	9th

The level of the librarian's readiness to adopt emerging technologies into library services

Respondents were asked to tick as it applies to them in the following scale: Very High Level (VHL), High Level (HL), Low Level (LL), and Very Low Level (VLL). Results in Table 3 shows that out of the 56 respondents, 42 (75%) indicated very high and high level that they will use emerging technologies because it will contribute to quality service delivery. Out of the 49 respondents, 40 (71.5%) indicate very high and high level that if the management can provide training, they will be ready to use emerging technologies. The majority (44: 78.6%) also indicated very high and high level that emerging technologies will make them more efficient and productive in their personal life and career, so they are ready. The results also show that 39 (69.6%) indicated very high and high level that technologies will keep them up-to-date of new trends in their career irrespective of location and time. The majority (42: 75%) indicated very high and high level that they worry that information they make available over the Internet could be misused or used against them by others. The results also show that 39 (69.6%) indicated very high and high level that they do not consider it safe to provide personal information over Internet platforms.

Table 3. The level of the librarian's readiness to adopt emerging technologies into library services

S/N	ITEMS	VHL	HL	LL	VLL
1.	I will use emerging technologies because it will contribute to quality service delivery.	12 (21.4%)	30 (53.6%)	8 (14.3%)	6 (10.7%)
2.	If the management can provide training, I will be ready to use emerging technologies.	24 (42.9%)	16 (28.6%)	7 (12.5%)	9 (16.1%)
3.	Emerging technologies will make me more efficient and productive in my personal life and career, so I am ready.	36 64.3%)	8 (14.3%)	9 (16.1%)	3 (5.4%)
4.	Technologies will keep me up-to-date of new trends in my career irrespective of location and time	21 (37.5%)	18 (32.1%)	9 (16.1%)	8 (14.3%)
5.	I figure out new high-tech products and services without help from others.	9 (16.1%)	6 (10.7%)	22 (39.3%)	19 (33.9%)
6.	I worry that information I make available over the Internet could be misused or used against me by others	33 58.9%)	9 (16.1%)	10 17.9%)	4 (7.1%)
7	I do not consider it safe to provide personal information over Internet platforms.	28 (50%)	11 (19.6%)	9 (16.1%)	8 (14.3%)

Overall, how ready are you to adopt emerging technologies in your library.

Overall, almost half (26: 46.4%) indicated that they are moderately prepared, followed by 13 (23.2%) who indicated they are barely prepared, 9 (16.1%) indicated they are highly prepared, and only 5 (8.9%) indicated very highly prepared. While, a small number (3: 5.4%) indicated not prepared (Figure 1).

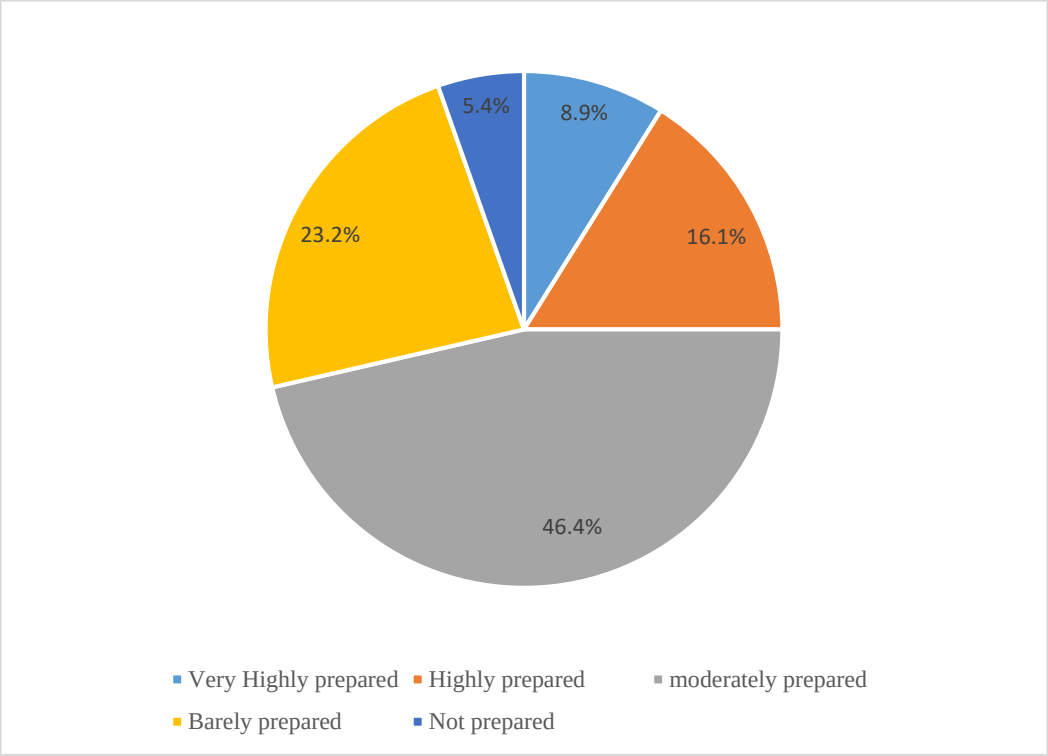

Figure 1. Librarians' level of readiness to adopt emerging technologies

The level of availability of infrastructure to use emerging technologies

The respondents were asked to indicate the level of availability of infrastructure in their libraries to show readiness to adopt emerging technologies to render library services. The majority **(**49: 87.5%) indicated that stable power supply in the library is not available, followed by 45(80.4%) respondents who indicated that their libraries lack skilled IT librarians, and 42 (75%) out of the 56 respondents indicated that their libraries lack stable Internet connectivity which can hinder from adopting emerging technologies (Table 4).

Table 4. The level of availability of infrastructure to use emerging technologies

S/N	Infrastructural needs to use emerging technologies	Available	Not Available
	Modern Computers	17 (30.6%)	39(69.6%)
	Stable Internet connectivity	14(25%)	42(75%)
	Stable power supply in the library	7(12.5%)	49(87.5%)
	Skilled IT librarians	11(19.6%)	45(80.4%)

Perceived challenges that can hinder the adoption of emerging technologies in the medical libraries in Nigeria.

Respondents were asked to indicate the challenges they perceived to hinder the adoption of emerging technologies. Results in Table 5 shows that the majority (51: 91.1%) agree that concern about data security can hinder the adoption of emerging technologies. The majority (43: 76.8%) also disagree that technophobia among the librarians can hinder the adoption of emerging technologies. More than half (30: 53.6%) of the respondents agree that resistance to change among librarians can hinder the adoption of emerging technologies. The majority (47: 83.9%) of the respondents agree that electric power is inadequacy therefore can hinder the adoption of emerging technologies. A little above half (29: 51.8%) agree that poor maintenance culture can hinder the adoption of emerging technologies. The majority (46: 82.1%) agree that expensive nature of the technology can hinder the adoption of emerging technologies. The majority (40: 71.4%) agree that unreliable Internet connectivity can hinder the adoption of emerging technologies. The majority 49: (87.5%) agree that low funding of academic libraries can hinder the adoption of emerging technologies. The majority (45: 80.4%) also agree that inadequate IT skilled librarians can hinder the adoption of emerging technologies.

Table 5. Perceived challenges that can hinder the adoption of emerging technologies in the medical libraries in Nigeria

S/N	Emerging technologies	Yes	No
1	Concern about data security	51 (91.1%)	5 (8.9%)
2	Technophobia	13(23.2%)	43 (76.8%)
3	Resistance to change among librarians	30 (53.6%)	26(46.4%)
4	Electric power inadequacy	47 (83.9%)	9(16.1%)
5	Poor maintenance culture	29 (51.8%)	27(48.2%)
6	Expensive nature of the technology	46 (82.1%)	10(17.9%)
7	Unreliable Internet connectivity	40 (71.4%)	16(28.6%)
8	Low funding of academic libraries	49 (87.5%)	7(12.5%)
9	Inadequate IT skilled librarians	45 (80.4%)	11(19.6%)

Discussion

Some emerging technologies that can be adopted to render services in the medical libraries.

The study revealed that cloud computing, Internet of Things (IoT), virtual reality, blockchain, Robots, chatbots are some of the emerging technologies that can be adopted to render services in the medical libraries. Although, there are still some that the librarians are not aware of. This may be why, Cooney (2020) reported that librarians in Nigeria need strong level of awareness towards emerging technologies like Cybrary, RFID, institutional repositories, Internet of Things, use of Library Guide application, Integrated library management system and WebOPAC for effective service delivery and their relevance to university libraries.

Similarly, Funmilayo and Ayo (2020) stressed that, librarians practicing the use of these technologies must upgrade themselves with the latest online technologies utilized worldwide to be able to furnish library services effectively. This is necessary for the fact that any librarian who is unaware of emerging technologies will be redundant and left behind. According to Onwubiko, Okorie and Onu (2021) cloud computing technology would assist libraries to maintain record data, private and delicate data. It is therefore imperative for librarians to have a solid understanding of this new technology landscape to move beyond a vague of its awareness to a more nuanced well-informed understanding of such concepts.

The librarians' perception of adopting emerging technologies in the medical libraries.

The study found that the majority of the librarians are of the perception that adopting emerging technologies will give easy access to library resources and services from anywhere with an internet connection, the majority also feel it will take the library services to the next level, while some perceive that absence of facilities will not let their library adopt some of the emerging technologies, and the majority are of the view that adopting some of the emerging technologies like robotics will lead to loss of job. Lack of university management support was another concern mentioned by majority as they feel finance will be involved, others mentioned that librarians need to upgrade their skills before adopting the emerging technologies, and more than half are of the view that Management policies don't permit quick adoption of these technologies. The findings show the positive perception and readiness of the librarians in embracing emerging technologies for service delivery.

This findings agree with previous findings by Ajayi, (2023) who examined the perception of librarians on cloud computing technology for library service delivery in public universities in Ekiti State, Nigeria and found that librarians generally had positive perception of the advantages of cloud computing technology for library service delivery, including its potential to improve user experience and facilitate collaboration and resource sharing among libraries. Similarly,

Keller, Brucker-Kley, and Stalder, (2022) explored the perceptions of librarians towards emerging technologies and how they can proactively engage with them to enhance their professional lives and the experiences of their users and reported that among the portrayed technologies such as Smart Glasses, Open Access, Virtual Meetings, AI, Streaming, except for Smart Glasses, are overall more imaginable than desirable for the participating librarians. The by Keller, Brucker-Kley, and Stalder, (2022) further revealed that AI and Virtual Meetings are the technologies with the least desirability.

The level of the librarian's readiness to adopt emerging technologies into library services

The analysis regarding the level of librarians' readiness in medical libraries in Nigeria to adopt emerging technologies revealed that to them the adoption of emerging technologies will contribute to quality service delivery in very high level, and will make them more efficient and productive in their personal life and career, so they are ready.

The findings also show that the librarians expressed some concerns such as lack of management support, policies, and inadequate training to upgrade skills level. Overall, the librarians indicated they are moderately prepared to adopt the emerging technologies. The findings show that the librarians in medical libraries in universities in Nigeria are very ready to adopt the emerging technologies. The findings of the present study support the study by Saibakumo (2021) that more than 60% of academic libraries in Nigeria are prepared to accept the introduction of emerging technologies for better information service delivery.

The level of availability of infrastructure to use emerging technologies

Concerning availability of infrastructure to use emerging technologies, the study revealed that majority of the librarians indicated unstable power supply in the libraries, their libraries lack skilled IT librarians, and that their libraries lack stable Internet connectivity which can hinder them from adopting emerging technologies.

The level of availability of infrastructure in the libraries shows some level of unpreparedness to adopt emerging technologies. This may be why Owate and Iroeze (2023) reported that many technologies have emerged for the consumption of library Information Professionals but are not yet fully provided for use in some public university institutions in Rivers State, Nigeria. While, some that have adopted emerging technologies for service delivery, the extent of utilization is still low. Several other studies have mentioned lack of stable power supply, inadequate skilled ICT librarians, and stable internet connectivity as major challenges confronting libraries in Nigeria (Baro, Eze, & Nkanu, 2013; Owate & Iroeze, 2023; Baro, Obaro & Aduba, 2019).

Perceived challenges that can hinder the adoption of emerging technologies in the medical libraries in Nigeria.

With regard to some perceived challenges that can hinder the adoption of emerging technologies in the medical libraries in Nigeria. The results show librarians mentioned challenges such as concern about data security, resistance to change among librarians, poor maintenance culture, inadequate electric power supply, unreliable Internet connectivity, and lack skilled ICT librarians as some perceived challenges that can hinder the adoption of emerging technologies in their medical libraries in Nigeria. Rahman, Ghazali and Sawal, (2025) studied the nuanced social factors contributing to resistance against technology adoption in university libraries in Bangladesh and found that social factors such as interpersonal influence and cultural context are key determinants of resistance to technology adoption. They reveal that positive peer dynamics, organizational norms, and societal expectations significantly affect attitudes towards technology innovations. Njuku and Anunobi, (2024) studied the relationship between digital skills of academic librarians and provision of virtual access services and resources discovery services in federal university libraries in south east and south-south Nigeria. The results indicate a significant relationship between digital skills of academic librarians and the provision of resources discovery services and access services, which is an indication that digital skills are necessary in the provision of resources discovery services and access services.

Conclusion

The digitization of content and the virtualization of the global information landscape has transformed the nature of library operations and the information-seeking behavior of users. In response, librarians must adapt to new competencies and face rapid technological change and innovations. This call for the adoption of emerging technologies require librarians to have a higher degree of computer skills. To become more active participants and leaders to deliver information in this digital era, there is a need to equip librarians with core competencies and emerging skills required for service delivery in electronic information environment. These skills are not only limited to having knowledge of ICT application but also related to understanding how these can be utilized with a proper blending of traditional library skills. Adesanya and Idowu (2015) identified shortage of digital skilled librarians to manage and maintain the required ICT infrastructure and erratic power supply as part of the challenges faced by virtual library implementation. The study conclude that librarians must engage proactively with emerging technologies and acquire new competencies to remain relevant in the 21st century.

Author Contributions

All authors contributed equally to the conceptualization of the article, as well as to the writing of the original and subsequent drafts. All authors have read and approved the final version of the manuscript for publication.

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Data available on request from the authors.

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Ethical considerations

The authors avoided data fabrication, falsification, plagiarism, and misconduct.

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Conflict of interest

The authors declare no conflict of interest.

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