Blockchain Technology and Organizational Practices: The Case of Nigerian Academic Libraries

Rebecca Chidimma Ojobor, Cletus Ifeanyichukwu Ojobor, and Jonathan Oluranti

1 Introduction

The emergence of modern technologies has modernized most organizational practices in the digital field and a new paradigm of the automated era with regards to service-oriented evolved. Considering these changes, organizations need to change significantly to accommodate the prevailing needs of their clientele. Similarly, the academic library is a vibrant organ known for the provision of intellectual resources and service-oriented to support and promote quality teaching, learning, and research product of its parent institution which is expected to follow suit; its personnel is equally expected to adapt to the new normal of working and providing services with the emerging technologies.

The academic library is an intellectual resource center established in tertiary institutions to play a supportive role in enhancing the knowledge frontier of students, teaching, and nonteaching staff of the institution [1]. Although the aims and objectives of the academic library remain unchanged, the development of information and communication technology (ICT) redefined its mode of services by ushering in new paradigms in its practices which requires new approaches in meeting the ever-increasing needs of information seekers. Authors in [2] note that academic libraries are affected by environmental and technological changes and will need to cope with the changing needs of their clientele due to the emergence of high-powered new technologies. The advent of ICTs induced the adoption and

R. C. Ojobor (✉) · C. I. Ojobor
University of Nigeria, Nsukka, Nigeria
e-mail: rebecca.ojobor@unn.edu.ng; cletus.ojobor@unn.edu.ng

J. Oluranti
Covenant University, Ota, Nigeria
e-mail: jonathan.oluranti@covenantuniversity.edu.ng

© Springer Nature Switzerland AG 2022

S. Misra, A. Kumar Tyagi (eds.), *Blockchain Applications in the Smart Era*,
EAI/Springer Innovations in Communication and Computing,
https://doi.org/10.1007/978-3-030-89546-4_9

use of the Internet, computer, e-mail, projectors, video CDs, social media apps, and many other technology-related applications in library practice. The impact of these technologies in library practices cannot be overvalued. They have redefined the ideology of library as a pool of information resources to an interactive, socializing, learning, knowledge creation, service-oriented, and information provision center. However, there are some accrued challenges resulting from such development that need to be addressed. Some of such challenges include changing the legal paradoxes of copyright, doubts on online payment for digital resources and databases, and poor record management due to the increasing volume of information resources and many other upheavals resulting from ICT advancement in the library. As life increasingly moves online, the greatest challenge facing Internet users is conducting financial transactions in a setting where the parties involved are unknown and do not trust each other [3]. Similarly, lack of reliable data on authorship and copyrights, together with the inequitable contractual terms authors are subjected to, lead to disjointed, inaccurate, and incomplete information on the original authors of most of the online resources and payment of royalties Ito and O'Dair in [4]. These challenges have been relegating library practices until the advancement of the semantic Web technologies popularly known as Web 3.0. Web 3.0 is conceptualized as the third-generation technology upgrade through 2010–the 2020s [5]. The technologies are designed to improve the services of the previous Web technologies and overcome various challenges characterizing the previous technologies. They include advanced technologies like wireless networks, the Internet of Things (IoT), and blockchain technology, which this paper intends to publicize its potentials to librarians.

Blockchain is a distributed ledger technology (DLT). It was first introduced in 2008 by Satoshi Nakamoto – a pseudonymous mastermind behind the theory of Bitcoin cryptocurrency. It is a new technical infrastructure for cash payments and document storage. It is more secure, traceable, and transparent as all transactions stored in it are equally saved on various computers and are verifiable by others reliably and securely [6]. Furthermore, blockchain technology can also be used to correct the poor voting system in Nigeria. As observed [7], the m-voting system was not reliable in solving the problems of voting system due to its inability of securing and storing the casted votes. But the blockchain, according to them, was proposed to eliminate the problems characterizing the m-voting system in Nigeria. Nevertheless, blockchain has other concealed potentials, which could significantly undermine the most challenging factors that subverted library practices. Malyarov [8] reveals that blockchain has the potentials to help libraries and academics mitigate Internet-induced risks. But ignorance of its potentials in most organizational practices precludes its adoption and use especially in Nigeria.

According to [9], Nigeria is characterized by inadequate ICT infrastructure. Although the United Nations (UN) ranks her high in the Online Services Index (OSI) and e-Government Development Index (EGDI), yet she does not feature among the top ten in Africa [10]. In 2019, Nigeria was ranked 75th in the Global Connectivity Index (GCI), which places her below the global average. This implies that Nigeria has fallen behind others in terms of broadband penetration [11]. Infrastructural deficiencies and lack of technological competencies in Nigeria affect most organizations in the country, academic libraries in particular. In this regard, the focus of this article

is on academic libraries, specifically those in public institutions of higher learning in Southeast Nigeria. This is because public institutions/organizations have more advantage and opportunity to obtain government subventions and subsequently have greater chances in adoption and use of emerging technologies regardless of their cost.

It is evidence-based that both the local and global competitiveness of any organization depend on how the organization deploys technology to transform its various sectors. Since technology plays a key role in enhancing organizational goals, there is a need for Nigerian organizations to reorient their practices and deploy ICT and digital technology to ensure the realization of global best practices. The library is one of the most prominent organizations that render services to many other organizations that need to be on the lead toward the development of ICT capacity and infrastructure to best serve the nation. However, the infrastructural deficiencies and lack of technological competencies in Nigeria affect academic libraries as most of their staff are not encouraged or sponsored to upgrade their ICT skills. Consequently, greater percentages of librarians are technologically illiterates and could hardly influence library practices with the innovative technologies of the time. The assertion advocates [12] that it is very important for librarians/information professionals to change with the system by ensuring knowledge and skills update as well as the utilization of emerging Web technologies in library service delivery. For this reason, coping with the best global library practices becomes a greater challenge to Nigerian libraries. The scenario calls for the need to create awareness on emerging technology such as blockchain, which has the potential to subvert the most challenging issues confronting libraries, and enhance and promote its activities to achieve global best practices.

Although scholars such as [13–15] have carried out studies on blockchain and its implications for libraries yet, literature in the area is still very slim. Besides, none of the previous studies investigated blockchain technology in organizational practices. It is on this platform that the researcher deems it necessary to embark on this study with regard to the following specifications:

To identify library practices that require the application of blockchain technology
To determine the extent to which blockchain technology enhances library practices
To determine the ways through which Nigerian libraries could support and encourage librarians to embrace emerging technologies

Identify the challenges associated with the adoption and use of blockchain technologies in Nigerian libraries.

The expected outcomes of the study are anticipated to be useful to libraries, librarians, authors and publishers, library administration, Nigerian youths, and future researchers.

It is assumed that the findings of the study will pave the way for greater improvement in library practices. This is because the technology is adopted and used in libraries which will get rid of the current deadlock among libraries concerning resource sharing and service delivery. Librarians are also to benefit from the findings of the study, because the adoption and use of blockchain in the library will lead to effectiveness and efficiency in the system. This will remove too much stress

on the side of the librarians and gives them a sense of belonging. It will also encourage knowledge and skill update among librarians. Authors and publishers will also appreciate the outcome of this study. This is because their intellectual property right (IPR) will fully be protected if libraries adopt and use blockchain technology. The result of the study will equally be beneficial to Nigerian citizens, especially the youths. If blockchain is used to store staff personal data, it will give no room for falsification of employment history, thereby ensuring that staff retires at the appropriate time. Consequently, there will be the need for employment, which will subsequently reduce the massive unemployment rate in the country. Library administrators will also find this work useful. The findings of the study will expose to the administrators the need to adopt this technology; this will encourage the management to provide adequate funds and other necessary support for adoption and use of the technology to enhance library activities toward achieving global best practices. Finally, the expected outcome of the study will add to the existing literature on blockchain technology in libraries and hence serve as a reference material to future researchers who will embark on a similar study.

In as much as no previous study was found to have examined blockchain technology in organizational practices in Nigerian academic libraries, the study is worth conducting. In so doing, the paper is sectioned into four. The succeeding section provides the review of related literature while the next to it (sect. 3) presents the research methodology. The last section that is the fourth section presents and analyzes the data collected for the study. The section has three subsections; while the first subsection discusses the major findings, the second subsection highlights the implications of the study, and the last subsection concludes the paper.

2 Review of Related Literature

Blockchain technology is an innovative technology with the capacity to transform organizational practices using new approaches. Blockchain technology as opines [16] is a database containing all the transactions ever executed in a peer-to-peer network system. It is a time-stamped series of immutable records of data that is managed by a cluster of computers not owned by any single entity [13]. It consists of blocks of data that are secured and bound to each other using cryptographic principles; 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 [17]. Furthermore, [18] describes blockchain technology as a shared electronic database that contains immutable and encrypted data records, which could be shared within a group of people, organizations, or a community; however, the authenticity of the data could be verified using a unique key associated with the data. This implies that blockchain database is not stored in any single location but rather on millions of computers indicating that the records are transparent, easily verifiable, and accessible to anyone on the Internet. This feature

makes the information stored in the blockchain difficult for hackers to corrupt as no centralized version of the information exists.

The technology according to [19] bears three distinct properties, which have necessitated its widespread consideration in organizational practices. These properties include the following: decentralization, transparency, and immutability. Because most developing nations are used to the centralized system of service, all their records are stored in an entity, and such data could be accessible only when there is close contact with the host. The banking system is a good example of a centralized system. Access to one's money stored in the bank is possible by going through the bank or bank-related apps. Besides, the traditional client-server model according to [19] is another example of a centralized system. Mougayar explains that in a Google search, the searcher sends a query to the Google server, which later gets back to him/her with the relevant information. Although a centralized system has been in use for decades of years yet, several vulnerabilities have been recorded. First and foremost, the system is an easy target spot for potential hackers. Secondly, any software upgrading will halt the entire system. Finally, if the centralized entity shuts down for whatever reason or gets corrupted and malicious, the system losses its entire records or data forever. However, an organization can get rid of these anomalies through the adoption and use of blockchain technology. Supportively, [20] submit that blockchain technology eliminates centralized risks, low efficiency, and high transaction cost. With the decentralized feature in blockchain, information is not stored by one single entity; therefore, everyone in the network owns the information, and interaction could be made without going through a third party.

- Transparency: With this feature, information stored in blockchain has wider visibility and traceability except for personal identity (user privacy), which can be protected by adding anonymity protections in the blockchain using the CoinJoin method [21]. According to Bünz et al., CoinJoin method is an attractive means of anonymizing blockchain transactions which require no modification to the Bitcoin protocol.
- Immutability: The cryptographic hash function in blockchain makes the data stored in it immutable. This implies that once data or transactions are appended, accepted, and confirmed by the nodes on the blockchain, it is not easily changed [22]. Barnes and Xiao's [23] also affirmed that because the blockchain ledgers cannot be modified or deleted the data is immutable. The feature safeguards all documents stored in the blockchain and subsequently makes the technology valuable to financial institutes and other institutions or organizations that deal with financial issues, since it has the potential to checks financial frauds.

With these inherent features, blockchain can potentially promote and enhance processes and service provision within various organizations [24]. However, this is not to claim that blockchain is a panacea to all organizational shortcomings, but it has the capacity for greater achievement for the organization of all kinds. The technology according to [25] is valuable in the financial organization as its contributions to financial organizations include but are not limited to eliminating the

need for intermediation and enhancing direct transactions between trading parties. Blockchain's usefulness is indispensable in the music industry [26]. In the same vein, an empirical study conducted by [24] on "the impact of blockchain technology on business models – a taxonomy and archetypal patterns" identify five archetypal patterns, which enhance the understanding of how blockchain technology affects existing and creates new business models.

2.1 Library Practices that Require Application of Blockchain Technology

Record Management
It is not an overstatement stating that record management is an integral function of any organization that deals with humans. Library as an organization cannot exempt from this role. The library has long been known for keeping document and are expected to provide high-quality information service to their patron at any point in time. Library records according to [22] are an integral form of evidence concerning accountability to the citizens, including such diverse categories of records as administrative records, registration files, financial records, and historical records. For these records to be used in their evidentiary capacity, they must be created, managed, and preserved, respectively, applicable policies, legislation, regulations, standards, codes of practice, procedures, and community expectations [27]. The tremendous increase in information resources and the explosive growth of digital devices and related applications as noted by [28] have collectively altered the traditional resource management practice in the library beyond recognition. Ensuring effective financial records of e-resources and databases, which are usually transact with unknown and untrusted party, is a challenging issue to most libraries. Besides, managing large volume of scholarly production, disseminating them to the wider user community, and preserving them for future use are other areas of concern to the library.

Above all is the ineffectiveness in securing the available records. Rein and Peterson [29] allege that despite libraries' best efforts to protect their systems, criminals might gain access to their databases and steal or manipulate records. Blockchain technology can help libraries in digitizing existing records and manage them within a secure infrastructure; once digital information is committed onto a blockchain, it is permanently stored and impossible to manipulate or hack [22].

Protection of Copyright
The potentiality of blockchain technology to serve as an effective digital right management tool qualify it to protect the copyright of materials stored in it. Because digital resources are inherently reproducible, they are indiscriminately reproduced by most users without the consent of the author or publisher. This has often led to the problem of piracy in the economy. This attitude has prompted publishers to

impose a digital management tool known as "draconian" on libraries and consumers to prevent copying their materials, but unfortunately, it was unworkable [30]. This heinous act debasing academic exercise can be overcome through blockchain technology. Because the blockchain creates a unique, verifiable record that can be accessed by anyone, it could be tied to digital materials and used as a method to show "provable scarcity" of that resource; this would allow digital materials to be uniquely identified, controlled, and transferred [30].

Resource Sharing Among Libraries

Resource sharing is the process by which resources facilities and services of the member institutions are shared effectively [31]. The practice of sharing resources among libraries has been an old and important activity because no library can independently satisfy the information needs of its users with its collection. Resource sharing activities usually include but are not limited to interlibrary lending, sharing of expertise, union list of periodicals, union catalog, directory of resource person, directory of research, training programs, and providing online open-access catalog (OPAC). This activity has some challenging factors, like poor funding, inadequate communication system, an uncooperative attitude of librarians, lack of trained staff, inadequate available resources, lack of mailing or transportation system, and inadequate security of materials, which usually undercut sharing practice among libraries, thereby hindering effective dissemination of information resources among information seekers. Although some libraries at their various capacities have deployed modern technologies to strengthen the weaknesses and improve on resource sharing practice, [32] argued that blockchain technology could serve best for this purpose because it possesses the following advantages – anonymity, efficiency, cost savings, security, flexibility, and many others. With the outlined advantages, blockchain technology can enable libraries to facilitate peer-to-peer sharing beyond just books, which could help members of the community authenticate the availability of different tools or services for a more efficient sharing economy. Though blockchain makes it harder to change these shared documents, it can help in making them more secure. This is in advocacy with [33] that user-centric blockchain applications could enable end users to control, trace, and claim ownership of every piece of content they share.

Partnership with Other Organizations

Successful collaboration among organizations is not easily achievable [34]. This is because most partners do lack commitment, lie, or cheat. Moreover, at times poor communication gap and transportation system together with other related issues may lead to uncompromising the terms of the agreement among the collaborative parties. However, [34] aver that blockchain can highly support collaborations, because it is a digital ledger where several people have joint control over shared information. The authors further explain that such a feature makes the blockchain technology ideal for situations where trust and information sharing are important. The outcome of an investigation on the applications of blockchain in libraries revealed that the technology among other things greatly facilitates partnership across centers/organizations [14]. The investigators explain that libraries can partner

with museums, universities, and government agencies to share machine-readable catalog (MARC) records, authority control, and user-generated content through a blockchain framework.

Endorsement of Personal Data

This is also and another crucial activity of the library. As an entity, the library keeps the personal data of its employees. These data include the credentials and employment records of every employee in the establishment. It is these records that determine the retirement age or period of disengagement of an employee. With the high rate of corruption in most organizations, which the library is not an exception, some staff do falsify their record to enable them to stay longer than the required time in the system. Such attitude consequently retards the progress of the organization, because such employees may no longer be strong enough to contribute effectively to the progress of the organization. Consequentially, an attitude of such kind, in the long run, leads to ineffectiveness and the inefficiency of the organization. Moreover, it contributes to the high rate of unemployment on the part of the youths, as the able men and women who have the energy and zeal to contribute positively toward increased productivity of the organization find it difficult to secure employment opportunities. However, such a devastating scenario could be ameliorated through the introduction or adoption of blockchain technology in the organization to checkmate such practices.

2.2 Challenges Associated with Adoption and Use of Blockchain in Libraries

Although scholars from different perspectives have revealed the abilities of blockchain technology in various organizations, most organizations in Nigeria are yet to benefit from it due to the following constraints.

Poor Funding: As noted [35], inadequate government funding inhibits IT application by African libraries. Poor funding is a major factor confronting Nigerian organizations in deploying modern technologies, because most of the organizations cannot afford the huge amount of money for the provision of the technologies. In libraries, for instance, the 10% budgetary allocation allotted to them by their parent institutions cannot sufficiently run the affairs of the library and afford to purchase modern technology such as blockchain. The situation in the library is even more alarming as [36] reveals that most libraries get lesser than 10% of their institution's budgetary allocation due to slim internal generated revenue and high rate of expenditure.

Lack of In-Service Training: Although the core knowledge and skills of traditional librarianship are still useful in this digital era, they need to be augmented by new technological knowledge [37]. Upgrading of skills and knowledge could be possible through in-service training. In-service training is a means of addressing weaknesses in staff performance, but, more importantly, it enables the staff to

upgrade their knowledge and skills to contribute effectively in an environment of ongoing change. Mthembu and Ocholla [38] are of the view that poor or nonexistent training affects the use of digital technologies and the difficulties in retaining qualified staff in most libraries deter adoption of modern technologies for managing the affairs of the library.

Lack of Management Support: Management support and commitment are proportional to the effective adoption and implementation of new technologies in any organization. In this regard, [39] maintain that management has the power to adopt or reject new technologies from being used by the organization. In the case of blockchain technology, most administrators are scared of adopting it, because it has high values of visibility and transparency, which makes it to lack privacy. In advocacy, [40] state that not every administrator supports these values, as it is capable of exposing their illegal practices and decisions.

Poor Broadband Connectivity: The issue of broadband connectivity is worsening daily in the country. Zubairu et al. [41] **reported that** Nigeria has fallen behind others in terms of broadband penetration. Actually, with the increasing rate of Internet connectivity and frequent vandalization of broadband infrastructure, the broadband connectivity in most organizations in the country is usually low.

Irregular Power Supply: Irregular power supply is another issue of great concern concerning the effective functioning of technological appliances in Nigeria. The intermittent power supply does not only cause malfunctioning of information and communication technologies but also leads to poor broadband connectivity, which is very irritating and disruptive.

Data Storage Capacity Limitation: Data storage capacity limitation in blockchain factor limiting its implementation in most organizations. Considering its cost efficiency, performance, and flexibility, the real design challenge is to decide what data and computation should be placed on-chain and what data should be stored off-chain. A common practice for storing data in the blockchain ledger is to store raw data off-chain and to store meta-data, small critical data, and hashes of the raw data only on-chain [42].

In summary, this section has extensively reviewed various literature concerning blockchain technology for a better understanding of the technology. The section highlights various areas of library practices that require the application of blockchain technology and however identify the most challenging factors to the implementation of the technology in the library. Of all the literature reviewed, none is conducted on blockchain technology in library practices. This, therefore, creates the gap which this study intends to fill.

3 Research Method

The study adopts a descriptive survey design. The design is deemed appropriate, because the study intends to describe the existing state of blockchain technology in libraries in the study area without manipulating the variables. The study is concluded

Table 1 Distribution of population size according to gender

S/N	Institutions	Academic librarians		
		Male	Female	Total
1	Libraries	31	37	68
2	Nnamdi Azikiwe library, UNN	17	13	30
3	Festus Aghagbo Nwako library, NAU	5	8	13
4	MOUAU library	6	10	16
5	FUTO library	4	2	6
Total		63	70	133

in Southeast Nigeria, which consists of five states – Enugu, Imo, Abia, Anambra, and Ebonyi. Each of these states has a federal university and their libraries are used for this study (Table 1). The population of the study is 133. It comprises all the academic librarians of the libraries under study. The study is a census study; thus, it requires no sample. A questionnaire and focus group discussion were used for data collection. A total of 133 questionnaires was administered to the respondents, and a returned rate of 86.5% was obtained. Data collected was analyzed using mean.

An item with a mean score below 2.5 is rejected, while items with a mean score of 2.50 and above are accepted.

3.1 Presentation and Analysis of Data

Table 2 displays respondents' mean responses on the library practices that require the application of blockchain technology. The data display in the table shows that resource sharing, protection of copyright, and record management with mean scores of 3.06, 3.05 and 2.92, respectively, require application of blockchain technology, whereas library tour ($\overline{X} = 2.23$) and user education ($\overline{X} = 2.03$) barely require application of blockchain technology.

Table 3 shows the extent to which blockchain technology could enhance library practices. The data displayed on the table indicates that blockchain technology can enhance the protection of copyright ($\overline{X} = 3.69$), record management ($\overline{X} = 3.59$), and resource sharing among libraries ($\overline{X} = 3.56$) to a very high extent. The table equally reveals that the technology has the potential to enhance endorsement of personal data and encourage partnership between libraries and other organizations to a high extent. The information on the table also indicates that blockchain technology is not an enhancing mechanism for library tours ($\overline{X} = 2.37$) and user education ($\overline{X} = 2.41$) as their mean score is below the criterion mean of 2.50.

Table 4 displays the respondents' mean responses on the various ways Nigerian libraries could support and encourage librarians to embrace emerging technologies. As indicated in the table, organizing seminars and workshops ($\overline{X} = 3.3$), in-service training ($\overline{X} = 2.97$), sponsoring conferences and workshops ($\overline{X} = 2.92$), and research grants ($\overline{X} = 2.75$) are the most supportive measures for encouraging

Table 2 Library practices that require the application of blockchain technology

No	Item statement	Strongly agree	Agree	Disagree	Strongly disagree	Mean	Decision
1	Endorsement of personal data	27	48	27	13	2.77	Agree
2	Record management	41	38	22	14	2.92	Agree
3	Protection of copyright	53	30	17	15	3.05	Agree
4	Resource sharing	41	53	8	13	3.06	Agree
5	Encouraging partnership with other organization	46	29	23	17	2.9	Agree
6	Library tour	20	18	45	32	2.23	Disagree
7.	User education	20	12	34	49	2.03	Disagree

Table 3 Extent blockchain technology could enhance library practices

S/N	Item statement	Very high extent	High extent	Low extent	Very low extent	Mean	Decision
1	Endorsement of personal data	29	37	19	30	2.57	High extent
2	Record management	78	27	10	0	3.59	Very high extent
3	Protection of copyright	85	27	0	3	3.69	Very high extent
4	Resource sharing among libraries	67	45	3	0	3.56	High extent
5	Encouraging partnership with other organization	40	36	27	12	2.9	High extent
6	Library tour	8	38	58	11	2.37	Low extent
7.	User education	36	15	24	40	2.41	Low extent

librarians to embrace emerging technology. However, the respondents disagree on the employment of skilled workers and staff promotion as supportive measures for librarians to embrace emerging technologies. The low mean score of 2.32 and 2.03, respectively, against the items indicated this.

Table 5 above discloses the mean response of the librarian on the challenges associated with the adoption and use of blockchain technology in Nigerian libraries. As indicated in the table, the respondents agree on all the items as factors confronting the adoption and use of blockchain technology in Nigerian libraries. The respondents' high mean scores above the criterion mean of 2.50 on all the items on

Table 4 Ways through which Nigerian libraries could support and encourage librarians to embrace emerging technologies

No	Item statement	Strongly agree	Agree	Disagree	Strongly disagree	Mean	Decision
1	In-service training	30	55	27	3	2.97	Agree
2	Research grant	28	45	27	15	2.75	Agree
3	Organizing seminars and workshop	64	30	13	8	3.3	Agree
4	Promotion	20	12	34	49	2.03	Agree
5	Employing skilled workers	45	36	14	20	2.32	Agree
6	Sponsorship for conferences and workshop	36	10	24	45	2.92	Agree

Table 5 What are the challenges associated with the adoption and use of blockchain technology in Nigerian libraries?

No	Item statement	Strongly agree	Agree	Disagree	Strongly disagree	Mean	Decision
1	Poor funding	68	6	12	29	2.98	Agree
2	Lack of in-service training	24	44	34	13	2.69	Agree
3	Lack of management support	36	16	45	18	2.61	Agree
4	Poor broadband connectivity	34	48	14	19	2.84	Agree
5	Irregular power supply	50	20	10	35	2.74	Agree
6	Lack of skilled technicians	37	53	12	13	2.99	Agree
7	Poor attitude of librarians toward knowledge update	10	12	44	49	1.85	Disagree

the table are proof. The low mean of 1.85 on item no.7 indicates a negative response on the item.

4 Discussion of Major Findings

From the data collected and analyzed in Table 2, it was discovered that various library practices, such as resource sharing among libraries, endorsement of personal data, record management, partnership with other organization, and protection of copyright, require application of blockchain technology. These findings are corresponding with [30], who reports that the problem of piracy is a serious issue between the publishers and libraries. However, he reveals that such a problem can be

controlled through the use of blockchain technology. According to [30], blockchain creates a unique, verifiable record that can be accessed by anyone; it could be tied to digital materials and used as a method to show "provable scarcity" of that resource; this would allow digital materials to be uniquely identified, controlled, and transferred [30]. The finding is also in line with [32], who argued the numerous challenges (lack of trained staff, inadequate available resources, lack of mailing or transportation system, inadequate security) characterizing resource sharing can be eliminated through the use of blockchain technology as the technology possesses distinct features, such as anonymity, efficiency, cost savings, security, flexibility, and many others. The finding to the study also relates with [22], who found out that blockchain technology can help libraries in digitizing existing records and manage them within a secure infrastructure; once digital information is committed onto a blockchain, it is permanently stored and impossible to manipulate or hack. It was also discovered that user education and library tours do not require blockchain technology. Response from the focus group discussion in this regard reveals that user education and library tour are programs through which librarians educate users on how to make efficient use of library resources and for the fact that blockchain is usually for safeguarding documents and enhancing online financial payment it does not have much influence on instruction programs.

Data presented in Table 3 reveals that blockchain technology could enhance most library practices to a high extent. This finding corresponds with [34] that blockchain can highly support collaborations, because it is a digital ledger where several people have joint control over shared information. It is also in line with the findings of [14], who after conducting a study on the applications of blockchain in libraries reveals that the technology among other things greatly facilitates partnership across centers/organizations.

The study also discovered various supportive measures that could encourage librarians to embrace emerging technology. These measures among other things are in-service training, organizing seminars and workshops, and providing research grants. This finding agrees with [37]; although the core knowledge and skills of traditional librarianship are still useful in this digital era, they need to be augmented by new technological knowledge. It also relates with the finding of [38] that poor or nonexistent training affects the use of digital technologies and the difficulties in retaining qualified staff in most libraries deter adoption of modern technologies for managing the affairs of the library. The respondents, through a focus group discussion, revealed that research grants, sponsoring of conferences, and workshops are very good measures for skill update, but unfortunately, they are not awardable by most libraries due to insufficient budget. The respondents also report that at times sponsoring conferences and workshops is not certain, because the library administration may not be buoyant at the time of conference or workshop.

Finally, the study identified various factors delaying the adoption and use of blockchain technology in Nigerian libraries. These factors among others include poor funding, inadequately skilled technicians, poor broadband connectivity, lack of in-service training, irregular power supply, and lack of management support. The finding coincides with [35] that inadequate government funding inhibits IT

application by African libraries. It also corresponds with [41] that the issue of broadband connectivity is worsening daily in the country. The respondents in a focus group discussion also report on the poor state of Internet connectivity. They explain that poor Internet connectivity and intermittent power supply hinder most of the online conferences and seminars, which would have been a great help to them to upgrade their knowledge and skill.

Implication of the Study

The findings of the study show that various practices of the library need to be enhanced to achieve greater productivity, standardization, and reliability. Most irregularities, like delay in service delivery, resource sharing, poor record management, and inadequate protection of authors' copyright, are issues of great concern. The implication is that the library may lose its worth and users will develop negative thinking and attitudes toward its usage. This will consequently lead to the underutilization of the library and its resources.

5 Conclusion

Based on the research findings, the paper concludes that the poor state of most library practices in the study area is not encouraging. But related literature reviewed shows that blockchain could serve best in enhancing the various practice of the library. However, some factors were identified as constraints hindering the adoption and use of blockchain in libraries. These factors among others are poor funding, lack of management support, irregular power supply, and poor broadband connectivity. There is, therefore, a need to take necessary action to encourage the adoption and use of blockchain technology in the library, since it can improve most library activities and achieve global best practices.

Acknowledgments It is a pleasure to acknowledge the support provided by Nnamdi Azikiwe Library, University of Nigeria, through its computer center and cataloging section. My thanks also go to my mentors, who always encouraged me to add to existing knowledge. To the authors, especially [43] whose article titled "A Step-by-Step Guide for Choosing Project Topics and Writing Research Papers in ICT Related Disciplines" serves as the pillar for building this paper, and librarians of various universities that were used for this research study, I am very grateful to you all.

References

1. Anyim, W. O. (2017). Improving reference services in Federal University Libraries in Southeast Nigeria using interpersonal communication mechanism. *Review of Information Science and Technology Journal, 2*(1), 27–38.
2. Noh, Y., & Chang, R. (2020). A study on the factors of public library use by residents. *Journal of Librarianship and Information Science 2020, 52*(4), 1110–1125.

3. Bohannon, J. (2016). The bitcoin busts. *Science, 351*(6278), 1144–1146.
4. Treiblmaier, H., & Beck, R. (2019). *Business transformation through blockchain* (Vol. 2, pp. 3–8). Springer.
5. Balaji, P. B., Vinay, M. S., Shalini, B. G., & Mohan, J. R. (2018). An integrative review of web 3.0 in academic libraries. *Library Hi Technical News, 35*(4), 13–17.
6. Lnes, S., Ubacht, J., & Janssen, M. (2017). Blockchain in government: Benefits and implications of distributed ledger technology for information sharing. *Government Information Quarterly, 34*, 355–364.
7. Abayomi-Zannu, T. P., Odun-Ayo, I., Tatama, B. F., & Misra, S. (2020). Implementing a mobile voting system utilizing blockchain technology and two-factor authentication in Nigeria. In *Proceedings of first international conference on computing, communications, and cybersecurity (IC4S 2019)* (pp. 857–872). Springer.
8. Malyarov, N. (2019). The impacts of advanced technology on libraries and education. *The Insider: The Future of Libraries Magazine.*
9. Gillwald A., Odufuwa, F., & Mothobi, O. (2018). *The state of ICT in Nigeria*.
10. United Nations. (2016). *E-government survey*. UNO.
11. Zubairu, H. A., Oyefolahan, I. O., Babakano, F. J., Etuk, S. O., & Mohammed. (2016). I.: Assessing the e-readiness of Nigeria for digital economy. *American Journal of Computer Science and Information Technology, 8*(2), 50.
12. Ayo-Olafare, F. R. (2020). Global trends and emerging technologies in libraries and information science. *Library Philosophy and Practice (e-journal), 3835*.
13. Hoy, M. B. (2017). An introduction to the blockchain and its implications for libraries and medicine. *Medical Reference Services Quarterly, 36*(3), 273–279.
14. Brown, J. L. (2018). Blockchain in the library? Researchers explore potential applications. *Digital Learning in Higher Education*.
15. Coghill, J. G. (2018). Blockchain and its implications for libraries. *Journal of Electronic Resources in Medical Libraries, 15*(2), 1–5.
16. Atozori, M. (2017). Blockchain technology and decentralized governance: Is the state still necessary? *Journal of Governance and Regulation, 6*(1), 45–62.
17. Blockgeeks, S. (2016). *What is blockchain technology?* A step-by-step guide for beginners http://blockgeeks.com/guides/what-is-blockchaintechnology.
18. Shaw (2016). *Smart surveillance: An enterprise-grade video surveillance solution for small and medium-sized businesses*. United State of America: California.
19. Mougayar, W. (2016). *The business blockchain: Promise, practice, and application of the next internet technology*. Wiley.
20. Ying, W., Jia, S., & Du, W. (2018). Digital enablement of blockchain: Evidence from HNA group. *International Journal of Information Management, 39*, 1–4.
21. Bünz, B., Bootle, J., Boneh, D., Poelstra, A., Wuille, P., & Maxwell, G. (2017). Bulletproofs: Short proofs for confidential transactions and more. In *Institute of Electrical and Electronics Engineers (IEEE) symposium on security and privacy (SP)* (pp. 315–334).
22. Masenya, T. M. (2020). Application of modern technologies in the management of records in public libraries. *Journal of the South African Society of Archivists, 53*, 65–79.
23. Barnes III, B. W., Xiao, B. (2019). *Organizational adoption of blockchain technology: An ecosystem perspective proceeding of the twenty-fourth digital workshop*. Mumch, Germany, December.
24. Weking, J., Mandalenaki, M., Hein, A., Hermes, S., Böhm, M., & Krcmar, H. (2019). The impact of blockchain technology on business models – A taxonomy and archetypal patterns. *Electronic Markets, 2020*(30), 285–305.
25. Short, C. (2018). Blockchain applications. *Modern Trader, 1*(539), 21.
26. Silvia, A. C (2019). *Blockchain challenges to copyright revamping the online music industry*. Master of Laws in European Intellectual Property Law Stockholm University.
27. Shepherd, E., & Yeo, G. (2003). *Managing records; a handbook of principles and practice*. Facet publishing.

28. Raju, J. (2014). Knowledge and skills for the digital era academic library. *The Journal of Academic Librarianship, 40*, 163–170.
29. Rein, L., & Peterson, A. (2015). *What you need to know about the hack of government background investigations*. The Washington Post.
30. Griffey, J. (2016). Blockchain and intellectual property. *Internet Librarian*.
31. Rifaudeen, M. M. (2008). The problems of resource sharing in Sri-Lanka: the case among scientific and technical libraries. A conference paper presented at the *International conference on information and knowledge management at Healthnet Nepal*, T.U. Central Library, Nepal March.
32. Bauerle, N. (2017). *How does blockchain technology work?* https://www.coindesk.com/information/how-does-blockchain-technology-work.
33. Chakravorty, A., Liang, C.R. (2017). Ushare: Use controlled social media based on blockchain. *Proceedings of the 11th international conference on ubiquitous information management and communication.* IMCOM.
34. Lumineau, F., Wang, W., Schilke, O., & Huang, L. (2021). How blockchain simplify partnerships. *Harvard Business Review*.
35. Irenoa, K. O., Emilian, B., & Eru, J. (2019). Funding academic libraries in Nigeria for effective services: Alternative to resource development and library management. *Journal of Library and Information Science, 21*(1), 104–111.
36. Alabi, A. T., Mojisola, O. O., & Abdulkareem, A. Y. (2013). Budgeting systems in universities in Southwest Nigeria. *Makere Journal of Higher Education, 4*(2), 203–219.
37. Dalkir, K. (2017). *Knowledge management in theory and practice* (3rd ed.). Cambridge MIT Press.
38. Mthembu, M. S., & Ocholla, D. (2019). Perceptions on job requirements of LIS graduates in public libraries: A reflection on public libraries in KwaZulu-Natal. *South Africa Mousaion, 36*(4), 1–5.
39. Amron, M. T., Ibrahima, R., Bakara, N. A., & Chuprata, S. (2019). Determining factors influencing the acceptance of cloud computing implementation. The fifth information systems international conference. *Procedia Computer Science, 161*, 1055–1063.
40. Leible, S., Schlager, S., Schubotz, M., & Gipp, B. (2019). A review on blockchain technology and blockchain projects fostering open science. *Frontiers Blockchain, 2*, 16.
41. Zubairu, H. A., Oyefolahan, I. O., Babakano, F. J., Etuk, S. O., & Mohammed, I. (2020). Assessing the e-readiness of Nigeria for digital economy. *American Journal of Computer Science and Information Technology, 8*(2), 50.
42. Xu, Q., Aung, K. M., Zhu, Y., & Yong, K. L. (2028). A Blockchain-based storage system for data analytics in the internet of things. *Studies in Computational Intelligence, 715*, 119–138.
43. Misra, S., Muhammad-Bello, B. (Eds.) (2021) *ICTA 2020, CCIS 1350* (pp. 727–744). Springer Nature Switzerland AG.