

To cite this article: Obim, I.E., Ukwueze, P. O, & Nwadike, C.. (2023) Utilization of Blockchain Technology for Effective Circulation Control in University Libraries in South-East, Nigeria. *Information Impact: Journal of Information and Knowledge Management*, 14:2, 1-15
DOI <https://dx.doi.org/10.4314/ijikm.v14i2.1>

To link to this article: <https://dx.doi.org/10.4314/ijikm.v14i2.1>

Utilization of Blockchain Technology for Effective Circulation Control in University Libraries in South-East, Nigeria

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Abstract

The study examined the utilization of block chain technology for effective circulation control in university libraries in Southeast, Nigeria. The study employed descriptive survey research design. The population of the study comprised of 472 librarians in 10 federal and state-owned universities in South-East, Nigeria. Total enumeration technique was used to study the entire population of librarians in the study area. Online structured questionnaire was used to collect the opinions of the librarians due to the constraint of distributing and accessing the respondents physically as a result of the ASUU strike. WhatsApp Groups of the various state chapters of Nigerian Library Association (NLA) in South-East Nigeria were used as method of sharing the link of the online questionnaire. Data collected were analyzed using frequency count, mean and standard deviation. The findings revealed among other things that, there was no extent of utilization of block chain technology among the university libraries studied for record keeping, tracking of transactions of users, reservation of resources, charging and discharging of information resources in university libraries in Southeast, Nigeria as there was a mean score of 1.61 for keeping and tracking records of registered users. However, it was agreed that, utilization of blockchain technology will facilitate effective circulation control in the university libraries. Lack of awareness, technophobia, inadequate skills and competence and inadequate technological facilities are the major challenges associated with the utilization of block chain technology in university libraries. The study recommended among other things that; university management should organize in-house training of librarians in the use of blockchain technology. Also, adequate technological facilities should be acquired and the work environment in the university libraries should be conducive for librarians.

Keywords

Block chain technology, circulation control, university libraries, record keeping, utilization

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Introduction

Technological advancement of the fourth industrial revolution (4IR) which includes blockchain technology has penetrated many industries including educational sector and most importantly the library which is the hub of information. The utilization of blockchain technology in libraries can facilitate enhanced metadata systems, maximum protection of users' records and details, and any form of resource sharing over cyberspace. This study sought to examine the extent of utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria.

Circulation section is the image maker of the library as it is the first section most users of the library have contact with, thus it has an influence on the public opinion and perceptions of the entire university library. According to Aina (2004) circulation control is a vital function in the library which include registration of new users, keeping records and tracks of registered users, charging and discharging of information resources, renewal of material borrowed, and reservation of book, sending overdue notices among others. Arsdale (2015) stated that circulation control entails the library functions of registration of new users, charging and discharging of books, issuance of overdue notice, reservation of books, preparing books for repair, taking stock of books in circulation with special emphasizes to books on open shelves, loan or reservation. These functions are critical and indispensable in libraries as it is the first point for users visiting the university library for the first time. Circulation of Library materials is central and imperative in every library operation (Adebowale, et. al, 2013). Circulation control is technical and tedious if done manually as misplacement of record can lead to loss of resources, thus a secured, reliable and fast technology such as blockchain technology has the potential to facilitate effective circulation control.

Blockchain technology is an extremely cutting-edge and emerging hi-tech that can be creatively applied to library service delivery, particularly circulation control. According to International Business Machine (IBM) (2022), blockchain technology can be defined as collective, immutable record that enables the process of recording transaction and tracking resources in a business network. Hussain (2020) opined that blockchain technology is broadly based on distributed ledger technology (DLT), technology that records transactions with an immutable cryptographic signature named hash. Similarly, Zayyad (2022) stated that, blockchain is a group or series of records for transactions structured into blocks that describe a section of a ledger or register, which is shared among peers, who trust on it as a secured and reliable authority to decide the validity of the records or ledger. The technology is called blockchain because each block in the ledger is connected to the block after it, forming a chain of blocks of interrelated records.

In the library parlance, blockchain technology can be used for keeping records of registered users, immutable records of books on the open shelves, loan or reservation which can be easily shared with other sections of the library for effective service delivery. Abid (2021) stated that, blockchain technology has the potential to solve diverse challenges in libraries as it is most appropriate for the storage of information in a distributed temper resistant setting. The author furthered that, blockchain in library settings can be used to gather, preserve and share authoritative information devoid of many technological hurdles. This implies that when utilized effectively, blockchain technology can facilitate secured transactions in the circulation section of the University libraries.

University libraries can utilize blockchain technology to make the tedious and rigorous functions in the circulation section more secure, fast, and efficient, thereby facilitating effective circulation control. According to Carrie (2019), blockchain technology is fast evolving and growing and Librarians, most especially those in university libraries who are serving large number of users have to understand the potentials of blockchain technology in terms of applicability, benefits and the risks of utilizing the technology in libraries. The author furthered that, blockchain technology will be a valuable technology for storage, preservation and dissemination of information in libraries. Abid (2021) postulated that blockchain technology can protect registered users' records as well as advance the privacy of users' biodata. With blockchain Technology the collaboration amongst library users and librarians can be enhanced geometrically. Thus, every university library that seeks to achieve effective circulation control should integrate and utilize blockchain technology in performing the tedious functions in circulation section.

Despite the numerous benefits of blockchain technology as a tool for facilitating effective circulation control most especially in areas of record keeping, tracking of records, sharing of stored records and protecting of records against external interference as mentioned in previous paragraph, the extent to which university libraries, most especially public university libraries in Southeast are utilizing blockchain technology for circulation functions is not certain due to lack of previous comprehensive empirical data. A search of the existing online literature reveals a scarcity of empirical studies on the use of blockchain technology in libraries, particularly in circulation control. However, efforts were made to review the few identified studies (such as Zayyad (2022); Carrie (2019). Abid (2021) stated that the utilization of blockchain technology in libraries has many advantages; some of which are increased capacity,

better security, immutability, and faster settlement. Similarly, Ahram, et al. (2017) stated that, blockchain technology provides improved security for a network of interconnected computer nodes that are used for networking transactions in the libraries. According to Mondal (2021), blockchain technology is amazingly a cutting-edge technology which if utilized for library services can facilitate accuracy of transaction records and quick tracking, cost reductions, efficient transactions, secure transactions, and transparency of records of transactions among others. Also, Lemieux (2016) postulated that, in this contemporary era characterized by rapid technological revolution, blockchain technology is most suitable for handling issues related to information integrity, since blockchain technology presence improved information management control, transparency, trust, efficiency, accountability, accessibility and security architecture.

Some challenges affecting the utilization of blockchain technology in university libraries, most especially for circulation control are lack of awareness of blockchain technology among librarians, inadequate skills and competence of utilizing blockchain technology among librarians, inadequate technological facilities for utilizing blockchain technology in university libraries, inadequate internet connectivity in university libraries among others. Orick (2000) stated that, keeping abreast of new technologies is an uphill battle in libraries, due to many challenges; some of such are inadequate skills of emerging technologies among staff, inadequate funding, technological inadequacy and the unwillingness of librarians to utilize emerging technologies among others.

In order to enhance the utilization of blockchain technology in university libraries, most especially for circulation control, the university library management should create awareness of blockchain technology among their staff through training and retraining; provide adequate technological infrastructures, adequate funding, employ technological skilled individuals among others. Abid (2021) suggested that libraries should consider the technical know-how of their staff, technological resources available, finance for acquiring standard infrastructures, and proactive staff. Emphasizing the place of adequate funding in enhancing the utilization of emerging technologies in libraries, Orick (2000) opines that, integrating any new technology in libraries or any other institution or organization requires a hefty budget. As identified earlier in this study, there is a paucity of empirical literature on the utilization of blockchain technology for university library services, most especially for circulation control. This is despite the potential of blockchain technology as a secured tool for protecting records of material and human resources in libraries, most especially the biodata of registered users against unauthorized access, among others. This is the gap in literature that the present study sought to fill.

Purpose of the Study

The main purpose of the study is to examine the extent of utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria. Specifically, the study sought to:

1. examine the extent of utilization of blockchain technology for circulation control system of information resources in university libraries in Southeast, Nigeria;
2. ascertain the extent to which the utilization of blockchain technology facilitates effective circulation control in university libraries in Southeast, Nigeria;
3. identify the perceived challenges associated with the utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria;
4. proffer perceived strategies to enhance the utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria.

Research Method

The study adopted descriptive survey design. According to Nworgu (2015) descriptive survey is the type of research design that seeks to collecting data on a particular phenomenon and describing the data collected in an organized manner to understand the characteristics, features or facts about a given population. Thus, descriptive survey was considered suitable because this study seeks to collect, describe and summarize empirical data on the extent of utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria. Secondly, descriptive survey research design was adopted for the study because the study is not interested in establishing the casual relationship among and between two or more variables. The population of the study was 472 librarians in 10 federal and state-owned universities in Southeast, Nigeria.

Total enumeration technique was used. Thus, no sampling technique was employed and no sample was selected. Online structured questionnaire was used to collect data from the respondents due to the constraint of accessing the respondents physically as a result of the eight months ASUU strike of 2022. The online structured questionnaire was titled "Extent of Utilization of Blockchain Technology for Effective Circulation Control in University Libraries Questionnaire (EUBTECCULQ)" which was constructed by the researcher and validated by three senior researchers in the field of Library and Information Science. The questionnaire consists of four parts; each answering one of the research questions guiding the study. The first part focused on the

extent of utilization of blockchain technology for circulation control system of information resources in university libraries, with eleven items. The second part, focused on determining the extent to which the utilization of blockchain technology facilitates effective circulation control in university libraries with nine items. The third part focused on identifying the challenges associated with the utilization of blockchain technology for effective circulation control in university libraries, with seven items. While the fourth part focused on the various strategies to enhance the utilization of blockchain technology for effective circulation control in university libraries, with seven items also. The response option was weighted using 4-point Likert scale. WhatsApp Groups of the various state chapter of NLA in South East Nigeria were used as a method of sharing the link of the online questionnaire; the researcher also sent the link to individual members via their emails. Data collected were analyzed using frequency count, mean and standard deviation. The decision rule for acceptance or rejection of the idea covered by an item, on the basis of the mean score of respondents was a benchmark of '2.50'. This implies that a respondents' mean score of 2.49 and below in an item, indicates disagreement/rejection of the view of an item, while a mean score of '2.50' and above implied acceptance of the said item.

Results

The result of the study was presented according to the research questions that guided the study. Three hundred and ninety six 396 librarians across the ten states and federal university libraries responded to the survey.

Table 1: Mean Response on the Extent of Utilization of Blockchain Technology for Circulation Control System of Information Resources in University Libraries in Southeast, Nigeria

S/N	Item Statement	VHE	HE	LE	VLE	Mean	St.D
1	Blockchain technology is utilized for keeping and tracking records of registered users	0	0	241	155	1.61	0.49
2	Blockchain technology is utilized for keeping records and tracking information resources on loan	0	0	187	209	1.47	0.50
3	Blockchain technology is utilized for sharing information on the eligibility of registered users to borrow	0	0	151	245	1.38	0.49

	information resources and the duration						
4	Blockchain technology is utilized for tracking information resources on open circulation shelves	0	0	148	248	1.37	0.48
5	Blockchain technology is utilized for the process of charging and discharging books in the university library	0	0	93	303	1.23	0.42
6	Blockchain technology is utilized for sharing details of registered users with overdue books for easy tracking	0	0	57	339	1.14	0.35
7	Blockchain technology is utilized for keeping records of the daily transactions in the circulation section of the university library	0	0	360	36	1.09	0.29
8	Blockchain technology is utilized for keeping records of user's request for reservation of books	0	0	35	361	1.09	0.28
9	Blockchain technology is utilized for storing records of information resources on reservation	0	0	24	372	1.07	0.24
10	Blockchain technology is utilized for tracking information resources that are overdue for return.	0	0	369	27	1.07	0.25
11	Blockchain technology is utilized for sharing records of information resources between cooperating libraries for inter library loan	0	0	6	390	1.01	0.12
	Aggregate Mean	-	-	-	-	1.23	0.36

Criterion Mean=2.50

The result above shows that, Blockchain technology has a mean score of 1.61 for keeping and tracking records of registered users. For keeping records and tracking information resources on loan with 1.47 mean score. For sharing information on the

eligibility of registered users to borrow information resources and the duration with 1.38 mean score. For tracking information resources on open circulation shelves with 1.37 mean score. For the process of charging and discharging books in the university library, with 1.23 mean score among other functions in the circulation section of the university library as none of the functions of the circulation section presented by the researcher obtained a mean score that is up to the criterion mean of 2.50. This implies that Blockchain technology was not utilized for circulation control system of information resources in university libraries in Southeast, Nigeria.

Table 2: Mean Response on the Perceived Extent to which the Utilization of Blockchain Technology Facilitates Effective Circulation Control in University Libraries in Southeast, Nigeria.

S/N	Items statement	VHE	HE	LE	VLE	Mean	St.D
1	It facilitates quick charging and discharging of books without repeating the rigorous practices of stamping, signing, filing etc. that characterizes manual circulation system.	72	171	99	54	2.66	0.92
2	It will record and preserve the daily transactions of the entire activities in the circulation section which can be tracked easily	72	135	144	45	2.59	0.91
3	It will facilitate secured record keeping of the entire registered users of the library with their full details	72	135	126	63	2.55	0.97
4	Blockchain technology will facilitate effective tracking of information resources on loan	63	144	126	63	2.52	0.94
5	It will improve the keeping of records of user's request for reservation of books	54	153	108	81	2.45	0.97
6	It will facilitate easy tracking of books on loan, especially overdue books	63	135	117	81	2.45	0.99
7	It will facilitate a secured records of books on the circulation open shelves of the	45	171	99	81	2.45	0.94

	university library.						
8	It will provide sufficient personal details of users with overdue books	54	153	108	81	2.45	0.97
9	It will facilitate interlibrary loan by sharing adequate records of information resources among and between cooperating libraries	36	153	135	71	2.39	0.89
	Aggregate Mean	-	-	-	-	2.50	0.94

Criterion Mean=2.50

Results from table 2 above shows that majority of the respondents accepted that the utilization of blockchain technology can facilitate quick charging and discharging of books without repeating the rigorous practices of stamping, signing, filing etc. that characterizes manual circulation system with 2.66 mean score. Others also believed that blockchain technology will record and preserve the daily transactions of the entire activities in the circulation section which can be tracked easily, with 2.59 mean score. Followed by those who believed that, utilization of blockchain technology will facilitate secured record keeping of the entire registered users of the library with their full details, with 2.55 mean score. And some who accepted that, blockchain technology will facilitate effective tracking of information resources on loan, with 2.52 mean score. On the contrary, many of the librarians who are unaware of the potentials of blockchain technology disagree that it can improve the keeping of records of user's request for reservation of books, facilitate easy tracking of books on loan, especially overdue books, facilitate a secured records of books on the circulation open shelves of the university library, provide sufficient personal details of users with overdue books, and facilitate interlibrary loan by sharing adequate records of information resources among and between cooperating libraries with 2.45, 2.45, 2.45, 2.45 and 2.39 mean score respectively which is less than the criterion mean of 2.50 mean score. In conclusion, the extent to which librarians perceive the utilization of Blockchain technology to facilitate effective circulation control in university libraries in South East, Nigeria is high.

Table 3: Mean Response on the Perceived Challenges Affecting the Utilization of Blockchain Technology for Effective Circulation Control in University Libraries in Southeast, Nigeria

S/N	Challenges	SA	A	D	SD	Mean	St.D
1	Lack of awareness of blockchain technology among librarians	270	99	9	18	3.57	0.75
2	Inadequate technological facilities for utilizing blockchain technology in university libraries	243	126	18	9	3.52	0.69
3	Lack of institutional policy mandating university libraries to utilize blockchain technology	234	126	27	9	3.48	0.72
4	Inadequate skills and competence of utilizing blockchain technology among librarians	243	90	45	18	3.41	0.86
5	Erratic electric power supply in university libraries	234	99	45	18	3.39	0.86
6	Inadequate internet connectivity in university libraries	207	126	54	9	3.34	0.80
7	Technophobia	180	117	81	18	3.16	0.90
	Aggregate Mean	-	-	-	-	3.41	0.80

Criterion Mean=2.50

Results from Table 3 shows that the major perceived challenges affecting the utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria is lack of awareness of blockchain technology among librarians with 3.57 mean score and a total respondents' number of 270 out of 472 strongly agreeing that lack of awareness is a challenge. Followed by inadequate technological facilities for utilizing blockchain technology in university libraries, with 3.52 mean score and a total respondents' population of 243 strongly agreeing. Other challenges include Lack of institutional policy mandating university libraries to utilize blockchain technology, with 3.48 mean score and a population frequency of 234, and inadequate skills and competence of utilizing blockchain technology among librarians, with 3.41 mean score and 243 population frequency. While, the least challenge is technophobia, with 3.16 mean score and population size of 180.

Table 4: Mean Response on the perceived strategies to enhance the utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria

S/N	Strategies	SA	A	D	SD	Mean	St.D	Decision
1	University management should organize in-house training for librarians in the use of blockchain technology.	270	108	18	0	3.64	0.57	Accepted
2	Adequate technological facilities should be acquired and installed	261	126	9	0	3.64	0.53	Accepted
3	Provision of adequate and constant internet connectivity	288	81	18	9	3.64	0.68	Accepted
4	Work environment in the university libraries should be conducive for librarians to adopt and utilize emerging technologies	252	126	18	0	3.59	0.58	Accepted
5	University library management should encourage their staff to cultivate positive attitude towards utilizing emerging technologies	252	117	18	9	3.55	0.69	Accepted
6	Provision of constant electric power supply	225	144	18	9	3.48	0.69	Accepted
7	Formulation of institutional policy mandating librarians to adopt and utilize emerging technologies for effective service delivery	234	126	18	18	3.45	0.78	Accepted
	Aggregate Mean	-	-	-	-	3.57	0.65	Accepted

Criterion Mean=2.50

Table 4 shows that the major perceived strategies to enhance the utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria are that, University management should organize in-house training for librarians in the use of blockchain technology, with 3.64 mean score and 270 respondents strongly agreeing to it, having same mean as adequate technological facilities should be acquired and installed with a total of 261 respondents strongly agreeing to it and also the provision of adequate and constant internet connectivity with 288 strongly agreed respondents. Other strategies are work environment in the university libraries should be conducive for librarians to adopt and utilize emerging technologies, university library management should encourage their staff to cultivate positive attitude towards utilizing emerging technologies, provision of constant electric

power supply, and formulation of institutional policy mandating librarians to adopt and utilize emerging technologies for effective service delivery, with 3.59, 3.55, 3.48, and 3.45 mean score respectively.

Discussion of the Findings

To begin with, the findings revealed that, the extent of utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria is very low as no university library studied is utilizing blockchain technology for circulation functions such as keeping records and tracking information resources on loan, sharing information on the eligibility of registered users to borrow information resources and the duration, tracking information resources on open circulation shelves, charging and discharging books in the university library, and sharing records of information resources between cooperating libraries for inter library loan among other functions. This implies that university libraries in Southeastern Nigeria are yet to utilize blockchain technology for circulation control. This finding is in accordance with that of Lemieux (2016) who stated that most libraries and information centers are yet to explore the advantage of blockchain technology for their services.

In addition, the findings revealed that, blockchain technology will facilitate effective circulation control in university libraries if utilized. It was agreed that the utilization of blockchain technology will facilitate quick charging and discharging of books without repeating the rigorous practices of stamping, signing, filing etc. that characterizes manual circulation system. It will also facilitate secured record keeping of the entire registered users of the library with their full details; facilitate effective tracking of information resources on loan among others. This implies that blockchain technology has much potential which can facilitate effective circulation control in university libraries. This finding further validates the assertion of Abid (2021) that the utilization of blockchain technology in libraries has many advantages; some of which are increased capacity, better security, immutability, and faster settlement. The findings also supports with that of Mondal (2021) who stated that, blockchain Technology is an amazing cutting-edge technology which if utilized for library services can facilitate accuracy of transaction records and quick tracking, cost reductions, efficient transactions, secure transactions, and transparency of records of transactions among others.

Furthermore, the findings revealed that the major challenges affecting the utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria are lack of awareness of blockchain technology among librarians, inadequate technological facilities for utilizing blockchain technology in university libraries, lack of institutional policy mandating university libraries to utilize

blockchain technology and inadequate skills and competence of utilizing blockchain technology among librarians. The findings is in agreement with that of Orick (2000) who stated that, keeping abreast of new technologies is an uphill battle in libraries, due to many challenges, some of such are inadequate skills of emerging technologies among staff, inadequate funding, technological inadequacy and the unwillingness of librarians to utilize emerging technologies among others.

Yet another finding revealed that, organizing in-house training for librarians in the use of blockchain technology, acquisition and installation of adequate technological facilities, provision of adequate and constant internet connectivity, creating conducive work environment for librarians, and motivating librarians to adopt and utilize blockchain technology are the major strategies to enhance the utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria. The above findings further validates that of Abid (2021) who suggested that libraries should consider the technical know-how of their staff, technological resources available, finance for acquiring standard infrastructures, and proactive staff.

Conclusion

The study examined the extent of utilization of blockchain technology for effective circulation control in university libraries in Southeast, Nigeria. Based on the findings the study concluded that, no state nor federal university libraries in southeastern Nigeria is utilizing blockchain technology for their functions which is majorly due to lack of awareness of blockchain technology among librarians, inadequate technological facilities for utilizing blockchain technology in university libraries, lack of institutional policy mandating university libraries to utilize blockchain technology and inadequate skills and competence of utilizing blockchain technology among librarians. The practical implication of this study is that it will create the awareness of blockchain technology among librarians who will be encouraged to acquire much skill either through training or self-study.

Recommendations

The following recommendations were suggested:

1. Awareness of blockchain technology should be created among librarians through in-house training, sponsorship to national and international conferences, seminars and workshops. The librarians are also expected to acquire the skills of utilizing blockchain technology through the above-mentioned medium of awareness.
2. University management should acquire and install adequate technological facilities required to utilize blockchain technology such as internet connectivity, hardware and other telecommunication facilities.

3. Work environment in the university libraries should be conducive for librarians to adopt and utilize emerging technologies.
4. University library management should encourage their staff to cultivate positive attitude towards utilizing emerging technologies.
5. Constant electric power should be provided in university libraries. Alternatively, solar power should be provided in university libraries

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