
Advancement of Smart Academic Libraries in Northern Nigeria: Issues and Way Forward

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ABSTRACT: *The 21st century is known as the beginning of the knowledge age; a millennium characterized by leveraging on information to stay ahead using technology. The library occupies a critical place in the quality of information accessed and leveraged on by researchers and students. Academic libraries in Nigeria are not disconnected from this technology-based-information revolution. This study looked at advancement of smart academic libraries in Northern Nigeria: issues and way forward. Its objectives was to determine smart services available, investigate the extent of deployment, examine the underlying issues that hinder effective smart service delivery and proffer strategies for way forward in Northern university public academic libraries in Nigeria. The study adopted a review of documents and literature on smart academic libraries in Nigeria. Five public universities were purposively observed and sampled on their smart library perspective and capacity. Google-Forms-structured questionnaire was used through different online platforms. Simple percentage and frequencies were used in analyzing data collected. Findings showed that there are existing smart library services in the academic libraries of Northern Nigerian public universities but the extent of deployment of smart library services in their academic libraries is low. The research also revealed the numerous issues faced in providing smart services. The study recommended that the institution and library managements of academic libraries in Northern Nigerian public universities step up on ICT policy framework, practical deployment of smart library technologies and training of library staff for improved smart services.*

KEYWORDS: Academic Libraries, Artificial Intelligence, Northern Nigeria, Nigeria, Smart Library, Technology.

INTRODUCTION

We live in a world where innovations have pervaded every aspect of society; standing on the brink of diverse technological revolution that have fundamentally altered the way we think, live, work, and connect with one another. From rapid change in education to religion, from ethics and accepted

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norms to economic redefinition and new perspectives in social standings; everything has evolved with the process of time. The complexity in the transformation is unlike anything humans have experienced before now because its scope and scale. This brings to mind the different shifts in time as a result of stages of industrial revolution (IR). At some point in time, water and steam power was used for mechanize production in the 1st IR, the discovery of electric power, prompted its use to create mass production in the 2nd IR. Advancement in discovery of electronics and information technology brought about automation in the 3rd IR while the 4th IR strongly consolidated on the third by improving on the digital revolution; closing the existing gaps between the physical, digital, and biological spheres through the fusion of technologies. The 4th IR evolved at an exponential pace, defying all norms of development. It disrupted almost every industry all over the world by the transformation it introduced in the systems of governance, management, production and marketing. Representing a fundamental change in the way we live, work and relate to one another. Enabled by extraordinary technology advances superior to those of the first, second and third IRs. 4 IR became a new chapter in human development, as these advances began to merge the physical, digital and biological worlds in ways that create both huge promise and potential jeopardy. Forcing us to rethink how countries develop, how organizations create value and even what it means to be human. The age brought more than just technology-driven change; it is an opportunity to help everyone, including leaders, policymakers and people from all income groups and nations, to harness converging technologies in order to create an inclusive, human-centered future (Jain, Mnjama, Jorosi, and Oladokun, 2022). In order to consolidate on the 4 IR, the 5 IR is now in place. The 5th IR is advocating for the advancement of deeper and broader concepts. It incorporates concepts such as “sustainability,” “human-centeredness,” and “concern for the environment” in addition to transformation of the industrial structure through the utilization of Artificial Intelligence (AI), Internet of Things (IoT), Big data, etc., which was debated in the Fourth Industrial Revolution (Murata Newsletter, 2023). It is centered on the Humans and Machines Synergy; which is expected to deepen the integration between Humans and Technology (human-technology fusion). It presents strong emphasis on personalization and craftsmanship dedicated to the better customer experience using technologies like AI, robotics. Artificial intelligence is already around us and substantial progress has been made in it in recent years, as seen in the innovation of self-driving cars to educational virtual assistants and software that translate, develop, suggest, discover research connections, edit and summarize academic works. With proper computing power, it also possess the ability predict diverse cultural interests. This underscores the fact that we are yet to grasp the magnitude of the changing aspects that are yet to be revealed. The only certain aspect in the whole process is that stakeholders in the academia are not left out.

In all of these happenings, libraries have not been singled out from these undeniable changes in every sphere of the society. The evolution of libraries has happened through three stages namely

Publication of the European Centre for Research Training and Development-UK modernization, automation and digitization (Nahak & Padhi, 2019). This means that Library materials have also evolved from one stage to the other; from clay tablets to papyrus, cuneiforms, books, CDs, microforms, e-books, database resources, open access, to virtual resources. Consequently, academic libraries in recent years have witnessed significant changes in the mode of providing information services as a result of information and communication technologies, prompting the traditional methods of information dissemination to give way to electronic means of communication. In the past, the passive and standalone function of academic libraries was the provision of books. Today, academic libraries and librarians no longer play that passive role, rather they have assumed active roles; evolved with the digital age to meet the changing needs of their patrons. They are no longer custodians of just physical books but the gate way to a myriad of information sources; new roles in information provision, dissemination and transfer. The development in the application of ICT in library operations improved and facilitated the dissemination of information and access. This has made information providers (academic librarians) to be constantly under pressure to provide relevant sources of information to their immediate communities because technology promotes change and it enforces the change. Since academic libraries have adopted these technologies, it means that they have welcomed the notion of smart academic libraries.

In the context of the Northern Nigerian Universities under study, the notion of smart academic library is an idea largely welcomed theoretically and less in practice. This is evident in their capacity to adapt, their collection development approach, their capacity to adequately provide the needed technology for the patrons, the sagacity of academic librarians' technical know-how and show-how, the environment, management and logistics preparedness, their level of information literacy and the information user-behavior of especially the University management, library management and academic librarians. These libraries have made significant attempts towards achieving the smart status, giving credence to the fact that it is a necessity not a choice, going by the current global realities especially as it pertains better service delivery for users as well as the increase in the value of the library. It proves that the acceptance is not in doubt. However, the degree to which it is accepted and the effort put in place to achieve it is what has played out in the process over time. It is in this light that this paper takes a look at the advancement of smart academic libraries in Northern Nigeria, bringing out the issues limiting its growth and possible way forward.

Against this background, the study's general focus of is to discuss on the advancement of smart academic libraries in Nigeria and examine the issues and way forward. Specifically, the study seeks to:

- a. Determine smart services in academic libraries of Northern Nigerian public universities.

- b. Investigate the extent of deployment of smart technologies in academic libraries of Northern Nigerian public universities.
- c. Examine the underlying issues that hinder effective smart service delivery in academic libraries of Northern Nigerian public universities and
- d. proffer strategies for way forward

LITERATURE REVIEW

Academic libraries of the 21st century are dynamic instruments of tertiary education that support the overall objectives of the institutions they belong to. They achieve this by activating their pertinent place in the disseminating scholarly information to support teaching and research, providing access to computers, the internet, electronic databases, hardware and software for learning, orientation to patrons and scholars on new developments in information literacy and information resources. Additionally, academic libraries have improved on their roles as it relates to information gathering, management and access through the collation, digitization and distribution of electronic materials/contents into their campus digital repositories, and in some cases, publishing open-access electronic journals in their various communities that is visible and accessible to the world.

Smart Academic Libraries

The term "smart library" refers to a library that has implemented various digital tools, such as online databases, e-books, and mobile applications to enhance its offerings and streamline its processes. The concept of a smart library represents a shift towards a more digital and technology-driven approach to library management and services (Achugbue, Igere and Azih, 2023). Smart libraries leverage on modern technologies to improve its operations and services. It is designed in such a way that information seekers can access the institutions' library remotely at their own convenience without visiting the physical library. Even when users visit Smart libraries, they use the readily available technologies at the library to satisfy their information needs. Baryshev, Verkhovets and Babina (2018) posit that the term "Smart library" appears in various contexts as a synonym for the concept of an intellectual library, digital library or virtual library. The term "smart" means flexible, adaptive, extendible, acknowledging and human. Emphatically, being smart literally means having and showing a quick-witted intelligence. Wang, Chen, Xu, and Wang (2019) and Zhang, Xu & Wang (2021) opine that a smart library is another kind of library that takes on present day innovations, for example, artificial intelligence, machine learning, man-made consciousness, the Web of Things, distributed computing, and huge information to upgrade the administration of library assets, work on the nature of library administrations, and increment client fulfillment. This means that smart libraries (SL) are also products of advanced technologies, such as Artificial Intelligence (AI) machine learning, automation, and data analytics, to enhance library

Publication of the European Centre for Research Training and Development-UK services and operations. This is embedded in their ability as computers or computer-controlled robots to perform tasks commonly associated with human intelligence. Thus, SL is a modern library that coordinates conventional library assets with computerized assets and furnishes clients with a more helpful and customized library experience.

Essentially, a smart library is designed in such a way that any library user who has a computer and connection to the library network can access not only the resources of that library but also a variety of information available through national and international networks without necessarily being physically present in the library. This is buttressed by the position of Baryshev, Babina, Zakharov, Kazantseva, and Pikov, (2015) who stated that SL is of a library that provides services that are interactive, innovative, informative, real, changing and international. Therefore, within the context of this research, given the various definitions above, a smart academic library is a modernized library that incorporates technology to optimize the quality and volume of library's resources, enhance the experience of library users and provide access to a vast collection of resources in various formats, such as e-books, e-journals, and multimedia materials, using digital technology.

Components of a Smart Library

According to Orji and Anyira (2021), in the context of the library, the term SMART is an acronym for the components of a smart library. Thus, being SMART stands for:

S=Services

M=Methods

A=Automation

R=Resources

T=Technology

Brief Explanations below:

1. Services

Library Smart services are largely based on artificial intelligence. This means that technological devices are involved in carrying out functions that librarians perform. These services can be divided into services given in the physical spaces of the library and that of the online/virtual interfaces.

2. Methods

The two dominant methods for delivering smart library services are physical method and online method. Both of them have the internet imbedded in them.

3. Automation

Automation is a working idea of using technologies to reduce human intervention in processes; its highest point is the invention of the Internet of Things (IoT). As a result, collected data is then transferred over a network without requiring human strength.

4. Resources

Relevant resources in this context are hinged on human and material resources. All resources put into use in any smart library project are geared towards better user satisfaction.

5. Technology

Technology is most essential among all the factors that determine smart libraries. Its existence is the strongest impetus for the smart library services.

Based on the above placement, a smart academic library must have machines (technologies) programmed with human intelligence to perform specified library functions just like any trained librarian. That is, for smart library services, there is a presence of a fusion of hardware and software installed to act as librarians by human intelligence.

Therefore, it is apt to say that the increasing advancement in technology has permeated the fabrics of library and information services in glaring and undeniable ways. There is now a symbiotic relationship between library services and technology because libraries are service-based organisations and technology has particularly transformed service-based organisations with hyper advancement in technologies. These technologies are the primary reason why this era is tagged as an advanced information technology era. Corfe (2018) supports this assertion by stating that this era has the latest advanced technologies that are building the digital revolution that commenced in the second half of the 20th Century. Tella, (2020) added that these technologies include but are not limited to the Internet of things, IoT; big data, robotics, artificial intelligence block-chain, additive technology, nanomaterial, cloud computing neurotechnology, synthetic biology, energy storage, machine learning, virtual reality, and others. It is of great interest to note that a substantial number of these technologies have found their way into the libraries activities and services.

METHODOLOGY

The study adopted a review of documents and literature on smart academic libraries in Nigeria. The documents were collected from five different online databases, especially from Google Scholar and those accessed through the University of Jos Online Electronic Databases like Proquest Research Library, Aggregated Journal Library Subscription (AJLS), sponsored by TETFund (Tertiary Education Trust Fund), and ARDI: Access to Research for Development and Innovation. The documents reviewed were on the existing modes of academic libraries in Nigerian public universities to identify the new ways through the acceptance smart academic libraries. Current literature on the present advancement in technology that is influencing the normal Nigerian academic libraries was also used. Five public universities were purposively sampled and observed on their smart library perspective and capacity. Google-Forms-structured questionnaire was used through different online platforms like WhatsApp and Telegram for library staff groups, students

Publication of the European Centre for Research Training and Development-UK groups and lecturers groups in the respective universities. The Scope of the study borders on the advancement of smart academic libraries in Nigerian public universities, identifying the challenges and proffering solutions. The selected libraries in Northern Nigeria are University of Jos, Abubakar Tafawa Balewa University; ATBU Bauchi, Benue State University, Makurdi; BSUM, Plateau State University; PlaSU and Federal University Lafia, FULafia. In data analysis, simple percentage and frequencies were used for the respective data collected. In addition, the related literature used from the listed sources above were based on the objectives of the study which were to determine smart services in academic libraries of Northern Nigerian public universities, investigate the extent of deployment of smart technologies in academic libraries of Northern Nigerian public universities, examine the underlying issues that hinder effective smart service delivery in academic libraries of Northern Nigerian public universities and proffer strategies for way forward. Findings of the analysis were thematically presented based the objectives of the study as indicated above.

RESPONDENTS DATA

Population and Sample Size of the Universities Studied

Respondents	Designation	Sample Size
Academic Librarians	Library operations and services	30
Library Officers/Para Professionals	Library operation Assistants	40
Patron A- Lecturers	Registered Library Users	35
Patron B- Students		125
Total		230

Source: Field Work

FINDINGS

Based on the objectives of the study, this section focuses on analysis of data presentation and findings. The Google-Forms-structured questionnaire used through different online platforms like WhatsApp and Telegram, returned 230 forms but 200 of them were validly completed while 30 were not. The research compiled its data based on the valid ones.

Smart services in Northern Public Universities academic library in Nigeria

Smart Library Services	Available	Percentage	Not Available	Percentage
Gate register through biometrics	0	0%	200	100%
Virtual library tour	10	5%	190	95%
Internet / Network	180	90%	20	10%
Library Management software	130	65%	70	35%
Electronic mail service (E-mail)	8	4%	192	96%
Google drive/Google books	145	72.5%	55	27.5%
Quick Response (QR) Code	40	20%	160	80%
OPAC services	190	95%	10	5%
Institutional repositories	197	98.5%	3	1.5%
E-document/E-journals	200	100%	0	0%
Electronic document delivery (EDD)	120	60%	80	40%
Virtual/online Library marketing and promotion service	50	25%	150	75%
Blogs	5	2.5%	195	97.5%
Online instruction/User education	85	42.5%	115	57.5%
Online readers advisory services	8	4%	192	96%
Kiosk in the library	0	0%	200	100%

Respondents Perspective. Source: Field Work

Table 1 reveals the information on the existing smart library services in the Northern public universities studied. As shown in the Table, there are reasonable positions of some of the services in the academic libraries but majority of the respondents view agrees more with the non-availability of the smart services listed above. Each of the smart service listed is shown with its percentage of availability and non-availability to better clarify their respective positions.

Extent of deployment of smart technologies in public university academic libraries in Northern Nigeria

Measured by use of VHE (Very High Extent) HE (High Extent) ME (Moderate Extent) LE (Low Extent) NE (No Extent)

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Extent of deployment of Smart Technologies	VHE	HE	ME	LE	NE
Gate register through biometrics	-	-	-	8	192
Virtual library tour	-	-	8	12	180
Internet / Network	-	45	50	105	-
Library Management software	-	30	55	95	20
Electronic mail service (E-mail)	5	10	40	45	100
Google drive/google books	2	20	45	100	33
Quick Response (QR) Code	-	-	3	97	100
OPAC services	33	47	100	20	-
Institutional repositories	75	95	15	10	5
E-document/E-journals	82	79	30	9	-
Electronic document delivery (EDD)	-	65	42	50	43
Virtual/online Library marketing and promotion service	-	-	76	45	79
Blogs	-	5	66	58	71
Online instruction/User education	8	28	33	67	64
Online readers advisory services	-	-	-	82	118
Kiosk in the library	1	-	5	18	176

Respondents Perspective. Source: Field Work

Data presented in Table 2 revealed that the aggregate position of the respondents points more to the negative. This implies that the extent of deployment of smart library services in public university academic libraries in Northern Nigeria is low. Based on the respective position of each respondent, the table clearly shows that less of their views are seen in the positive position. Therefore, it was concluded that the deployment of smart library technologies is not sufficient.

Underlying issues that hinder effective smart service delivery in Northern public universities academic libraries

Measured by use of VHE (Very High Extent) HE (High Extent) ME (Moderate Extent) LE (Low Extent) NE (No Extent)

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Issues that hinder Effective Smart Service Delivery	VHE	HE	ME	LE	NE
Unstable Power Supply	180	20	-	-	-
Inadequate Smart Technology devices	140	55	5	-	-
Poor Internet / Network services	90	70	25	15	-
Inadequate use of Library Management software	70	102	21	7	-
Inadequate Orientation on Library Smart Services	28	107	45	12	8
Restricted Access Some to Library Smart services e.g Electronic Resources Database login details	68	101	31	-	-
Librarians and Library Officers with Negative/indifferent attitude towards Smart Technologies	181	15	4	-	-
Lack of federated Search Engine	156	42	1	1	-
Inadequate knowledge on Smart technology Usage by patrons	74	72	50	1	3
Low online presence of academic Libraries in marketing and promotion their services	180	18	2	-	-
Inadequate Smart-skilled Academic Librarians	104	67	17	11	1
Ineffective library eateries and relaxation spots for patrons to take breaks	192	7	1	-	-

Respondents Perspective. Source: Field Work

As shown in table 3, this aspect of the objective was achieved through guided close ended questions. It was discovered that majority of the problems listed were on the side of very high extent. Even in aspects that it was not so, it measures up strongly when added to the 'high extent', which is in the same trajectory. The finding in table 3 proves that these problems are highly felt by academic libraries in Northern Nigeria.

Strategies: Way Forward

Measured by use of VHE (Very High Extent) HE (High Extent) ME (Moderate Extent) LE (Low Extent) NE (No Extent)

Way Forward	VHE	HE	ME	LE	NE
Alternative Quality Power Supply	196	4	-	-	-
Adequate funding and Monitoring	145	67	12	-	-
Training and Re-training of Librarians	128	75	3	-	-
Regular Orientation on Library Smart Services	67	64	49	15	5
Inculcation of federated Search Engine	178	18	4	-	-
Compulsory courses on Smart technology Usage for all patrons	65	105	18	7	5
Virtual/Online Library Marketing and Promotion Team (VOLiMPT)	38	85	45	28	4
Development of Library App	117	72	9	2	-
Developing library eateries and relaxation spots	149	32	19	-	-

Respondents Perspective. Source: Field Work

Based on the close ended format, suggested strategies were identified and respondents had options to place their views. Table 4 shows that the listed solutions are in accordance. Respondents made their views very strong in the positions listed as most of the findings are on the ‘very high extent’. This implies that there is a need to improve the state of smart services in Northern academic libraries.

DISCUSSION

The findings of this study shed light on several important aspects of the Smart library services and deployment in Northern public university academic libraries. Respective results support the research question that there are existing smart library services in Northern public university academic libraries. This is consistent with the global trend in smart service delivery. However, the level at which they operate their smart services in the academic libraries under study is on the negative side. What this means is that conscious efforts need to be practically put in place to match the verbal acceptance of smart services to actions. This aspect aligns with the second objective of the study which disclosed the extent of deployment of smart library services in Northern public university academic libraries is low. It buttresses the need for Northern public universities in Nigeria to follow the trend of what operates in the global environment in the area of smart services in their academic libraries where Generative Artificial Intelligence and Robots are presently being

Publication of the European Centre for Research Training and Development-UK used to enhance information service delivery. In the southern part of Nigeria, University of Lagos has taken the lead on this aspect as it has a robot known as Libby. The university uses it to augment their academic library operations. This makes the university one of the pioneer universities in Africa to achieve this feat. This is also a challenge to the management of Northern universities and the management of their academic libraries; it is very important that mentioned authorities take practical steps in making funds available to acquire these advanced technologies as this is what dominates the scene in most of developed academic universities presently.

On the challenges, they are numerous and deep. The foremost of all is the attitude of librarians and library officers towards smart services. Based on the data in table 3, it is the second highest, but in terms of categorization on scale of importance, it is an integral aspect that needs to be visited. Irrespective of all the challenges in place, this group of persons (professionals) has the ability to ameliorate these issues and provide soft landing for library users. In situation where a library staff is not in tune with the rapid change all around and such person is saddled with the responsibility of bringing the change, it become a humongous setback, especially when the room for improvement is strongly not given or not yearned for. Other challenges in table 4 are also strong, pointing to the fact that to serve the patrons well in this era, most of the Northern public university libraries need re-skilling and up-skilling, new innovations and approaches to deploy smart services. Strategies to ameliorate these challenges have also been suggested with quality alternative power supply strong in the suggestions. Development of federated search (all in one search engine) for library users will cut down the need to seek for login details and searching through different databases to get needed information. Library app is also another aspect that is expected to improve on the library-patron relationship and boost the use of library visits, both physical and virtual. One integral aspect here too is the area of funding. Smart academic library requires a lot of financial resources because the technologies involved are not cheap. Fervent financial input is constantly needed to keep it running efficiently in an updated status.

CONCLUSION AND RECOMMENDATIONS

The study focused on the advancement of smart academic libraries in Northern Nigeria: issues and way forward. The research exposed that there are existing smart library services in the academic libraries of Northern Nigerian public universities but that the extent of deployment of smart library services in their academic libraries is low. The research also revealed the numerous issues faced in the process of providing smart services. Based on findings of the study, it recommends that the institution and library managements of academic libraries in Northern Nigerian public universities step up by developing realistic and measurable ICT policy framework, backed by the practical deployment of smart library technologies and training of library staff for improved smart services as obtained globally.

Limitations of the Study

The researchers acknowledge that the findings of the study cannot be generalized beyond the case study areas as the study covered 5 universities in Northern Nigeria. However, these findings may serve as guide/motivation to the North and other geopolitical zones in Nigeria seeking to operate smart academic libraries in their higher institutions of learning. The researchers also understand that processes involved in goal attainment are dynamic in nature; centripetal and centrifugal forces greatly affect them. Thus, this study covers for the active period of this research as development or underdevelopment may have taken place after this research in this research area.

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