

DIGITAL TRANSFORMATION AND SERVICE DELIVERY IN ACADEMIC LIBRARIES: A POST COVID-19 APPROACH

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Abstract

In the library environment, digital transformation has revolutionised in-house routine and service delivery such that users can access adequate and current information promptly and remotely. This paper examined the digital readiness of academic libraries in Nigeria in relation to adoption of the major variables considered in the study as indices of digital transformation applicable to deploying library services. These are: kiosk technology; QR code technology; mobile technology; artificial intelligence and Radio Frequency Identification. Also, identifying library services that are being deployed using the listed digital technologies; assessing how digital transformation has impacted positively on library patronage and examining the challenges faced in adopting digital transformation were part of the objectives of the study. The study population was academic libraries in Nigeria and sample was drawn purposively from 18 universities in South-West Nigeria. Findings revealed that digital transformation is yet to be fully embraced in Nigerian university libraries. Also, there is no significant change in the use of digital technologies in the deployment of library services in Nigerian academic libraries pre and post Covid-19 era. Though the study established that digital transformation has impacted library patronage greatly and positively, the greatest challenges facing digital transformation is paucity of funds and lack of infrastructure. The study recommends that organisational policy that supports the adoption of digital technologies in libraries must be put in place. Also, since the annual subvention allocated to libraries is barely enough, library managers should adopt public private partnership to assist in meeting some of their financial obligations.

Keywords: Digital transformation, service delivery, artificial intelligence, academic libraries, Covid-19.

Introduction

In the digital world, transformation has wielded a supernatural force that has impacted on almost all aspects of human endeavour causing a rapid shift from the analogue way of doing things to the digital format. The emergence of the global pandemic - Covid -19 further lend credence to the technological revolution that ushered in digital transformation in almost all aspects of human endeavour. Mergel et

al (2019) associated digital transformation with the need to use new technologies to stay competitive in the internet age where services and products are delivered both online and off-line. Bhaskar (2022) described digital transformation as the integration of technology into all areas of a business, essentially changing how business operates. In other words, digital transformation could be referred to as the process of using digital technologies to create or change existing business operations and pattern in order to meet market postulations and consumer's needs.

Digital transformation otherwise referred to as web 4.0 is subsumed in the Fourth Industrial Revolution (4IR). Even before the emergence of the global pandemic Covid-19, the Fourth Industrial Revolution (4IR) has already ushered in an increase in utilisation of new technologies such as cloud computing, artificial intelligence, robotics, advanced wireless technologies, 3D printing, Internet of Things (IoT), extensive information and research, online networks and others (Akpobasah et al, 2022; Foresight Africa, 2020). The 4IR which is a fusion of digital, biological and physical words is characterised with Mobile App through the use of smart phones (Schwab, 2016). In the library environment, digital transformation has revolutionised in-house routine and service delivery such that users can access adequate and current information promptly and remotely. Bradley (2018) submits that digital transformation in libraries may include provision of Kiosk based services, mobile based services, institutional repositories, multimedia contents, electronic information resources (books & journals), SMS services and so on. Indeed, research has established that 'the information profession and discipline has influenced and advanced digital transformation through data, information, knowledge, technology, people, and services (Makori, 2021).

Though already embraced by some libraries especially in developed nations, the emergence of the novel pandemic Covid-19 gave rise to rapid transformation of the traditional mode of library operations to the digital mode where various technological tools are being deployed to deliver library services in terms of provision, access and use of information resources even in developing countries such as Nigeria. This transformation otherwise referred to as the 'new normal' is making waves and turning the tides of the status quo ante that libraries were used to. Today, across the world, traditional library services such as reference service has metamorphosed to virtual or online reference live chat, traditional card catalogue to online public access catalogue (OPAC) and recently to mobile online public access catalogue (MOPAC), current awareness service (CAS) to content alert service, interlibrary loan to online interlibrary loan and service, and so on. It must be noted that these paradigm shift was easy for libraries in developed nations as some of them were already rendering services digitally, especially the academic libraries.(cite). It is obvious that the 4IR has ushered in digital technologies that are reshaping and transforming our world and libraries are not lagging behind in this transformation. Importantly, digital transformation for libraries is a paradigm shift from print resources and physical services to digital environment. Service delivery is the bane of any library's existence. Covid-19 pandemic no doubt has transformed the traditional mode of service delivery in libraries

such that use of technological tools has taken the center stage of delivering library services. This development has turned the tides of the status quo ante that libraries were used to; and academic libraries as research hubs were at the forefront of this transformation. It is not certain if this shift has been embraced in Nigerian university libraries. This study aims at exploring the extent to which digital transformation has affected service delivery in Nigerian libraries especially post Covid-19 era. However, this discourse is limited to university libraries in Nigeria and it is believed that the outcome of this study will serve as an expose to where we are as a nation and further guide on the way forward.

Objectives of the Study

The general objective of the study is to explore the extent to which digital transformation has affected service delivery in Nigerian Universities especially post Covid-19 era. To achieve this, the specific objectives that guided the study are:

1. Ascertaining the digital transformation readiness of academic libraries in Nigeria.
2. Identify library services that are being deployed digitally in Nigerian academic libraries.
3. Assessing how digital transformation has impacted positively on library patronage.
4. Examining the challenges faced by academic libraries in embracing digital transformation.

Concept of digital transformation

The concept of digital transformation was heralded by the proliferation of technologies. All over the world, there has been growing demand for use of technologies in carrying out activities that were hitherto performed manually especially in the area of business information even before the outbreak of the global pandemic. Organisations – public, private and not for profit as well as individuals were beginning to leverage on digital competencies to manage their businesses in order to remain relevant and competitive (Harlem Campus, 2023). The upsurge of the pandemic – Covid-19 further lend credence to the use of digital technologies in almost all spheres of human endeavour. For libraries where service delivery is the bane of their existence, digital technologies were already embraced in pockets to perform some of its operations. Activities like digital archiving of print resources; library automation; online public access catalogue (OPAC), and so on already witnessed transformation from analogue to digital mode.

However, the outbreak of Covid-19 pandemic played a major role in the rapid transformation of other traditional mode of library operations to the digital mode where various technological tools are being deployed to deliver library services in terms of provision, access and use of information resources. This transformation otherwise referred to as the ‘new normal’ is making waves and turning the tides of the status quo ante that libraries were used to. In the words of Mergel et al (2019); Makori and Bitso

(2021); Ikenwe and Udem (2022), digital transformation is associated with the need to use new technologies to stay competitive in the internet age where services and products are delivered both online and offline. In the context of this study, digital transformation simply means using technology to transform library services delivery.

Digital transformation and library services pre and during the Covid-19 era

Before the emergence of the 4IR, modern libraries of the world have started recognizing the presence of the web 2.0 as well as the mobile services in creating interactions that promote a digital culture for library users (Bradley, 2010). It was a period the world experienced computerization and web-based interconnectivity which led to accelerated and global research through online technology amongst other things (David-West, 2021). During this period, many of the library routines were performed using the opportunities presented by information communication technologies. One major advantage of web 2.0 is that it encourages people to interact and collaborate online and because it is a participatory social web, interaction in social media discourse became the in thing (Shukla, 2022) and libraries took advantage of this in delivering services to its users.

Though, provision of library services via the online environment is not totally strange to libraries, the emergence of Covi-19 ushered a monumental increase across the libraries of the world. Durodolu, Ibenne and Dube (2021) averred that during the wake of Covid-19, libraries moved from traditional methods of providing information resources to the online platform. In addition to existing services, new library services that were deployed using digital environment especially in academic libraries emerged. These include: additional website information, artificial intelligence (chatbots), online LibGuide access (Molepo & Shokane, 2021); online requests for information resources, remote access to electronic resources, free and expanded access to e-resources, open access resources, free access to covid-19 related resources, assistance in technological initiatives, news/orders and guidelines on covid-19, easing of penalty rules for all types of reading materials, assistance in information searching and scholarly writing, email alert services, plagiarism checking and grammarly services, organisation of virtual events (Dadhe & Dubey, 2020) and so on.

Meanwhile, some authorities affirmed that the fourth industrial revolution (4IR) is under way (David-West, 2022; Schwab, 2016) but in the opinion of the authors of the on-going study, it seems the 4IR is here with us. Events playing out globally in all human endeavours are indications that the world is already experiencing the fourth industrial revolution. The 4IR which is associated with networking, virtualisation and digitization has to do with automation and data exchange in manufacturing technologies that are based on digital technology (Spotti & Windelband, 2020). The implication of this for libraries is that many of the in-house functions and traditional library services and many more will be deployed using digital technologies. This was already happening in modern libraries and the outbreak of Covid -19 accelerated it further. This digital transmission of library services and resources which relies on information communication technology and mobile technologies is a new terrain and a

paradigm shift from physical to digital environment. For instance, libraries now use self-service tools like Library Kiosk and Quick Response Code (QR) to provide 24/7 library services to their users. Singh (2018) affirms that many reputed libraries in India and other countries are already using library kiosk as a self-service tools to provide unlimited access to their resources.

Apart from library kiosk and QR Code, other library services that were ushered in by digital transformation include: mobile public access catalogue (MOPAC), mobile library website, mobile databases, QR Code, E- resources platform, Online reference service, Audio Video tutorials, Institutional repository, Online Educational Resources (OER), E-mail/SMS alert, Ask a Librarian, Library blogs, Library orientation, Library user guide and so on. Some of these services can be delivered through social media platforms as well as other technological tools. This development made it possible and easy for libraries especially in developed nations to meet the information needs of their users during the wake of the global lock down ushered in by Covid-19 pandemic because of the existing structure available to them.

Status of digital transformation and library services in Nigerian academic libraries

Obviously, Covid-19 experience came with a lesson for the whole world, and that is the fact that things can be done differently. During the heat of the epidemic, there is no aspect of living that did not experience the ‘New Normal’. as a matter of fact, some facets of life are still patterned after the new normal way of doing things. For instance, today in the academia unlike pre Covid -19 times, emphasis has shifted from on site to online. Conferences, meetings, seminars and workshops and are now held online via zoom. Distance is no longer a barrier to remote participation. Teaching and learning has been revolutionised. Hybrid is the order of the day. Other sectors such as health, business, banking and public are not left out of this development. Digital transformation is being embraced and one can conclude that the fourth industrial revolution is here with us.

In Nigeria, libraries are not left out in ushering in digital transformation. There are evidences that some academic libraries in the country found a way of meeting their users’ needs even in the wake of the lock down by making their resources available and accessible through their websites, but they are few in number (Emasealu &Umeozor, 2021). Some others adopted technology to render services like online public access catalogue, mobile technology, ask a Librarian, FAQs, blogs, email, institutional repository, social media platforms, radio, television and so on during the lock down (Omeluzor et al, 2021).The questions begging for answer are:

- Now that there is no lock down and the world is gradually breathing an air of relief, how many of those academic libraries in Nigeria are still functioning in the digital clime?

- How many more have come to terms with the reality that digital transformation is the in thing and has embraced it in service delivery post Covid-19 era?

Ameh, et al (2021) affirm that globally,

‘libraries are providing authentic news sources, databases, and links to support research and medial scientists. They are creating special programs and operations including virtual story-telling and digital contents, they are more forgiving about item return dates and have various initiatives to collect and preserve materials about the pandemic. They are providing space for the vulnerable during the pandemic, serving as contact tracers and are offering literacy and learning services to the clients in order to combat the new disease. These innovations did not just happen in those climes. With diligence and endurance, they were able to propel into the unknown to deliver breath-taking innovations to face new circumstances that arise like the COVID-19 pandemic. Therefore, libraries and librarians in Nigeria need to take a cue from these exploits and ensure that proper attention is given to libraries in terms of adequate policy framework so they can receive adequate funding and function effectively’.

Emasealu &Umeozor (2021) report that only thirteen (13) universities in Nigeria had functional websites where library resources were made available and accessible to users during the Covid-19 lock down. Let us assume that these 13 academic libraries are still thriving in that area and even doing more. For instance, University of Lagos library already introduced QR code technology into its services before the breakout of the pandemic. This technology is for library registration and it is still functional even post Covid-19. This has made it possible to barcode many of the library’s print resources and upon lending, the barcode reader is used to desensitise it. In addition, the University of Lagos library has introduced Library self-service kiosks into its services. Standalone touch screen iPads are erected on each floor of the library to enable users carry out services such as search the OPAC, accessing e-resources, article download, and so on without the help of library staff.

Also, the University of Lagos library is the first of its kind in Nigeria to adopt Artificial Intelligence (AI) using robotics technology to deploy library services. Aside the fact that the robots named Roboscholar welcomes users into the library; it also performs quick reference services such as providing users direction within the library. It captures user’s face and saves necessary details for future interactions. It tracks head counts and does temperature checks. It creates user friendly environment. The library has 2 robots. While one performs the aforementioned functions, the second one provides access to the library’s OPAC as a self-service point. Apart from the robots, other components of AI engaged in deploying library services in university of Lagos Library is the RFID and barcode However, sometime in 2022, it was reported in a national daily as well as on the internet (Allnews) by Oyewole (2022) that Kwara State University library, Malete was set to introduce artificial intelligence robotics into its

library operations. Suffice to say that AI is changing the general information landscape of libraries around the world (Olayode, 2022).

Challenges of Digital Transformation in Libraries

While numerous benefits such as improved customer experience, increased efficiency, competitive advantage, increased productivity, data driven insights and so on (McDonnell, 2022) have been attributed to digital transformation, one must not overlook the various challenges confronting its adoption especially in a developing nation like Nigeria. Integration of Information Communication Technologies is a prerequisite of digital transformation in any library. Previous studies established that some of problems confronting ICTs in Nigeria include lack or poor funding, epileptic power supply, poor internet connection, lack of skilled personnel amongst others (Olorundare et al 2022; Baro et al, 2013). By implication, these are also problems of digital transformation in Nigeria. Saka, Ahmed and Akor (2021) also identified lack of proper monitoring and evaluation of ICT policy implementation by policy planners as part of the challenges of digital transformation in libraries. In summary, Adeleke, Ojokuku and Ojo (2022) in their study conclude that though many libraries in Nigeria are electronically enabled, they are far from being ready to fully embrace digital transformation

Methodology

The research design adopted for the study is survey. The study population comprised of academic libraries in South Western geo-political zone of Nigeria. Sample of the study was drawn across eighteen (18) universities in the zone. This include: six (6) public universities, six (6) States owned and six (6) private owned universities. Purposive sampling technique was adopted to select either the Reference or Automation Librarian from each of the universities under study. However, in one of the institutions, 2 people instead of one person responded to the questionnaire thereby increasing the sample size nineteen (19) people. Instrument of data gathering was questionnaire administered through survey monkey. Survey monkey is an online research tool use for data gathering. It can be deployed via email and WhatsApp. Results of data was analysed using counts, frequencies, percentages, tables, charts, descriptive statistics and T-test to ensure clarity.

Results of findings

As mentioned earlier, one person who is either the Reference or Automation Librarian from each of the selected institutions participated in the survey. Details of the institutions that are presented in table

Table 1: List of sampled institutions

S/N	Name of Institution	Ownership	Name of Library
1	University of Lagos, Akoka-Lagos	Federal Government of Nigeria	University Library
2	University of Ibadan, Ibadan	Federal Government of Nigeria	Keneth Dike Library
3	Obafemi Awolowo University, Ile Ife	Federal Government of Nigeria	Hezekiah OLuwasanmi Library
4	Federal University of Technology, Akure	Federal Government of Nigeria	Albert Ilemobade Library
5	Federal University, Oye Ekiti	Federal Government of Nigeria	University Library
6	Federal University of Agriculture, Abeokuta	Federal Government of Nigeria	Nimbe Adedipe Library
7	Lagos State University, Ojo-Lagos	State University	Fatiu Ademola Akesode Library
8	Adekunle Ajasin University, Akungba	State University	University Library
9	Osun State University, Osogbo	State University	Osun State University Library
10	Ekiti State University, Ado Ekiti	State University	Ifedayo Oladapo University Library
11	Olabisi Onabanjo University, Ago Iwoye	State University	Olabisi Onabanjo University Library
12	Ladoke Akintola University, Ogbomosho	State University	Olusegun Oke Library, LAUTECH
13	Afe Babalola University, Ado Ekiti	Private University	University library
14	Convenant University, Ota	Private University	Centre for Learning Resources
15	Elizade University, Ilaramokin	Private University	Elizade University Library
16	Lead City University, Ibadan	Private University	Lead City University Central Library
17	Redeemers University, Ede	Private University	Tekena Tamuno Library
18	University of Medical Sciences, Ondo	Private University	UNIMED Library
	Total	18	18

Digital transformation readiness of academic libraries in Nigeria

To ascertain the digital transformation readiness of academic libraries in Nigeria, some variables of digital technology that could be used for service provision in libraries were listed and respondents were asked to confirm which of them have been embraced in their library. These include: library kiosk, mobile technology, QR code, artificial intelligence and radio frequency identification (RFID). The results are presented in figure 1.

Figure 1 :Digital Technology in Use for Deploying Library Services in Nigerian Academic Libraries

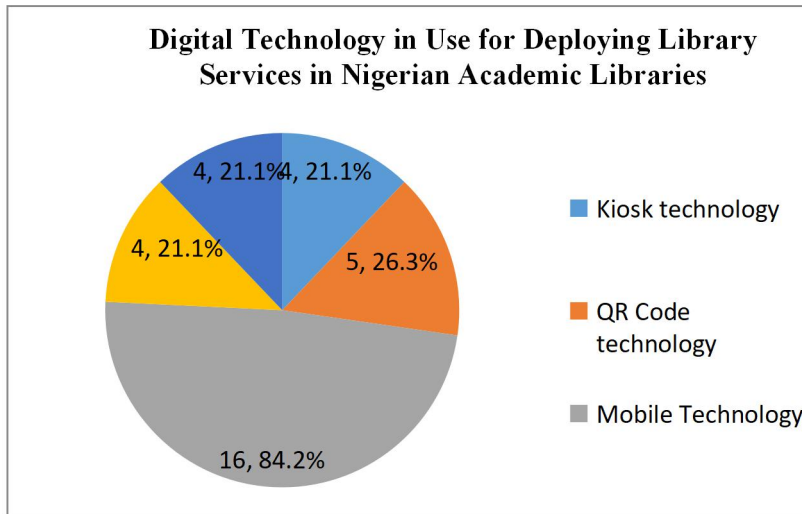


Figure 1 revealed that mobile technology (84.2%) is the mostly use for this purpose. Next to this is QR Code technology (26.3%) while the remaining 3 types of technology viz: Kiosk technology, Artificial Intelligence and Radio Frequency Identification (RFID) scored 21.1% each. Obviously, digital technology is yet to be fully embraced in university libraries in Nigeria owing to the prevalent result.

Library services deployed digitally in Nigerian academic libraries

The second objective sought to identify the various library services that are being deployed digitally in Nigerian academic libraries. 2 questions were raised to address this objective. The first question sought to identify the various digitally enabled library services pre Covid 19 outbreak and the second question addressed library services that are being deployed digitally in these same libraries post Covid 19. Table 2 presents the result.

Table 2: Descriptive statistics on library services deployed digitally in Nigerian academic libraries

Library services	Before Covid-19		After Covid-19		Percentage change
	N	Percent	N	Percent	
Online Public Access Catalogue (OPAC) services	17	89.5%	17	89.5%	0.0%
Electronic database and Open Access	16	84.2%	16	84.2%	0.0%
Email services	16	84.2%	14	73.7%	-10.5%
Online Reference Services	14	73.7%	12	63.2%	-10.5%
Social media (whatsApp, twitter, LinkedIn etc) services	13	68.4%	15	78.9%	10.5%
Online Document delivery (copying and printing and scanning)	11	57.9%	10	52.6%	-5.3%
Online Resource sharing services	10	52.6%	10	52.6%	0.0%
Online Current awareness services (CAS)	10	52.6%	13	68.4%	15.8%
Online Selective dissemination of information (SDI)	10	52.6%	9	47.4%	-5.3%
Institutional Repository (IR)	10	52.6%	13	68.4%	15.8%
Online research consultation	9	47.4%	9	47.4%	0.0%
Computerised Circulation services	9	47.4%	11	57.9%	10.5%
Online interlibrary loan services	8	42.1%	9	47.4%	5.3%
Virtual research and Digital Learning Support	8	42.1%	8	42.1%	0.0%
Online Library User Education	8	42.1%	8	42.1%	0.0%
Audio Visual tutorial services	7	36.8%	5	26.3%	-10.5%
Mobile Online Public Access Catalogue (MOPAC)	7	36.8%	6	31.6%	-5.2%
Open Educational Resources (OER)	6	31.6%	14	73.7%	42.1%
Online Book Reserve	5	26.3%	10	52.6%	26.3%
	194		209		
Overall usage of digital tools in library services deployment Before Covid-19 = 9.842; Overall usage of digital tools in library services deployment After Covid-19 = 10.682; Overall increase in percentage of library services deployed digitally post Covid-19 = 6.7%; T-Test = 1.374, p = 0.186					

Source: Authors computation (2023).

From the result in Table 2, it is evident that some of the variables of digital technology were already embraced for service delivery by university libraries in Nigeria even before the outbreak of Covid -19 pandemic. Obviously, 10 out of the 19 services

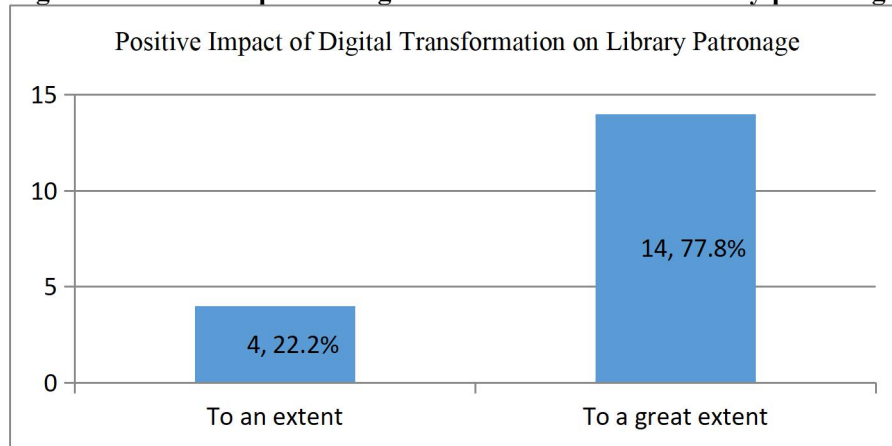
measured got above 50% ratings as indicated on the table. These include: Online Public Access Catalogue (OPAC) = 89.5%, Electronic Database and Open Access = 84.2%, Email = 84.2%, Social Media (WhatsApp, Twitter, LinkedIn, etc) = 73.7%, Online Resource Sharing = 68.4%, Online Reference Service = 57.9%, Online Current Awareness Service = 52.6%, Online Selective Dissemination of Information = 52.6%, Online Document Delivery = 52.6% and Institutional Repository = 52.6%. The remaining 9 variables were rated below 50% which is an indication that academic libraries in Nigeria are on the average in digital technology adoption.

Furthermore, the analysis shows that overall total value of library services deployed using digital technology pre Covid 19 was 194, this increased to an overall value of 209 post Covid 19. This suggests a 6.7% increase in general library services deployment post Covid-19. Further analysis shows that, overall usage of library services before Covid-19 indicates a mean score of 9.842 while overall usage of library services after Covid-19 shows a mean score of 10.862, with t-value of 1.374 and a probability score ($p>0.186$). This suggests that there is no significant change in the how digital tools were used to deploy library services before and after Covid-19 in Nigerian academic libraries.

Positive impact of digital transformation on library patronage in Nigerian academic libraries

Every innovation has its impact. This could be positive or negative but for this study, an assessment of positive impact of digital transformation on library patronage was carried out. Figure 4 presents the result.

Figure 4 Positive impact of digital transformation on library patronage

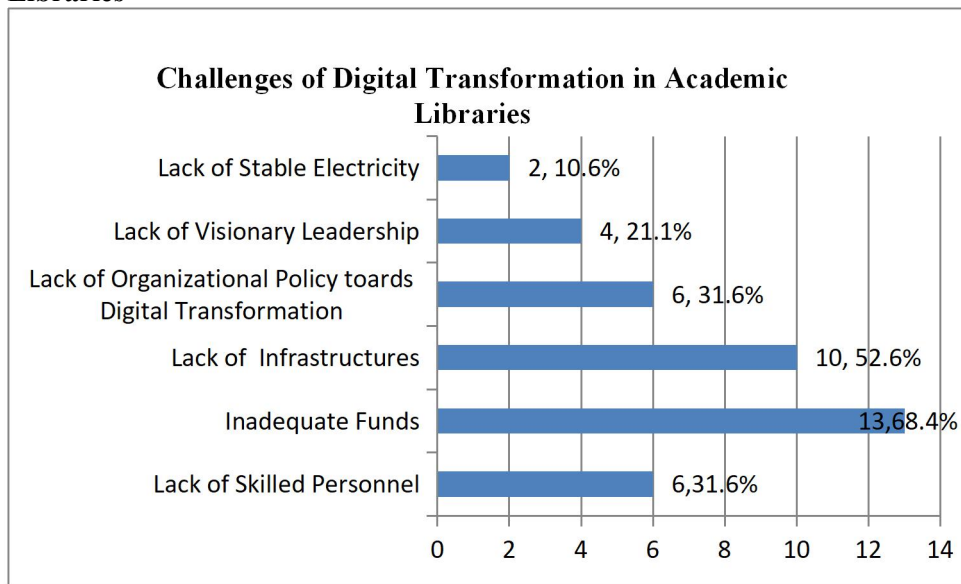


Results on figure 4 affirmed that digital transformation has positively impacted library patronage to a great extent as indicated by more than three quarter (77.8%) of the respondents.

Challenges of digital transformation in academic libraries

Of course, there is no invention without challenges. As technology evolves, challenges also abound. Regarding the study under review, a few challenges have been identified and these are presented in Figure 5.

Figure 5 :Challenges of Digital Transformation in Academic Libraries



Obviously, inadequate funds (68.4%) top the list of the challenges while the least of the challenges is unstable electricity.

Discussion

Digital transformation otherwise referred to as web 4.0 belongs to the Fourth Industrial Revolution (4IR). Even before the emergence of the global pandemic Covid-19, the Fourth Industrial Revolution (4IR) already ushered in increase in utilisation of new technologies and libraries were not left out of this. Therefore, there is no gain saying that digital technology has come to stay in library operations. Today, modern libraries of the world have moved from traditional mode of service delivery to digital mode. Library routine are now been repackaged and deployed in a more conducive and user friendly environment such that place and time is no longer a barrier to accessing library resources and services. Also, technology has made it possible for users to access some library services with little or non dependency on library staff. Some library routine has become ‘do it yourself’ thing thereby making access to library resources faster. In this discourse, five digital technological tools applicable in library services were studied. These are: Library Kiosk, QR Code Technology, Mobile technology, Artificial Intelligence and Radio Frequency Identification.

Library kiosk: Library kiosk is a library point of service that has Internet connectivity and has electronic equipment or other materials physically available to provide access to library resources including the library catalogue and patron accounts (Library of Michigan, 2017). . Library kiosk is a self- service tool that is being controlled through a login or credit system. Some of the services that can be deployed through library kiosk include book checkout, book check-in, book renewal, access to library catalogue, library's online sources and resources. Many academic libraries are now integrating Tablet kiosk by installing a secure tablet or I-Pad stand within the library for self service. Many tablets support e-reading apps such as iBook store or Kindle which have the capacity to host millions of books and other information resources. The tablets and their touch screen multi-app capabilities are engaging and can motivate especially students to learn. Users can use the device without any staff support. Other benefits of library self -service kiosk include provision of multiple information and resources at a place in a jiffy, quick and fast library services to users. Reduction of paper work for library staff is also one of the benefits of library kiosk.

QR Code technology: The term QR Code means Quick Response Code. It is readable by android phones or similar devices with cameras. It is a kind of 2D barcode. It is also referred to as 2D codes, 2D barcode and mobile code (Das & Das, 2021).QR Code is a technology which converts information from physical to virtual mode within a second. It encodes and decodes information with high speed and makes it accessible to users through scanning and downloading. Das and Das (2021) further highlighted a number of library services that can be deployed using QR Code. All it requires is scanning the required resources using QR technology and making the code available to users. Such services include: library registration, check outs and check in, library contact, downloaded article file and other resources such as library handbook, book contents and e-books, access to library catalogue, old question paper and study materials, E-thesis and dissertation, news clipping services, library tour information and so on. QR Code is very beneficial to users because it requires no technical accessory other than an Android or I-Phone with internet connection. It can be used by anyone, anywhere and at any time. It is free, fast and safe to use and has high storage capacity. Above all, it requires no specific skill or expertise.

Mobile technology: Mobile technology gives room for deployment of a lot of library services via mobile applications. For instance, services such as Online Public Access Catalogue (OPAC) which enables user to access a library's holdings on a stationed computer system in a designated place within the library is made available on mobile Apps so that users do not have to visit the library physically to know what it holds in terms of information resources. Summarily, MOPAC is a mobile version of a library's Online Public Access Catalogue that provides the same information as the OPAC. MOPAC provides a mobile-friendly interface for accessing the library catalogue using smartphone (Visva Bharati University, n.d). So also is Mobile Library Website which enables automated libraries to showcase what they have and what they do on their websites to the public. A typical library website would contain contact information,

link to the library hours, online catalogue, mobile databases, staff list, reference email, liaison list, Frequently Asked Questions (FAQ), news and events, help desk, Open Educational Resources (OER), Ask a librarian and so on. Many libraries have made their library websites available on mobile apps such that users can access them on smart phones. Mobile database is another service available to library users via mobile technology. Users are able to access proprietary databases in a library. Many academic libraries now render this service by developing a mobile accessible database that provides opportunities for users to download from the databases using their android or smart phones. Registered users can access mobile databases with their authorised login identities and passwords. This access is usually IP based and could be within campus only or remotely as well. Other library services accessible via mobile technology include: online reference service, online interlibrary loan, open access institutional repository, online research consultation, open educational resources (OER), audio video tutorials, find your librarian and so on.

Artificial Intelligence: Artificial Intelligence is one of the key technologies of digital transformation. Artificial intelligence is gradually gaining traction into educational institutions and libraries in developing nations are already leveraging on the opportunities presented by this machine learning technology. Without mincing words, AI is a vibrant technology that can be used in deploying library services as it has the capacity to accelerate library operations in the right direction (Hussain, 2023).

Radio Frequency Identification (RFID): This is one of the foundational technologies of the Internet of Things (IoT) movement. Radio Frequency Identification (*RFID*) is the wireless or contactless transfer of a *digital* ID and additional data between an *RFID* tag. This technology is used in library as a security especially for library resources. It is usually installed at the entrance of the library to check out users and library resources. In addition to these are services such as online Library orientation, online Library user guide, Ask a librarian, virtual research and digital learning support, and many more.

This study explored the extent to which academic libraries in Nigeria have embraced the 5 variables of digital transformation discussed above especially pre and post Covid 19 era, and their impacts on library service delivery and patronage. Four objectives guided the study and findings established the followings: digital transformation is yet to be fully embraced in Nigerian university libraries as four out of the various technologies applicable in library services were rated below 30% usage. Only the use of mobile technology got 84% rating in adoption. This is not surprising because mobile technology is one of the characteristics of the fourth industrial revolution and almost everybody make use of smart phones these days including the academic environment. This finding supports Sahoo (2021) assertion that the growing influence of mobile technology in libraries is an emerging trend that enables a more affordable and reliable network access to library's website.

Secondly, out of the 19 library services under study, only 10 were rated 50% and above both pre and post Covid-19 period. Specifically, Online Public Access Catalogue (89.5%) was the highest rated service pre and post covid-19. This signifies that OPAC service was the most digitally deployed library service in Nigerian academic libraries pre and post covid-19 pandemic. The implication of this is that almost all academic libraries in the south western region of Nigeria have their resources on the OPAC and are accessible to their teeming patrons. This is followed by electronic database and Open Access with a constant percentage score of 84.2% before and after the pandemic. E-mail services with a drop in deployment from 84.2% pre covid to 73.7% post covid was ranked third. It is obvious from this finding that, the top three digitally deployed library services before and after the pandemic by academic libraries in Nigeria are OPAC, electronic database and Open Access and email services. This a bit disturbing and only shows that the rate of digital transformation in Nigerian academic libraries is slow. One would expect that the experience of the Covid -19 period would have sent a signal to university libraries in Nigeria but this study shows that not much has changed from what it used to be before Covid-19 outbreak. To ensure clarity in this regard, the result of the T-Test analysis of rate of digitally deployed library services before Covid-19 indicated a mean score of 9.842 while that of post Covid-19 era shows a mean score of 10.862, with t-value of 1.374 and a probability score ($p>0.186$). This suggests that generally, there is no significant change in the use of digital technologies in the deployment of library services in Nigerian academic libraries pre and post Covid-19 era. This situation calls for urgent action from the stakeholders, and according to Ikenwe and Udem (2022), ‘there is a great need for innovative digital transformation in libraries to sustain modern information services’.

This finding is in tandem with the report of Adeleke, Ojokuku and Ojo (2022) in their study of ‘digital maturity of University libraries in Nigeria’ where they established that university libraries in Nigeria are yet to attain digital maturity though they are electronically enabled. Interestingly, four other services gained increase in use post Covi-19. These are: social media, open educational resources (OER), institutional repository (IR) and online current awareness (OCAS).

Surprisingly, even in the state of not fully adopting digital technologies, the study established that digital transformation has impacted library patronage greatly and positively. The implication of this is that greater user satisfaction and higher patronage could be attained if more of the services are deployed digitally. Obviously there are challenges. Number one challenge is lack of funds followed by lack of infrastructure. These are the top two challenges established in the study. Some other challenges established are lack of skilled personnel and unstable electricity. This could be taken care of when there is adequate fund. Personnel could be trained and alternative source of power generation (generating set) could be procured to address these two challenges. However, lack of visionary leader and absence of organisational policy towards digital transformation were also identified as part of the challenges of digital transformation in the study. These aspects require serious attention. The onus lies on library and information professionals. The world is going digital and adoption of digital

technology in libraries has no alternative. Library professionals need to up their games and be on top of the situation. Not being visionary in this wise is not acceptable and until the leadership of libraries foresee and dream it, having an organisational policy that supports digital transformation may yet remain an illusion even when the global narrative is already tending towards 5th industrial revolution.

Conclusion and Recommendations

Based on the findings, the study concludes that not many academic libraries in Nigeria have fully embraced digital technology in service delivery owing to some challenges. It must be noted that these challenges are not insurmountable. All it requires is getting our priorities right as a people and doing the needful as a nation. In view of this, the study recommends that:

1. To fully embrace digital transformation in academic libraries in Nigeria, stakeholders especially library managers must envision and pursue provision of library services through digital environment. Organisational policy that supports the adoption of digital technologies must be put in place.
2. The study established that not many services are rendered through the digital environment in Nigerian academic libraries. This needs to change. Stakeholders must make concerted efforts to put in place proper measures geared toward leveraging on the various technologies that are being adopted for operations in modern libraries. To deliver more library services via the digital environment, resources both human and materials needed to achieve this must be procured not just to prepare for future occurrence, but also to be at par with their counterparts in developed nations in reaching wider user coverage.
3. Paucity of funds is a major challenge militating against the adoption of digital technologies in Nigerian academic libraries. Federal allocation to the education sector should be reviewed upward. Technology adoption costs good money. To procure required resources, more funds must be committed to the education sector to ensure that a reasonable amount would be allocated to academic libraries. Also, public and private partnership should be encouraged. Institutions must learn to woo the town to assist especially in meeting some of their financial obligations.
4. To obtain the pre-requisite skills needed to deploy library services in the digital environment, there should be continuous learning and development for librarians. Library management should encourage learning, unlearning and re-learning among the stakeholders.
5. Lastly, university authorities should support their libraries in the adoption of digital technologies by providing the wherewithal needed to function in digital clime.

It is believed that addressing the identified challenges of digital transformation will reposition our academic libraries for better service delivery in the digital age.

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