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Awareness and acceptance of emerging technologies for extended information service delivery in academic libraries in Nigeria

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Abstract

Expanding and modernising information services are crucial to the continual existence and patronage of academic libraries in the digital era. Technological evolutions have impelled libraries to incorporate all-encompassing, user-friendly and technology-driven service delivery approaches in academic libraries. Emerging technologies seem to fill this perceived gap. This study brings to light the level of awareness, adoption, preferred and readiness for the incorporation of emerging technologies into academic libraries activities in Nigeria. Amid 18 emerging technologies, adoption is stumpy, only an infinitesimal number (WebOPAC, library website, Cybrary, social media and Institutional repository) considered, and awareness remained high. Technologies like RFID, Integrated Library Management System, Library Guide app and Internet of Things were inclusively preferred based on usefulness and the nature of the learning environment. Although, emerging technologies received overwhelming reception based on readiness, its full implementation by regulatory and funding bodies including parent institutions is constrained by underfunding among others.

Keywords: Emerging technologies, information services, academic libraries, awareness, itechology

Introduction

There are speculations that conventional (traditional) libraries will go extinct if they don't diversify their activities and ways of providing services due to emerging technologies dishing information at a click. Hybrid library which is a combo of traditional and digital/virtual library is now recommended accordingly. The inclusion of emerging technologies in libraries has made information professionals sometimes referred to the library as 'Smart Libraries' (Baryshev *et al.* 2018; Cao *et al.* 2018; Gul & Bano, 2019) or 'Intelligent library' (Cox *et al.* 2018) and this is fast becoming a household name. Wenborn (2018) in his blog post opined that libraries will be integrated into the core value system and workings of society, adapt to human behavioural changes in the shortest possible time through the accommodation of new technological applications for teaching, learning and research. It will basically cause a force of unification for libraries and learning institutions worldwide. Scholarly materials will be available, easily discoverable, and useful to library patrons and information resources can be preserved for a longer period of time. There is need to rethink the activities of academic libraries especially now that students and other library patrons rely on many other sources of retrieving information almost everywhere and at any time. Libraries needs to seek for new ways to explore patrons needs and satisfy them

Emerging technologies in libraries and their usefulness

The influx of technology-based support services has improved service delivery in a faster and more accurate way in academic libraries, which gives credence to the usefulness of proposed emerging technologies for libraries (Omosor, 2014). Technology or web enabled services have provided a better working environment for libraries and tertiary institutions (Sood, 2016; Mittal, 2017; Chukwueke & Onuoha, 2019) and their patrons, for example, library management system aimed at automating libraries, radio frequency identification (RFID) for access control,

conservation and security of print resources like Web-OPAC (online public access catalogue) as against the manual OPAC for cataloguing services (Jindal & Khan, 2019). There is transition from reference desk assistance to web-based remote access to information resources.

Technologies like digital storytelling, RFID (Princh Blogspot, 2020), library bookmark application, big data, and Internet of Things (IoT) (Nag & Nikam, 2016; Gupta & Singh, 2018; Kaladhar & Rao, 2018) have been introduced into libraries recently. Hoy (2017) opined that the use of Blockchain for metadata and networking of libraries and in medicine will go a long way in improving information services. Other newly introduced technologies in libraries include augmented reality (AR), virtual reality (VR) (Oyelude, 2017; Pope, 2018); QR (quick response) barcode technology, gamification, cloud computing, enabled integrated library management system which also houses OPAC, social media applications and artificial intelligence (AI) (Sheik & Olugbenga, 2019). Artificial intelligence, robotics (Odeyemi, 2019), ambient intelligence and data mining have currently been introduced into libraries making the libraries smarter, improving work capabilities of staff, satisfying customer needs, and bridging the information gap, a tremendous positive impact as reported (Massis, 2018; Gul & Bano, 2019). An AI lab has been built at Rhodes Island public library. Unstacked, a user-friendly application is being used at the Queensland State Library. It helps users to visualise information resources digitally (Princh Blogspot, 2020).

In Bangladeshi libraries, RFID technology is now in use (Rahman & Islam, 2019). Hiremath *et al* (2019) mentioned that VR applications like 360 Cities and Aug That, and they mentioned that the 3D printer technology utilises VR platform too. In Canada, a team of librarians from the International Islamic University in Malaysia have developed an automated Reference service program called R-StARS for the University of Windsor (Ryu, 2019). Big data can facilitate library services by providing access to user mind otherwise called customer intelligence after user's consultation of large dataset storage. Augment reality applications like 'librARI' that allow library patrons search for books and discover related content which is currently at Halton Libraries in the United Kingdom. The Hillsboro Public library in Oregon, United State of America has developed a self-service book borrowing and usage trend tracking device called Book-O-Mat. This helps them to make informed decision on patron's preferences for books (Princh Blogspot, 2020).

Some challenges with technology use in academic libraries

Omosor (2014) never mentioned any specific emerging technology, he however, reported that inadequate technical staff, complexity of the technology interface, slow bandwidth and the growing demands of users has become some of the major challenge for most libraries. Ahmed (2012) has earlier said information and communication technology (ICT) skill acquisition and training is pertinent for emerging technology to be introduced into Nigerian libraries since it stands as a threat to library services. Odeyemi (2019) said Nigerian libraries are fully prepared to accept emerging technologies like robotics into the library service delivery system even though a few factors like technophobia militate against this possibility whilst they await adoption of emerging technology. Otunla (2016) mentioned lack of funding, lack of ICT staff, and insufficient power supply as challenges with using emerging technologies like library management software. Several other challenges have been reported and they need to be examined and addressed for emerging technologies to be fully implemented in academic libraries in Nigeria.

Problem statement

As important as libraries universally, they are feared extinction considering the recent impacts of information technology, the daily vicissitudes with information seeking behaviour of humans and the introduction of remote information access services from tech giants like Google. So, it is

important for libraries to expand their horizon and accommodate as many useful and friendly technology based services offered in libraries (academic and public) across the globe especially in developed countries. What is the fate of the exact condition in Nigeria? Is there any move made by relevant authorities or library management is the leaving the whole idea to time and chance. It is not clear if the moving trend in libraries developing and adopting new technologies have struck a chord in libraries in developing countries. The challenges involved and why there is need to follow suit. Studies on emerging technology use in academic libraries in Nigeria are limited, with most of them largely reviews, opinionated papers, focused on only one or two (Urhiwuhu *et al.* 2015; Otunla, 2016; Emiri, 2019; Oluwole & Adeyinka, 2020) or non-empirical studies. Some of the available one includes Omosor (2014) who only reported generally on new technology with no specifics. Chukwueke and Onuoha (2019) paper also only reviewed emerging technologies and it wasn't empirical. Amogu and Okezie (2019) recently advocated for the adoption of emerging technologies, however, it is not clear if any of such plea has been considered. This is the reason why this study is carried out.

Objectives

The following objectives were set forward in order to guide the data collection for this study;

1. To find out librarian's level of awareness of the new technology based services offered in academic in developed countries.
2. To ascertain if these emerging technologies have been adopted for service delivery in the academic libraries.
3. To know which of them will be most useful to librarians and students based on the peculiarities of the Nigerian learning environment.
4. To know the level of readiness of libraries to in cooperate emerging technologies into library routine.
5. Know if there are going to be any challenges in adopting these emerging technologies.

Methodology

The descriptive survey design was used for this study. Respondents were randomly drawn from 12 University libraries in six (Ekiti, Oyo, Delta, Bayelsa, Anambra and Imo) states (two at least from each) from three (south-west, south-south and south-east respectively) geopolitical regions in southern Nigeria comprising of public (seven) and private (five) academic libraries. A total of 90 librarians were used (15 from each). Questionnaire was the main instrument used for data collection. It was made of an introductory letter, bio data section and items to respond to in answering the research questions for the study. Section A elicited responses on the level of awareness, B; on their opinions about the relevance of emerging technologies, C; on their level of adoption, D; on the most preferred emerging technologies and lastly section E on the challenges to be faced upon eventual adoption. A two (mean = 1.5) and three (mean = 2.0) point Likert scales were used and criterion means to ascertain the acceptance or rejection of an item. The useful instruments returned rate was 91% (N = 82). Simple descriptive (mean, standard deviation, percentages and frequency counts) statistics was used to analyse the collected data with Microsoft Excel application software.

Results and Discussion

The results of the study are presented in Tables 1 to 6 below.

Biodata of librarians: Table 1 shows the bio data of the respondents (librarians) which revealed an unbiased and fair distribution among the demographic factors. There was equal distribution of responses for the librarians from all cadre of librarianship apart from the apex cadre, university

librarian which didn't have any response probably due to busy schedule of librarians of that rank. The respondents were mostly (41.5%) of the rank of Librarians I with Librarian II been the lowest (7.3%). Male respondents were more (63.4%) than female respondents. Majority of the librarians were first degree holders (51.2%) with those with other professional degrees or certifications (7.3%) been the least. Marital status showed that 46.3% of librarians were married while only 9.8% divorced. The working experience range from 0 – 4 years and 20 years and above standing at 9.8% to 10 – 14 years at 41.5%. The religious group where most of the respondents belong to was Christianity (63.4%) which is possibly so because the sampled region is dominated by Christians.

Table 1: Demographic information of librarians

S/N	Demography	Variables	N	%
1	Cadre in Librarianship	University Librarian	0	0.0
		Deputy University Librarian	15	18.3
		Senior Librarian	19	23.2
		Librarian I	34	41.5
		Librarian II	6	7.3
		Assistant librarian	8	9.8
2	Gender	Male	52	63.4
		Female	30	36.6
3	Educational Attainment	OND/Diploma	14	17.1
		HND/BSc	42	51.2
		Masters	5	6.1
		Doctorate	15	18.3
		Other professional	6	7.3
4	Marital status	Married	38	46.3
		Single	27	32.9
		Divorced	8	9.8
		Widowed	9	11
5	Working experience (years)	0 – 4	8	9.8
		5 – 9	14	17.1
		10 – 14	34	41.5
		15 – 19	8	9.8
		20 and above	18	22.0
6	Religion	Christian	52	63.4
		Muslim	21	25.6
		African tradition	9	11.0
Total			82	100

Awareness of emerging technology: Librarian's level of awareness about the emerging technologies found useful in academic libraries was found to be very high (mean = 2.21, 73.7%) as shown in Table 2. The technologies most common to librarians were social media (93.5%), institutional repository (90.7%), WebOPAC (89%), library website (87.8%), RFID (85.4%) and Internet of Things (81.3%). While the ones with least awareness were Google partnered Libraries-Ready-to-Code Initiative (52.4%), Digital storytelling (50.8%) and 3D/2D Digital printing (48.8%). This probably due to the fact that librarians are widely read, they are research focused and have been involved in several conferences discussing emerging technologies. Access to publication about emerging technologies and the recent deliberations about the subject matter on all library and information science platforms may be necessitated this high level of awareness.

Table 2: Level of awareness of the emerging technologies in academic libraries

S/N	Emerging technologies	Fully aware	Partially aware	Not aware	Mean	Stdev	Level of awareness
1	Google partnered Libraries-Ready-to-code Initiative	8	31	43	1.57	0.67	52.4
2	Social Media	68	12	2	2.8	0.46	93.5
3	Voice-Over-Internet Protocol Telephony for patrons	16	43	23	1.91	0.69	63.8
4	Artificial/Ambient Intelligence	31	44	7	2.29	0.62	76.4
5	Virtual/Augmented Reality	43	28	11	2.39	0.72	79.7
6	Specialised library website	58	18	6	2.63	0.62	87.8
7	Digital storytelling	10	23	49	1.52	0.71	50.8
8	RSS Feeds	18	40	24	1.93	0.72	64.2
9	Coding club for youth/children	23	38	21	2.02	0.74	67.5
10	Library Guide Apps	35	36	11	2.29	0.69	76.4
11	WebOPAC	62	13	7	2.67	0.63	89
12	Cloud computing, storage and printing	33	21	28	2.06	0.87	68.7
13	Cybrary	21	49	12	2.11	0.63	70.3
14	Integrated Library Management System	44	27	11	2.4	0.72	80.1
15	Institutional Repository (e.g. DSpace)	63	15	4	2.72	0.55	90.7
16	Radio Frequency Identification (RFID)	52	24	6	2.56	0.63	85.4
17	3D/2D Digital Printing	6	28	48	1.46	0.63	48.8
18	Internet of Things	48	22	12	2.44	0.74	81.3
	Weighted mean				2.21	0.67	73.7
	Criterion mean (N = 82)				2.0	-	66.7

Adoption of emerging technologies: As against the criterion of 66.7% adoption set this section, the level of adoption of emerging technologies was found to be extremely low (mean = 1.41, 47%) as reported in Table 3. The two currently adopted and used technologies were social media networks (mean = 2.18, 72.8%) and institutional repositories (mean = 2.0, 66.8%). Others almost at brink of adoption were cybrary, specialised library website and WebOPAC (mean = 1.8, 60.2%) probably because they are follow each other concomitantly. The ones that are far away from been adopted include digital storytelling, RSS Feeds, coding club, artificial intelligence and virtual reality (mean = 1.0, 33.3%). There seem to be attempts aimed at adopting integrated library management software, RFID and Internet of Things. This is probably so, as most Nigerians librarians have published papers concerning this areas and there evidence of adoption like that of Emiri (2019) on OPAC in the Niger Delta region, Urhiewhu *et al.* (2015) on WebOPAC and social media networking in south eastern Nigeria and Otunla (2016) and Oluwole and Adeyinka (2020) on KOHA integrated library management system and OPAC respectively from south western Nigeria on the relevance of the adopted emerging technologies and have made repeated efforts to appraise the concern authority for funding and utilisation of the technologies.

Table 3: Level of option of the emerging library information service based technologies

S/N	Emerging technologies	Fully adopted	In the process	Not adopted	Mean	Stdev	Rate of adoption
1	Google partnered Libraries-Ready-to-code Initiative	0	14	68	1.17	0.38	39
2	Social Media	24	49	9	2.18	0.61	72.8
3	Voice-Over-Internet Protocol Telephony for patrons	0	18	64	1.22	0.42	40.7
4	Artificial/Ambient Intelligence	0	0	82	1	0	33.3
5	Virtual/Augmented Reality	0	0	82	1	0	33.3
6	Specialised library website	24	18	40	1.8	0.87	60.2
7	Digital storytelling	0	0	82	1	0	33.3
8	RSS Feeds	0	0	82	1	0	33.3
9	Coding club for youth/children	0	0	82	1	0	33.3
10	Library Guide Apps	0	18	64	1.22	0.42	40.7
11	WebOPAC	14	38	30	1.8	0.71	60.2
12	Cloud computing, storage and printing	0	12	70	1.15	0.36	38.2
13	Cybrary	12	42	28	1.8	0.67	60.2
14	Integrated Library management System	6	48	28	1.73	0.59	57.7
15	Institutional Repository (e.g. DSpace)	25	32	25	2	0.79	66.8
16	Radio Frequency Identification (RFID)	10	22	50	1.51	0.71	50.4
17	3D/2D Digital printing	0	10	72	1.12	0.33	37.4
18	Internet of Things (IoT)	8	38	36	1.66	0.65	55.28
	Weighted mean				1.41	0.42	47
	Criterion mean (N = 82)				2.0	-	66.7

Preferred emerging technologies: In Table 4, the preferred emerging technologies were elicited from librarian. The data showed the most preferred based on their usefulness in the Nigerian academic libraries to be institutional repository (46.3%), remotely accessible library website (41.5%), social media network (37.8%) and library management software (35.4%). Others included library guide application, Internet of Things, WebOPAC, The least preferred based on our learning capabilities were 3D/2D digital printing (2.4%), Libraries-Ready-to-Code Initiative (4.9%), RSS Feeds (6.1%), artificial intelligence (9.8%) and virtual reality (13.4%). These choices were probably made based on the growing demand of remote learning and information retrieval for e.g. the use of social media for direct interaction with library management. The ease of the use of library will reduce questions and queries on the activities, services and resources of the library since they will be regularly updated on the website. There are several things that are far away from reality like virtual or augmented reality in the Nigerian academic libraries. It is yet to be implemented in routine learning-teaching case. Same goes for artificial intelligence and other least preferred.

Table 4: Preference for most important emerging technology for the libraries

S/N	Emerging technologies	Preference based on usefulness (N)	Percentage (%)	Ranks for preference
1	Google partnered Libraries-Ready-to-code Initiative	4	4.9	15 th
2	Integrated Social Media	31	37.8	3 rd
3	Voice-Over-Internet Protocol Telephony for patrons	18	22	10 th
4	Artificial/Ambient Intelligence	8	9.8	13 th
5	Virtual/Augmented Reality	11	13.4	11 th
6	Specialised library website	34	41.5	2 nd
7	Digital storytelling	8	9.8	13 th
8	RSS feeds	5	6.1	14 th
9	Coding club for youth/children	10	12.2	12 th
10	Library Guide Apps	28	34.1	5 th
11	WebOPAC	19	23.2	9 th
12	Cloud computing, storage and printing	23	28	7 th
13	Cybrary	20	24.4	8 th
14	Integrated Library management System	29	35.4	4 th
15	Institutional Repository (e.g. DSpace)	38	46.3	1 st
16	Radio Frequency Identification (RFID)	31	37.8	3 rd
17	3D/2D Digital Printing	2	2.4	16 th
18	Internet of Things	25	30.5	6 th
	Total	82	100	

Readiness for adoption and utilisation of emerging technologies: The level of readiness as presented in Figure 1 showed that a good number (56%) of academic libraries are prepared (highly prepared and very highly prepared) to adopt emerging technologies while 12% seem not to be prepared. This is clear indication that academic libraries in Nigeria, despite the low level of adoption of a few emerging technologies are ready to accept others if there is platform convenient enough for them for the use of any of the emerging technologies. This may be due to the importance placed on the technologies and their usefulness in learning and teaching.

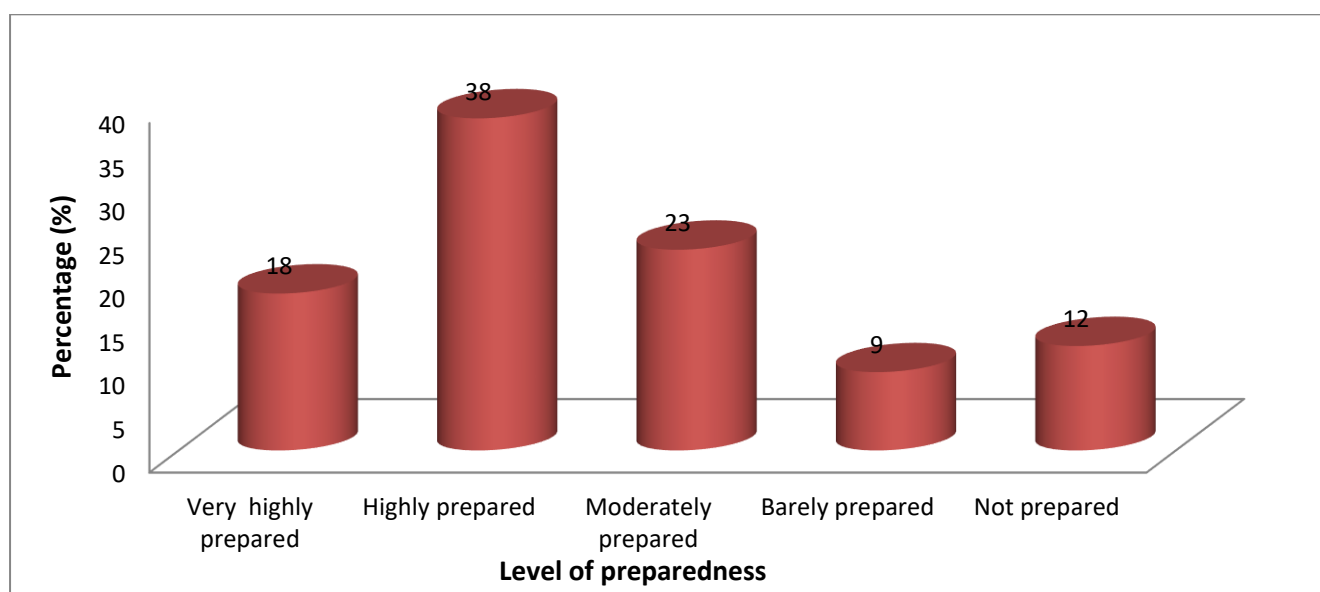


Figure 1: Level of preparedness to accept emerging technologies in academic libraries

Challenges forestalling the adoption of emerging technologies: The study showed in Table 5 that the listed challenges were generally low funding, cost effective nature of acquiring emerging technologies, poor electricity supply, shortage of ICT staff and poor maintenance culture for advanced technology topped the list of perceived challenges. These findings are same or similar to what Odeyemi (2019), Otunla (2016) and Ahmed (2012) had mentioned. Not much can be said about these challenges since they are seemingly widespread across various fields of endeavour mostly in academics.

Table 5: Perceived challenges with the use of emerging technologies in academic libraries

S/N	Challenges	Yes (%)	No (%)	Mean	Stdev
1	Technophobia	39 (47.6)	43 (52.4)	1.48	0.5
2	Complexity of technology interface	51 (62)	31 (38)	1.62	0.49
3	Fear for non-acceptance of technology by students and librarians	17 (20.7)	65 (79.3)	1.21	0.41
4	Electrical power inadequacy	58 (70.7)	24 (29.3)	1.71	0.46
5	Poor maintenance culture	49 (59.8)	33 (40.2)	1.6	0.49
6	Expensive nature of the technology	61 (74.4)	21 (25.6)	1.74	0.44
7	Internet connectivity problems	55 (67.1)	27 (32.9)	1.67	0.47
8	Durability of technology in the face of student's unchecked use.	54 (65.9)	28 (34.1)	1.66	0.48
9	Low IT skillset of librarians to deliver services or assistant students.	44 (53.7)	38 (46.3)	1.54	0.5
10	Low funding of academic libraries	62 (75.6)	20 (24.4)	1.76	0.43
11	Shortage of ICT staff	48 (58.5)	34 (41.5)	1.59	0.5
12	Negative attitude of staff	30 (36.6)	52 (63.4)	1.37	0.48
Weighted mean (N=82)				1.58	0.47

Major findings

1. Amongst librarians from Nigeria, there was a high level (74%) of awareness of the various emerging technologies and their significance for academic libraries.
2. On the contrary, the level of adoption is below expected trend (47%) as noticed in developing countries.
3. Librarian's prefer to make readily available emerging technologies like social media, institutional repositories, Cybrary, library websites, WebOPAC, RFID, Integrated library management system, use of Library Guide application and Internet of Things for effective service delivery.
4. More than 60% of academic libraries prepared to accept the introduction of emerging technologies for better information service delivery.
5. However, these efforts are constrained by poor funding, lack of power super, poor maintenance to mention just a few.

Conclusion and Recommendation

There is rapid transition from hard to soft and print to digital as the case may be. The need for library users are also changing literally mimicking the changing global environmental climate just to buttress the point that this change is almost uncontrolled by evident factors like management

system of libraries. The study carefully investigated the level of awareness and adoption of 18 globally emerging technologies for academic libraries in Nigeria. Librarian's choice of most useful emerging technology was elicited and the challenges that come along. There was overwhelming high awareness of emerging technologies but a contrary underwhelming current level of adoption of same. Among the listed emerging technologies, social media, institutional repositories, cybrary, library websites, and WebOPAC are in the process of adoption or fully adopted. However, apart from the already used emerging technologies, librarians revealed that their preference extends inclusively to RFID, integrated library management system, use of Library Guide application for patrons, and implementation of Internet of Things for their libraries as they show a considerable level of readiness to work with emerging technologies. Although, as opined by librarians, academic libraries may face a couple of challenges in the face of these important technologies which include poor funding, power outage, poor maintenance traits as seen in older technologies used among others. Based on the findings of the study, the author recommends that full implementation of policies regarding the establishment and incorporation of modern technology in academic libraries. There is need to improve on power supply, increase funding of libraries and train librarians on how to manipulate emerging technologies to be adopted. Awareness campaign on proper maintenance and student use should be carried out.

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