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Assessment of Preparedness of Academic Libraries towards the Use and Adoption of Robotic Technologies in Public Universities in Bayelsa State

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ABSTRACT
This study investigated assessment of preparedness of academic libraries towards the use and adoption of Robotic technologies in public university libraries in Bayelsa State. 3 research questions and 3 hypotheses guided the study. The population consists of 35 information professionals in the four university libraries in Bayelsa State. A sample size of 35 information professionals representing 100% of the population served as respondents. Census sampling technique was used for the study. A 15-item questionnaire was used for data collection. Cronbach alpha statistics was used to obtain 0.75 reliability. The mean scores and standard deviation were used to answer the research questions while the z-test statistics was used to test the hypotheses at 0.05 level of significance. The result amongst others revealed that, there are yet no provisions of uninterrupted power supply, no search record machines for easy access to library collections and no advanced digital technological infrastructure. Meanwhile, there are challenges like insufficient knowledge and awareness of robotic technologies and application by information professionals, inability of library administrators to bravely implement robotic technologies, lack of human resources with requisite skills to provide effective robotic library services. It was recommended that, Information professionals need to be trained and exposed to various trainings that will promote the adoption and use of the robotic technologies.

KEYWORDS: *Preparedness, Academic Libraries, Robotic Technologies, University Libraries and Information Professionals.*

INTRODUCTION

The advancements of library automation as an innovative means of technological reformation in the usual manual operations of many libraries especially in the developing countries has been given serious attention by information professionals around the world. Before this time, academic libraries relied passionately on integrated library systems that help in managing and providing access to library collections and services such as the integrated library services

(ILS) which was designed at the time when academic library collections was operating primarily of physical items and they provided automated support for a very broad range of the tasks related to the management and access to these materials. Meanwhile, this transition with its increasing proportions of electronic and digital materials solvent the ILS beyond the limits of what it was designed to manage. Then in a bid to curb these new formats, library automation shifted its base from ILS by introducing other specialized applications, including link resolvers, knowledge bases of e-content, electronic resource management systems, digital asset management systems, discovery services, and institutional repository platforms and now robotics.

On the other hand, for a more sophisticated reduction in human labour and a better scientific ways of handling library collections and management, robotics have being created as series of scientific and technological advances that have changed the way of life of human beings in handing library matters. The invention of such intelligent technological devices with human forms such prominence that it has resulted in multitudes of applications that previously only existed in science fiction books and films. The use of these devices have increased dramatically, especially in the aspects of human lives such as control of unmanned flights, automation in amusement parks, control of food products and so on (Anchez, et. al., 2019). Current technologies have made human/machine interaction increasingly friendly to the point that are gently incorporated into the field of education, called educational robotics, which has led to the development of devices used for different purposes (Anchez, et al, 2019).

The incorporation of robotics as an educational technology has represented as an innovative mechanism towards improving teaching and learning in our higher institutions. Robotics are introduced for the improvement of interdisciplinary learning environments where students and lectures can structure their research and solve problem in more concrete means; developing new skills and abilities in people, giving positive responses to things, contributing to the development of student's creativity and cognitive capacity (Edward, 2013). According to Talaviya, et al. (2020) for university libraries to achieve their mandate effectively, they need to deliberately deploy robotic technologies to facilitate and enhance library operations, improve library services and promote efficiency. Robots are described by Talaviya, et al. (2020, p.3) as "mechanical devices that automate tasks led by direct human supervision or a pre-defined programme and set of general guidelines, through the use of artificial intelligence (AI) techniques".

On the other hand, Abraham (2019) sees robotics as forms of machines used to carry out different automated actions that are being programmed by computers. This description clarified roboticsas a subset of AI that are related with motor task along with machine learning. On this note, Harada (2019) figured out the functions of robots into three distinctions which include industrial Robots that perform autonomous work on behalf of a man in an automatic manner in production. Working in Hazardous Environment these are robots used in accident sites where people finds it difficult to acclimatize. Daily life support that are specifically designed to provide human support functions in organisations like academic libraries, military, nursing care and other vital activities. These robots imitate the form and movements of humans and perform their duties in organisations or institutions (Tella, 2020). Robotics adoption helps in the improvement of operational efficiency through the optimization of collection analysis, visualization, preservation and reduction of expenses associated with library service delivery (Tella, 2020).

Level of preparedness of university libraries towards robotic technologies in terms of digital infrastructure

The preparation for the adoption of robotic technologies in handling library activities, there is need to have necessary infrastructural facilities that would prepare the ground to kick start such innovative programme. Digital Advanced mobile devices which are operated through the use of Wi Fi or 3G network must be in place since the library is digitized. Advanced

digital technological infrastructure that can help in storing digital collections in databases like CDs, CD-ROMs, DVDs, Hard disk in shelves, e-books and other electronic materials must be in place for this innovative drive of robotic library technology. There are bound to be difficulties to search record when there are no digitized systems to adopt robotic technologies in the library operation. Asogwa, et al. (2015) opined that library operations can be upgraded through Artificial Intelligence (AI), like cataloguing, intuitional repository, online public access catalogue etc.

Notwithstanding, in achieving this new innovations in our libraries especially in Bayelsa State, necessary policy documents must be prepared to guide the conduct and use of these technologies, and information professionals must be trained and exposed to various digital trainings basically to promote the adoption and use of robotic technologies in the libraries. Kamble, et al. (2018) unveiled some notable things that should be in position in preparation for the adoption of robotics in the libraries which includes augmented reality and robotic systems, Internet of Things (IoTs), telecommunication facility, cloud computing, provision of uninterrupted power supply, simulation prototypes, big data analytics and 3D printing.

Various usages of Robotic Technologies in Academic Libraries

Robotic technologies in the operation of academic libraries have attracted various usages more especially for real-time browsing of printed materials through a web interface where clients engage the computer and robots for simple automatic retrieval of requested items where library maker space are useful in hosting a robotic club, which can be used in educating and teaching students or clients about how to code through robotics (Asemi & Nowkarizi, 2021). Robots are used in academic libraries for purposeful scanning of shelves and for deliberate self-navigation, most specially at night, through the use of radiofrequency identification (RFID) tags, that are attached to books normally to generate reports on the said books (Coleman, 2017). In a technologically operative libraries autonomous shelf reading robots, tele-presence, chatbots and humanoid robots are used for referencing services and maintenance of circulation records for easy operations in the library. This process helps to ease the physical human operations that seems tiring sometimes (Tella, 2020).

Challenges University Libraries face in the Adoption and Use of Robotic Technologies

The introduction and adoption of robotics in academic libraries is associated with many challenges as universities most especially the developing world may not have the required facilities to carry out robotic operations in the libraries successfully. According to Samuel (2019) some of these challenges come as a result of insufficient knowledge and awareness of robotic technologies and application by information professional and inability of library administrators to bravely implement such technology in the library systems. Odeyemii (2019) stresses on epileptic power supply as a real challenge facing the adoption of robotic technologies in the university libraries in Nigeria and the problem of making ready human resources with requisite skills to provide effective robotic library services through the use of advanced digital technologies and automation coupled with the issues of some professionals who seem to be technophobic (Aliet, et al. 2020). Asogwa, et al. (2015) mentioned lack of network capacity to cope with increased data usage and inadequate e-learning facilities as some challenges that hinder the progress of robotic operations in the libraries.

On this same note, Adebayo, et al (2018) figured that some library managers who are not adequately informed and aware of the necessity of offering routine services through the application of robotic technology will have less interest, confidence and efficacy in the adoption and application of such AI in the library which is a big challenge. Samuel (2019) also named few challenges as unreliable power supply, inadequate technology infrastructure, unstructured means of storing digital collections in databases like CDs, CD-ROMs, DVDs, Hard

disk in shelves, e-books and other electronic materials.

The absence of technical skills by librarians, lack of digital mobile device operation through the use of Wi-Fi or 3G network are all challenges. Absence of capable management support have affected librarians positive attitude towards advanced automation, use of inappropriate library software and the effect of technophobia by information professionals and so on. There are bound to be difficulties to search record when there are no digitized systems to adopt robotic technologies in the library operation.

STATEMENT OF THE PROBLEM

In the quest to carry out library functions effectively, university libraries deemed it necessary to adopt the use of automation in various library services, which include cataloguing, serials, acquisition and so on which consumes human efforts. However, in recent time, robotic technologies is currently adopted to deliberately minimize the demand for human interactions in various library operations. No matter the importance of robotics and its adoption in developed countries for library application in universities, many issues have slowed down its adoption in Nigerian academic libraries especially universities in Bayelsa State.

There are issues of sluggish readiness of academic administrators to adopt the technologies, inadequate infrastructural facilities and trained information professionals to carry out the services effectively, electricity problems, funding, digital preparedness, policy guidelines and many other challenges have slowed down the adoption of this laudable programme. Nevertheless, if universities failed to adopt new technologies like robotics to carry out library services in line with international counterparts, they will definitely be backward in the universality of library operation which cannot be good for credible academic excellence.

AIM AND OBJECTIVES OF THE STUDY

The study assessed the preparedness of academic libraries towards the use and adoption of Robotic technologies in public university libraries in Bayelsa State. The study figured out the following objectives:

1. Examine the extent of preparedness of university libraries towards robotic technologies in terms of digital infrastructure in public universities in Bayelsa State.
2. Examine the potential usages of robotic technologies in academic libraries in public universities in Bayelsa State.
3. Ascertain the potential challenges university libraries may face in the adoption and use of robotic technologies in public universities in Bayelsa State.

RESEARCH QUESTIONS

1. To what extent are university libraries prepared towards robotic technologies in terms of digital infrastructure in public universities in Bayelsa State?
2. What are the potential usages of robotic technologies in university libraries in public universities in Bayelsa State?
3. What are the potential challenges that university libraries may face in the adoption and use of robotic technologies?

HYPOTHESES

1. There is no significant difference between the mean scores of information professionals in federal university and state universities on the extent university libraries are prepared towards robotic technologies in terms of digital infrastructure in public universities in Bayelsa State.

2. There is no significant difference between the mean scores of information professionals in federal universities and state universities on the potential usages of robotic technologies in academic libraries in public universities in Bayelsa State.

3. There is no significant difference between the mean scores of information professionals in federal universities and state universities on the potential challenges that university libraries may face in the adoption and use of robotic technologies

METHODOLOGY

The study used descriptive survey research design. The population consists of the 35 information professionals in the four universities in Bayelsa State. Niger Delta University (17), Federal University, Otuoke (13), University of Africa (3) and Bayelsa State Medical University (2) respectively. A sample size of 35 information professionals in the four universities represent 100% of the population. Census sampling method was used for the study. Out of 35 respondents, 33 responded to the questionnaire. In doing this, all the information professionals that make the population were used. The instrument that was used for data collection in this study was a 15-item questionnaire titled: Assessment of Preparedness of Public University Libraries towards the Use and Adoption of Robotic Technologies in Public Universities in Bayelsa State Questionnaire" (APALTUARTQ).

The questionnaire was divided into two sections: section A was used to collect demographic data from the respondents, while section B which is the questionnaire instrument with 15 items was used to gather responses from the respondent. The criterion mean of 2.50 was used as the bench mark for agreeing or disagreeing to responses in the mean calculations in the study. The 4- points modified likert rating scale of Strongly Agree (SA) = 4 points; Agree (A) = 3 points; Disagree (D) = 2 points; and Strongly Disagree (SD) = 1 point) and Very High Extent, High Extent, Low Extent and Very Low Extent was used as response options to guide the respondents' opinions on the instrument Cronbach Alpha statistics showed a reliability coefficient of 0.75. Mean scores and standard deviation were used to answer the research questions while the z-test statistics was used to test the hypotheses at 0.05 level of significant.

RESULTS AND DISCUSSION

Data Analysis and Empirical Results

Research Question 1: To what extent are university libraries prepared towards robotic technologies in terms of digital infrastructure in public universities in Bayelsa State?

Table 1: Mean and Standard Deviation Analysis of Information Professionals in Federal University and State Universities on extent university libraries are prepared towards robotic technologies in terms of digital infrastructure in public universities in Bayelsa State.

S.N.	Items	Information Professionals in Federal University(12)		Information Professionals in State University (21)			
		$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}_1\overline{X}_2$	Remark
1	There is a provision of uninterrupted power supply	2.12	1.18	2.01	1.22	2.07	Very Low Extent
2	There are Computers for easy access to library collections	1.89	1.27	2.12	1.18	2.01	Very Low Extent
3	There are advanced digital technological infrastructure that can help in storing digital collections in databases in the library	1.83	1.32	1.85	1.29	1.84	Very Low Extent

4	There are internet facilities installed to carry out library services	3.00	1.23	2.60	1.22	2.8	**High Extent**
5	Digital Racks Telecommunications network are in place in the library	1.80	1.32	1.60	1.37	1.7	**Very Low Extent**
Average mean and standard deviation		2..13	1.26	2.04	1.26		

Table 1 indicates that items 1, 2, 3 and 5 have mean scores below the criterion mean of 2.50 indicating that, to a very low extent university libraries are prepared towards robotic technologies in terms of digital infrastructure because, to a very low extent there is provision of uninterrupted power supply, there are no search record machines for easy access to library collections, there are no advanced digital technological infrastructure that can help in storing digital collections in databases in the library and digital shelves telecommunications network are no yet in place in the library. Meanwhile, item 4 has a mean score of 2.8, indicating that, there are internet facilities installed to carry out library services.

Research Question 2: What are the potential usages of robotic technologies in academic libraries in public universities in Bayelsa State?

Table 2: Mean and Standard Deviation Analysis of Teaching Staff in public University libraries on the potential usages of robotic technologies in academic libraries in public universities in Bayelsa State

S.N.	**Items**	**Information Professionals in Federal University(12)**		**Information Professionals in State University (21)**			
		$\overline{X}$	**SD**	$\overline{X}$	**SD**	$\bar{X}_1\bar{X}_2$	**Remark**
1	Robots are to be used in academic libraries for purposeful scanning of shelves	3.01	1.23	3.19	1.31	3.1	Agreed
2	Robots do not perform automatic retrieval of requested items	1.99	1.22	1.94	1.25	1.97	Disagreed
3	Robots would assist in referencing services	2.5	1.82	2.60	1.22	2.55	Agreed
4	Robots assist in real-time browsing of printed materials through a web interface where clients engages the computer	3.07	1.26	2.68	1.13	2.88	Agreed
5	Adoption of robotic in the libraries would ease the physical human operations that seems tiring	3.12	1.28	2.60	1.22	2.86	Agreed
Average mean and standard deviation		**2.74**	**1.36**	**2.60**	**1.23**		

Table 2 indicates that item number 1 had the highest mean score of 3.1 followed by item 4 with 2.88, item 5 with 2.86, item 3 with 2.55 and item 2 with 1.97 respectively. Items 1, 3, 4 and 5 had mean scores above the criterion mean of 2.50. This clearly indicated that, adoption of robotic in the libraries would ease the physical human operations that seem tiring, robots would assist in real-time browsing of printed materials through a web interface where clients

engages the computer, robots would assist in referencing services and robots are to be used in academic libraries for purposeful scanning of shelves. Meanwhile, item 2 had mean scores below the criterion mean of 2.50. This means that, robots would perform automatic retrieval of requested items.

Research Question 3: What are the potential challenges university libraries may face in the adoption and use of robotic technologies?

Table 3: Mean and Standard Deviation Analysis of Teaching Staff in public Universities on the potential challenges university libraries may face in the adoption and use of robotic technologies

S.N.	Items	Information Professionals in Federal University(12)		Information Professionals in State University (21)			
		$\overline{X}$	SD	$\overline{X}$	SD	$\bar{X}_1\bar{X}_2$	Remark
1	Insufficient knowledge and awareness of robotic technologies and application by information professional	3.22	1.33	3.72	1.25	3.47	**Agreed**
2	Inability of library administrators to bravely implement robotic technologies in the library	3.60	1.57	3.46	1.39	3.53	**Agreed**
3	Information professionals possess less interest to embrace the application of robotic technologies in their libraries	1.89	1.27	2.13	1.19	2.01	**Disagreed**
4	Lack of human resources with requisite skills to provide effective robotic library services	3.42	1.45	3.38	1.43	3.4	**Agreed**
5	lack of network capacity to cope with increased data usage	3.32	1.38	3.39	1.43	3.36	**Agreed**
Average mean and standard deviation		**3.09**	**1.4**	**3.22**	**1.34**		

Table 3 indicates that item number 2 has the highest mean scores of 3.53 followed by item 1 with 3.47, item 4 with 3.4, item 5 with 3.36 and item 3 with 2.01 respectively. The scores of items 1, 2, 4 and 5 are above 2.50 which is the criterion mean. This simply implies that, insufficient knowledge and awareness of robotic technologies and application by information professional, inability of library administrators to bravely implement robotic technologies in the library, lack of human resources with requisite skills to provide effective robotic library services and lack of network capacity to cope with increased data usage are major challenges confronting academic libraries in the adoption and usage of robotic technologies. Meanwhile, item 3 has mean scores below the criterion mean of 2.50. This means that, information professionals have interest to embrace the application of robotic technologies in their libraries.

Ho_2: There is no significant difference between the mean scores of information professionals in federal universities and state universities on the potential usages of robotic technologies in academic libraries in public universities in Bayelsa State.

Table 4: z-test Analysis of the Difference between the Opinions of Information Professionals in Federal University and State Universities on the potential usages of robotic technologies in academic libraries in public universities in Bayelsa State

Subject	N	$\bar{x}$	SD	Df	z-cal.	z-crit.	Level of Sig	Remark
IP in Federal University	12	2.74	1.36	2 31	0.29	±1.96	0.05	Accepted
IP in State Universities	21	2.60	1.23					

The result of hypothesis 1 showed that the z-calculated value of 0.29 is less than the z-critical value of ±1.96 at degree of freedom of 31 at 0.05 level of significance. We therefore retain the null hypothesis and uphold that, there is no significant difference between the mean scores of information professionals in federal universities and state universities on the potential usages of robotic technologies in academic libraries in public universities in Bayelsa State.

Ho_3: There is no significant difference between the mean scores of information professionals in federal universities and state universities on the potential challenges that university libraries may face in the adoption and use of robotic technologies

Table 4: z-test Analysis of the Difference between the Opinions of Information Professionals in Federal University and State Universities on ways information is dissemination for sustainable learning among academic librarians in public universities in Rivers State.

Subject	N	$\bar{x}$	SD	Df	z-cal.	z-crit.	Level of Sig	Remark
IP in Federal University	12	3.09	1.4	2 31	-0.27	±1.96	0.05	Accepted
IP in State Universities	21	3.22	1.23					

The result of hypothesis 1 showed that the z-calculated value of -0.27 is less than the z-critical value of ±1.96 at degree of freedom of 31 at 0.05 level of significance. We therefore retain the null hypothesis and uphold that, there is no significant difference between the mean scores of information professionals in federal universities and state universities on the potential challenges that university libraries may face in the adoption and use of robotic technologies.

SUMMARY OF FINDINGS

1. It was found that, there are yet no provision of uninterrupted power supply for the adoption of robotic technologies in the library, no search record machines for easy access to library collections, no advanced digital technological infrastructure that can help in storing digital collections in databases and digital shelves telecommunications network are no yet in place in the library.
2. It was found that, adoption of robotic in the libraries would ease the physical human operations that seem tiring, robots would assist in real-time browsing of printed materials through a web interface where clients engage the computer, robots would assist in referencing services and robots are

to be used in academic libraries for purposeful scanning of shelves.

3. It was found that, insufficient knowledge and awareness of robotic technologies and application by information professional, inability of library administrators to bravely implement robotic technologies in the library, lack of human resources with requisite skills to provide effective robotic library services and lack of network capacity to cope with increased data usage are major challenges confronting academic libraries in the adoption and usage of robotic technologies.

DISCUSSION OF FINDINGS

The result of first findings is in consonance with Kamble, et al. (2018) who unveiled some notable things that should be in position in preparation for the adoption of robotics in the libraries which includes augmented reality and robotic systems, Internet of Things (IoTs), telecommunication facility, cloud computing, provision of uninterrupted power supply, simulation prototypes, big data analytics and 3D printing. Ugwu and Ugwuanyi (2015) opined that library software and technophobia, search record machines, digital shelves telecommunications network, incorporation of advanced digital technologies and automation, library e-resources which includes Online Public Access Catalogue, repositories of local content are the infrastructural challenges that are bound to be encountered in the adoption and use of robotic technologies.

The result of second findings is in coincides with the findings of Coleman (2017)who found that, Robots are used in academic libraries for purposeful scanning of shelves and for deliberate self-navigation, most specially at night, through the use of radiofrequency identification (RFID) tags, that are attached to books normally to generate reports on the said books. Tella (2020) also found that, robots are used for referencing services and maintenance of circulation records for easy operations in the library.

The result of third findings is supported by the findings of Ugwu & Ugwuanyi (2015) who found that, lack of network capacity to cope with increased data usage and inadequate e-learning facilities as some challenges that hinder the progress of robotic operations in the libraries.

CONCLUSION

It is very clear from the above findings that the adoption and use of robotic technologies in academic libraries, there is yet no provision of uninterrupted power. no search record machines for easy access to library collections and no advanced digital technological infrastructure in the attempt to prepare for such adoption. Meanwhile, the effort of this adoption may be challenged by, insufficient knowledge and awareness of robotic technologies and application by information professional, inability of library administrators to bravely implement robotic technologies and lack of human resources with requisite skills to provide effective robotic library services.

RECOMMENDATIONS

Based on the findings of the study, the researchers recommended that:

1. There is need for university libraries to be well prepared for the adoption of robotic technologies in academic libraries by making workable policy documents that will guide the use of these technologies.
2. Information professionals need to be trained and exposed to various trainings that will promote the adoption and use of the robotic technologies.

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