Robots in Nigerian academic libraries: Investigating infrastructural readiness and potential for library services

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Abstract
The study used the lens of Robotics and related strands such as Artificial Intelligence (AI) in the libraries to view how ready the selected Nigerian universities libraries vis-a-vis their librarians' potentials of the technologies. The study addressed the following questions: What is the level of readiness of university libraries in Nigeria in terms of digital infrastructure, policy framework and human capacity for the adoption and use of robots in providing library and information services? What services are currently available in the university libraries that can potentially be adopted and rendered through robots? What are the attitudes of librarians towards the potential use of robots in providing and accessing library and information services?

Keywords: Robots, Infrastructural readiness, Library services, Digital technologies, Artificial intelligence

Introduction
Library in universities are essential agents that develop, organize, provide easy access to and preserve materials to meet the needs of students and scholars. In an attempt for a library to attain its mandate, many activities are performed by the library which translates to library and information services. In other words, they have the mandate to assist research process by collecting, preserving and making available an array of information resources relevant to their research community. Also, to fulfil their mandate effectively, libraries do sought software

applications, deploy technological utilities to facilitate and enhance services. Technology applications exponentially improve libraries' effectiveness and efficiency, provided such library could afford the infrastructure and resources required. Therefore, the emergence of digital technologies applications and devices are removing the physical barriers thereby turn the library space into an intelligent space.

The Libraries in the developed world serves international students, academics, researchers and senior executives where users demand access to data and value information through the technology and devices they use. They are innovative and anticipate the latest technological trends, then integrates them into the user experience, offering new formats and environments to provide a disruptive learning environment as an essential part of the current digital transformation in higher education. Libraries do implement technologies such as Augmented Reality, Virtual Reality, immersive reality, sensory immersion, gesture recognition, humanoid robots, mobile app, and gamification. These initiatives have totally changed their user experience and make information discovery more intuitive, accessible and entertaining (Cotera, 2018)

It should be noted that the Nigerian academic libraries have rich collections of various information materials (journals, magazines, books, reference works, newspapers, government publications, reports, theses/dissertations, database, CD ROMS, artworks, photos, manuscripts, etc.) covering array of subjects to serve its academic community. In the recent years, automation has played a vital role in library systems that handle tasks of acquisition, cataloging, serials, and circulation. Deployment of robotic systems and their associated technologies would in turn, minimize the demand for human interaction. Therefore, gauging the readiness of robots deployment in Nigerian libraries as an advancements in automation will provide an overview on the current state of library automation infrastructures, addresses the need for changing personnel to accommodate these changes, and assesses the future for academic libraries in the developing countries as a whole.

Purpose
This study investigated the infrastructural readiness of Nigerian academic libraries in deploying robots and its potential for the provision of library services. The further focus of the study is to use the lens of Robotics and related strands such as Artificial Intelligence (AI) in the libraries to view how ready the selected Nigerian universities libraries *vis-a-vis* their Library and information specialists and professionals on potentials of the technologies.

The study addressed the following questions: What is the level of readiness university libraries in Nigeria in terms of digital infrastructure, policy framework and human capacity for the adoption and use of robots in providing library and information services? What services are currently available in the university libraries that can potentially be adopted and rendered through robots? What are the attitudes of librarians towards the potential use of robots in providing and accessing library and information services? What factors influence the adoption and use of robots by librarians in providing and accessing library and information services?

Motivation
This study was motivated by the fact that Robot as a machine which performs automatic set of tasks are gradually gaining entrance into libraries in the developed world. It was observed that Nigeria as a developing country are leapfrogging to embrace the emerging fields such as The Industry 4.0. This has to do with the current and developing environment in which disruptive technologies and trends such as Robotics are having a huge impact changing the way we live and work.

This study, therefore, investigated the infrastructural readiness for robotic deployment and their potential for library information services of university libraries in Nigeria. It is expected that the outcome from the study would pave the way for policy, practical and managerial interventions in areas of infrastructure development, capacity building, awareness creation, institutional framework and budgetary support to prepare the ground for using robots to provide library and information services as we are approaching the fourth industrial revolution (4IR).

Review of Literature
The empirical and theoretical literature reviewed was derived from both electronic and print library resources in databases, e-books, books, journals and other related resources. The rapid technological developments and the accessibility of information resources real-time, online and in a virtual environment have changed how research is done. Academic libraries can now effectively support intellectual and academic endeavours for information seeking and researching (Cabrerizo *et al*., 2015). According to Papy & Jakubowicz (2017), libraries are full of innovative activities that is empowering users and increasing their potential for research.

Nigeria and other developing countries especially Africa can leapfrog technologically in terms of digital infrastructure deployment and use in driving research. Digital technologies are becoming concept that is more firmly embedded and assumes greater significance for public and academic organisational information policies and strategies in Nigeria (Dickson *et al.*, 2016; Baro, 2016; Onyam & Akpom, 2016). In other words, all universities are setting embracing technologies to drive research and the need for a higher level framework to organise our understanding of these developments becomes more pressing (Ogunsola, 2005; Etim, 2006). Premised on the global practices, Nigeria witnessed recent establishment and use of technologies in its universities (Ajuwon, 2006; Ani & Ahiauzu, 2008; Abubakar, 2011). The deployment was towards a stepping stone in the provision of viable and vibrant academic library services that are desired in the 21st Century.

In Nigeria of recent, various studies has been carried out on assessment of e-resources use, social media application and skills to render Information Communication Technology (ICT) services in the academic libraries such as Simon & Ogom (2015); Nkamnebe, *et.al,* (2015); Ojeniyi & Adetimirin (2016) while Asogwa, Ugwu & Ugwuanyi (2015) evaluated the quality of online services in academic libraries in Nigeria as regard the functionality of electronic infrastructures. Libraries strengthen overall user experiences by having customer value-based services perspective to keep a larger "share of customer" (Weinstein & McFarlane, 2017). Researchers have it that

visual and interactive features embedded in science related e-learning application have the potential to induce positive satisfaction of users (Violante & Vezzetti, 2015). There are excellent findings in terms of poor funding, intermittent power supply and weak telecommunication infrastructures as constraints and challenges facing academic libraries in the use of advanced automation systems in Nigerian universities (Asogwa, Ugwu & Ugwuanyi, 2015; Quadri & Adebayo, 2016; Ukon, Wogu, & Obayi, 2016; Chigbu, John-Okeke & Omekwu, 2016; Njoku, 2017; Azubuike & Madu, 2017).

To the best of my knowledge, the existing literature did not address the status of libraries in deployment of robots for improving the usage of their resources and services in Nigeria. There were also nothing on policies, services and the sustainability framework with which the academic libraries are using as regards adoption of emerging technologies that can then be used to guide future research and practice. The recent issue on robotic deployment was the University of Pretoria's (UP's) Department of Library Services that "employed" the first client service robot known to be in use in any university library in Africa. The university says the introduction of the robotic librarian is in keeping with its focus on evolving in line with the fourth industrial revolution.

Approach

The study adopted the post-positivist paradigm and a survey research design using observation and semi-structured interview for a focused group. The observation checklist was utilised to collect data to guide on infrastructural readiness of the libraries, while the interview schedule was used to elicit qualitative data from set group of librarians/ICT professionals on potentials of robots deployment in their libraries. Three academic libraries in Nigeria were purposively selected based on their ownership (federal, state and private), namely: Federal University Oye-Ekiti, Ekiti State University, Ado-Ekiti and Afe Babalola University, Ado-Ekiti to form the site of the study. The data collected through the use of checklists and the engaged group were analysed using content, narrative and discourse for new data to emerge as findings.

Through the interviews, I directly ask librarians the level of readiness in terms of digital infrastructure, policy framework and human capacity for the adoption and use of robots in providing library and information services. What services are currently available for potential robots assistance? The attitudes of librarians towards the potential use of robots in providing and accessing library and information services were gauged.

It is worthy of note that the participants all agreed that Robots are used for various purposes in day-to-day life and part of the library's innovative progress. The disruptive technology, economy and competition has created desire for doing work in less time, For instance, Library Management Robot (LMR) will mitigate the problems by collecting the books from library counter and then arranging the books, one by one, into shelves. They further agreed that the deployment of robotic systems aim at minimizing the efforts required to arrange books in a library in consideration that

their libraries consists of thousands of books and they complained that there are few employees to arrange them.

Findings

Although, librarians were skilful in the use of digital facilities and infrastructures with varying levels of competencies but not without several challenges hindering the effective use of digital technologies in the libraries. These challenges included but were not limited to unreliable power supply, inadequate technology infrastructure, absence of technical skills, not too positive attitude towards advanced automation, perceived absence of senior management support, use of inappropriate library software and technophobia (threat to their jobs). There are difficulties to search record when there is no digitized system, or if the records are large in number. Shelving challenges in placing books from the counter or reading table to the respective shelves. Difficulties due to increase in the number of shelves in the library makes it difficult for a single person to remember such a large record. Financial problem to manage the library as well as how the few personnel could be helped to decrease efforts in managing the books in the library.

The telecommunications network is having high penetration in Nigeria making the delivery and access to library services through internet easier but not without challenges. However, human resources and requisite skills were inadequate to provide effective library and information services through the use of advanced digital technologies and automation. Even though, the surveyed institutions had e-resources such as Online Public Access Catalogue, e-books, e-journals, and repositories of local content that could be upgraded using AI. The librarians are enthusiastic towards the potential use of robots in providing and accessing library and information services except few that seems to be technophobic. The overall conclusion from this study was that Nigerian university libraries are partially ready to embrace any technological framework to offer library and information services but certain infrastructure and skills issues must be addressed.

Finance may not allow the Nigerian academic libraries to catch up easily with their counterparts in developed countries but public and private agencies such as Tertiary Education Trust Fund, Nigerian Communication Commission, MTN Telecommunications company and other International agencies like Ford Foundation, British Council, CIDA, UNESCO and UNICEF are contributing to digital technologies development in academic libraries and these have accelerated access to computers, connectivity and localized internet content. The findings of the study revealed that automation in academic libraries in the three surveyed sites was limited and at varying stages of development.

Originality/value

There is a scarcity of reports in published library literature about the use of Robotic systems in academic libraries in Nigeria and other developing countries of Africa.

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