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# Fostering Cybersecurity in Institutional Repositories: A Case of Nigerian Universities

**Ifeoma Stella Njoku**
*The Library,Federal University of Technology, P.M.B. 1526 Owerri, Nigeria.*
*somanjoku@gmail.com,*
*ifeoma.njoku@futo.edu.ng*

**Buniechukwu Chidike Njoku**
*Department of Science and Technology, University of Burgundy France.*
*buniechukwunjoku@etu.u-bourgogne.fr,*
*bunienjoku@gmail.com*

**Scholastica A. J. Chukwu**
*The Library, Federal University of Technology, P.M.B. 1526 Owerri, Nigeria*
*nnechika2005@gmail.com,*
*austinjanek2@yahoo.com*

and

**R. Ravichandran**
*Resource Centre, National Institute of Technical Teachers Training and Research Taramani Chennai 600113, Tamil Nadu, India.*
*keelairavi@hotmail.com, ravi@nitttrc.ac.in*

## Abstract

*Some Nigerian universities are digitising their scholarly heritage and the high risk of loss or attack of digital records due to viruses and cyber hacks is worrisome, with far reaching consequences on the confidentiality, integrity and availability triad. This paper examines cybersecurity and institutional repository (IR) protection in Nigeria, highlighting the impact of cybersecurity and risk management. The study explores the five core frameworks of cybersecurity with emphasis on strategies for policy development and management of risk. It also analyses security threats through feedback from professionals in the referenced domain. A manual assessment was conducted with all Nigeria institutional repositories registered on opendoar.org using qualitative descriptive analysis. The sample size of the study consists of 88 librarians and information, communication and technology workers. A structured questionnaire on threats and risks of institutional repositories in Nigeria were distributed and 62(70.4%) responded. Results show that, of 198 federal, state and private universities, only 29 (14.6%) have established institutional repositories with slow adoption rate of 12.5% from 2009 to 2020, and 2019 having the highest established IR at a growth rate of 24%. Total number of items uploaded was 22,828. This paper found that DSpace open repository software had 79.3% use among institutions, while 26 institutions (89.6%) have uploaded journal articles. Hardware and software threats stood out prominently as leading causes of sub-optimal repository performance. Evaluated against an assigned weighted point system (of 31) derived from number of technical workers in IR domain, data reveals malware and malicious code as the biggest risk to repository resources, with 30.6%, followed by password attacks at 28% and IP theft 27.8% points respectively. However, hardening security systems guarding institutional hardware, software and infrastructure such as; management of identity access and operation, secure network application and data, could reduce incidents of cyber-crime. The research study recommends the development of modern cybersecurity framework for university libraries, mechanism for data defenses and redundancy strategies such as decentralisation of data and networks to mitigate the risk of vulnerability to attack and reduce loss from cyber incidents.*

**Keywords:** Cybersecurity, Cybercrime, Cyber Attack, Institutional Repositories, Open Research, Digital Resources.

## Introduction

The development of information technology (IT) and networked systems in the world has positive attributes on the institutional repositories. This migration of conventional repository to digitised format available on software, hardware and internetworked infrastructure has put host and delivery systems at great risk from threats like denial of service, malware, adware, ransom ware, virus attacks, social engineering, illegal data access, data theft, data confidentiality attacks and compromise of data integrity.

The concept of cybersecurity has been prompted by the need to provide seamless protection of data and information. Cybersecurity is the body of plan, policies, guidelines, approaches, actions, training, practices, assurance and technologies that can be used to protect the organisational assets such as computing devices, personnel, infrastructure, applications, services, telecommunications systems, and all the transmitted and stored information in the cyber environment (*International Telecommunication Union, 2012*). The rapid evolution of cyber attacks has led to concepts such as; Cybercrime as a service, encompassing concepts such as Malware-as-a-service and Phising-as-a-service. These concepts offer end-to-end services for malware distribution and spam attacks in digital environment. Cybercrime is on the increase and the cost has a cumulative effect on victims and organisations involved in cyberspace losses. Cybercrime undermines the overarching benefits of IT in achieving a scholarly environment. Incidents in 2011 affected over 40 million people in the US, 54 million in Turkey, 20 million in Korea, 16 million in Germany, and more than 20 million in China (McAfee, Intel Security, 2014).

Cyber-attacks incur an annual cost to the global economy of more than $400 billion in losses, which is more than national income of some countries (Lewis and Baker, 2013). Forbes (2015) asserts that the global cybersecurity market capitalisation as at 2015 was $75 billion and is expected to hit $170 billion in 2020. However, most countries and organisations underestimate the risk they face from cybercrime and how quickly this risk can grow. Evidence shows that Internet protocol theft and recovery loss accounts for the cost of cybercrime and its impact on national income that would otherwise be used for national development.

A study by Intel system on 51 countries in all regions of the world which accounts for 80% of global income shows that there are variations of losses among countries and Nigeria falls into a moderate confidence rating of 0.8% cybercrime tracking per gross domestic product (GDP) (McAfee, Intel Security, 2014).A 2022 Sophos Whitepaper concluded that 66% of organisations were affected by cyber attacks in data encrypted ransonware, with average ransom payments amounting to over $812,360 in the same period (Sophos, 2022). This data reveals that despite attempts by the state departments and agencies of security like National Information Technology Development Agency (NITDA) in Nigeria, there is still an overwhelming influence of threat actors on national and organisational integrity, resulting in financial loss (Madobi, 2023 and Ezeh, 2022).

A report by the National Communications Commission (2017) shows that about 91 million Nigerians use the Internet. This accounts for more than 48.9% of the population- one of the highest in Africa. Consequently, Nigeria ranks third with 5.8% among the top ten countries in the world with the highest individual perpetrators in cybercrime (Internet Crime Complaint CentreIC3 Report, 2010 and IC3 Report, 2017). Nigeria has been struggling with data theft issues, piracy and vandalism. Institutional repositories are not spared as they face the challenge of cybersecurity. The most common exploitation techniques of cyber crime in institutional repositories consist of social engineering, a situation where cybercriminals use programming or implementation failure to gain access to information (Anderson, Barton, Bohme, Clayton, Van Eeten, and Levi, 2012). A study of 600 students in tertiary institutions in Ekiti State, Nigeria to determine students' participation in cybercrime in Federal University of Oye-Ekiti, Ekiti State University and Afe-Babalola University shows that phishing, data theft and plagiarism are significant cybercrime in Nigeria (Omodunbi, Odiase, Olaniyan and Esan, 2016). According to finding by Adetoro and Okike (2020) on threats to the operating systems across the selected university libraries, malware was the major threat to the database/OPAC systems with a mean value of 62%, viruses and wormsa mean

value of 60%, while, external hacking had a mean value of 31.7%.These effects diminish investment in research and also reduce the global rate of technological development.

An investment in research preservation, accessibility and visibility is to create innovation, attract users and competitors. Weak cyber law enforcement encourages cyber criminals and inhibits organisations and country's ability to build innovative infrastructure and development. Thus, the need for effective institutional repository protection achieved through institution, national and international policies and implementation, counter defence attack and preventive systems. Institutions are thereby required to influence and develop policy to enable Nigerian higher education realise the benefits of open research.

Nigeria has one hundred and ninety eight (198) federal, state and private universities (National Universities Commission, 2022). The study focuses on the protection of institutional repositories in Nigerian university libraries as they have in recent years, joined the open access to information in making scholarly publications available to the global community in the quest to link indigenous information heritage access to the world. Yet, inadequate data security, security framework policy and implementation continue to demean information protection. One of the recent challenges encountered by the library as it manages institutional repository is poor performance of the network firewall, which exposes the IR server to cyber-attacks (Chisita and Chiparausha, 2021). Some of the ways of reducing such menace includes; ensuring that institutions protect their information technology infrastructure such as computer systems and networks, computer architecture and details of configuration guideline.

### Statement of the Problem

The Nigeria university libraries have in recent years, joined open access to information in making scholarly publications available to the global community in the quest to host indigenous (research) information heritage access to the world. However, inadequate data security framework, data loss management and physical implementation continue to degrade information protection. More challenges due to gaps in the protection of cyberspaces are weak digital intelligence, weak laws and implementation for cybercrime which means that domestic vendors face little risk of arrest and prosecution. The gap makes cyber criminals successful at the national level and even across borders. Nigeria needs to create strong laws to check data loss, promote data management and encourage the growth of institutional repositories. The study explores security threat analysis and risk, and recommend directives for cybersecurity implementation in university libraries to protect valuable repository data.

### Objectives of the Study

This work analyses the impact of cybresecurity threats on libraries and institutional repositories. The study focuses on the protection of institutional repositories of university libraries in Nigeria. This work aims to establish an inventory of threats to institutional repositories in Nigeria.

### Research Questions

1. What are the university libraries that have established institutional repositories in Nigeria?
2. What are the software platform adopted for the institutional repositories in Nigeria?
3. What are the content types of resources in the institutional repositories in Nigeria?
4. What are the security threats to institutional repositories in Nigeria?

## Cybersecurity Framework

Technological organisations are promoting policies and strategies to deal with the problem of cybersecurity. The National Institute of Standards and Technology (NIST) (2014) for example, established guideline in its framework that encourages checks and evaluation. See figure (1) below for the framework.

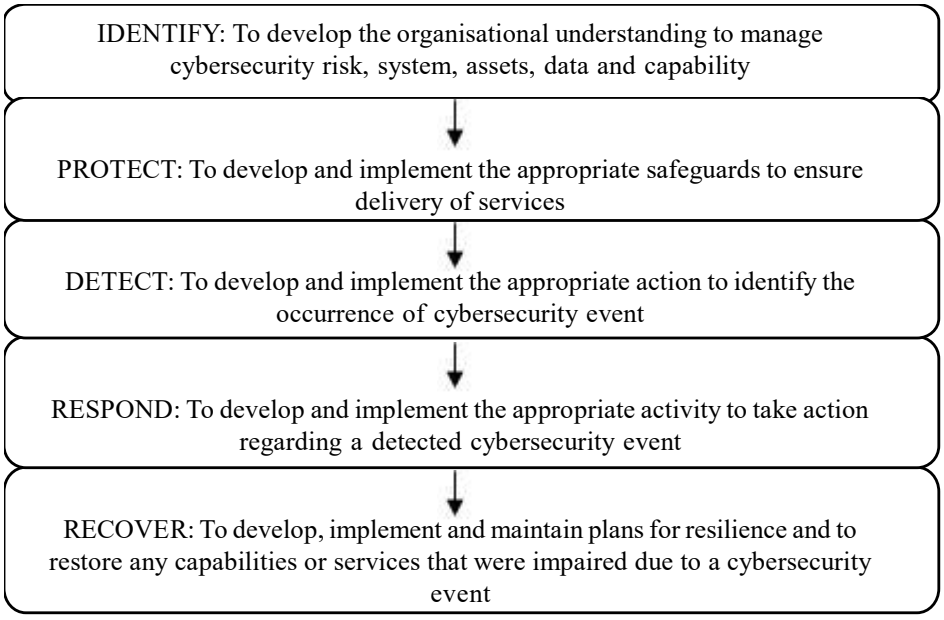


**Figure 1: Framework of Cybersecurity**

***Source*:** The National Institute of Standards and Technology (2014). Framework for improving critical infrastructure cybersecurity. *https://www.nist.gov/sites/default/files/documents////draft-cybersecurity-framework-v1.1-with-markup1.pdf.*

This framework's five core functions are intended to perform concurrently and continuously to form an operational culture that addresses the dynamic cybersecurity risk in the development, implementation, maintenance, and services of cyber networks. The framework focuses on cyber security context, function and risk that deals with organisational management strategy as a top priority. Implementation of the framework is based on the organisational determination for effective service delivery and maximisation of investment and outcomes. Though the framework was updated in 2017 to include feedback which makes it easier to use. The new framework did not replace existing management tools and policies in the model but identified gaps in the previous processes and developed models for improvement and management of the risk of cyber invasion. The most important response to cybercrime are policy and decision therefore, institutions are to manage the loss from cybercrime by deciding on the level of investment required to reduce the risk of cyberespionage and improve cyber supply chain risk management.

## Institutional Repositories in Nigeria

Institutional repositories reflect the social-economic and indigenous knowledge value of a society. These collections represent the cultural heritage of a society consisting of data base of research output of an institution. Nath, Joshi and Kumar (2008) define it as a digital achieve of an institutions intellectual capital. Salawu (2010) asserts that it is an expression and communication of a community locally owned and adopted knowledge, as well as experience cumulated over the time for communication to the international community. This also showcase to the international community social economic cultural value of a communal knowledge. The need for institutional repositories according to Ridwan (2015) is to enhance open access research and scholarly output to national and international community. Ghosh and Das (2007) Ivwighreghweta (2012) maintain that institutional repositories encourage the free availability and dissemination of scholarly research globally. Mohammed (2013) states that institutional repository has become an information and communication technology channel through which

academic research communities make their scholarly product visible to user. While, Nath, Joshi and Kumar (2008:52) assert that it is an open access gateway that preserves and disseminates the knowledge of institution through network with the aim to achieve institutional scholarly output that forms part of a larger global system of repositories using a standardised searchable interface (OAI-PMH). The release of OAI- PMH version 1.0 and version 2.0, open access repositories became more interoperable and this invention catalysed the progression of Institutional Repositories (Lagoze and Sompel, 2003). This development has opened up new ways of information harvesting, accessibility and dissemination of open knowledge globally thus, closed barriers of representation of cultural heritage of Nigeria.

Nigeria has one hundred and ninety eight (198) federal, state and private universities (National Universities Commission, 2022). Twenty nine or 14.6% universities have digitised some of their resources and uploaded to open access directory (*OpenDOAR, 2022).* Umar, Musa, and Aliyu (2014) write that some libraries in Nigeria have initiated the digitisation project into self-archiving open source software such as DSpace and Eprints.

## Security Issues for Institutional Repositories

Though there are processes where traditional authentication and authorisation are required, access to digital environments requires security between a user's browser and a web server. There are scenarios of unauthorised users getting access to important websites and information theft through Internet Protocol authentication and password cracking. To evade these scenarios, access management control relates the remote identity information necessary to the service manager for authentication to enable an identification decision (Smith, 2002). Access identification login and password security are technologies that eliminate access vulnerability. Different authentication measure includes: Login identification, Sign-in and Password access (Antón, 2007). The primary use of a computer login procedure is to authenticate the identity of any computer user or computer software attempting to access the computers services (Stathopoulos, Kotzanikolaou and Magkos (2006).

Reasons for security control access to materials in a repository may include user authentication, digital material authentication, authorisation and identification. The foundation of safeguarding digital environment lies in dynamic change process strategy practices that require standards, collaboration and communities. Adequate security is expedient to secure system architecture and configuration information. This is to avert security threat emanating from traffic and use of network system. Security traffic analysis against threats consists of share, embed and analyse operations.

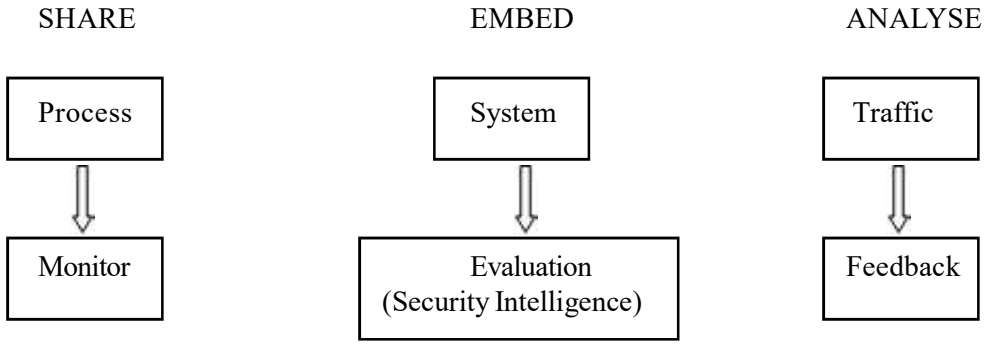


**Figure 2: Security Traffic Analysis:** ***Model by Authors: Njoku, I.S., Njoku, B.C., Chukwu, S.A.J. and Ravichandran, R.***

Effective monitoring, evaluation and feedback are used to develop confidentiality security authentication that safeguard digital platforms. Modeling and risk analysis consist of security intelligence and protection of critical systems and assets such as software, hardware and virtual private networks. Emphasis on protection of infrastructure like networks and computer systems is to avert damage indices and promote recoverability.

When developing an institutional repository, analysing and determining the digital identity and security of content is a major objective. Emphasis is on the type of technology, digital content, security of the systems / communication channel, diversity of users' platform and diversification responses at end users.

However, there are adverse negative effects presented through various attack vectors; the most prominent being malicious mail attachments, web page content, port scans, networked internet externally exposed ports. Also, attack surfaces such as databases, data entry, files, e-mail and other messages, cloud and local storage, login point are prone to malicious attacks.

Counter measures and protection mechanisms should be institutional goals to reduce the potential for threat and overall risk. Common measures are change control processes, physical entryway locks and barriers, passwords, firewalls and virtual private network tunnels. Vulnerability scan on data infrastructure in institutional repository can be performed with software as Nessus, Nexpose, Qualys, Nmap and web application scanners such as Skip fish, Arachni and IBM App.

Digital repository requires expertise in information technology, collection development, resource description, project management and high investment for maintenance of resources. These barriers account for the slow adoption of this initiative in developing nations. The United Nations (2010) resolution on cybersecurity encourages the creation of a global culture of cyber security and taking stock of national efforts to protect critical information infrastructures. One of the biggest challenges of cyber security is the quick rate at which in security risk[s] evolve. Discouraging cybercrime is the responsibility of a national cybersecurity and critical information infrastructure protection strategy that includes: the adoption of adequate legislation against the misuse of ICTs for criminal or activities intended to affect the integrity of national technological infrastructures. This responsibility requires coordinated action related to prevention, preparation, response and recovery from incidents and on the part of government institutions, private sector and citizens (International Telecommunication Union, 2012).

Cybercrime is a threat against various institutions connected to the Internet through their computers. Institution repositories strategies call for protection of data and information resources in the networked environment. In this regard, access management has emerged as major issue which hinders progress. While considerable work has been done in past decades within institutions and, more recently in support of digital repository, new policy issues emerge in the organisational access management control context. Weak security framework, poor implementation of infrastructure services, such as role-based access control; authorisation and authentication user and password protection are among the challenges facing institutional repositories. Without a proper access management method, confidentiality and integrity of information cannot be guaranteed. In most cases in-built mechanisms for security in repository software and operating systems are adopted for users' authentication, authorisation, digital rights and permission.

## Methodology

Qualitative descriptive analysis was used for the study. Data collection shows that 29 out of 198 Nigeria federal, state and private universities have established institutional repository managed by Directory of Open Access Repositories (OpenDOAR, 2022).Manual assessment of institutional repositories establishment, use and security was conducted on 29 Nigerian Universities registered on Opendoar.org (2022). Data is presented with tables, frequencies, graphs, and result findings discussed. This study was conducted in March 2022. An update on the analysis was conducted in February 2023.

Table 1 below shows the Nigerian universities registered with OpenDoar. OpenDoar is a directory of open access institutional repositories. It is a quality-assured global directory that enables the identification and search for repositories to countries of the world (Opendoar.org. 2022).

**Table 1: List of Nigerian Universities Registered with Opendoar**

| Nigerian Universities Registered with Opendoar | | | | | Metadata Count/ Subject | |
|---|---|---|---|---|---|---|
| **S/N** | **Universities** | **Content** | **URL** | **Software** | **Metadata** | **Subject Type** |
| 1 | ABU DSpace | Journal Articles | http://kubanni.abu.edu.ng/jspui | DSpace | 8449 | Multidisciplinary |
| 2 | Afe Babalola University Ado-Ekiti | Journal Articles | http://eprints.abuad.edu.ng/cgi/oai2 | EPrints, Version: 3 | 744 | Multidisciplinary |
| 3 | African Digital Health Library | Theses and Dissertations | http://adhlui.com.ui.edu.ng/ | DSpace | 1196 | Health and Medicine |
| 4 | African Digital Health Library-University of Ibadan | Theses and Dissertations | http://adhlui.com.ui.edu.ng/ | DSpace | 1196 | Health and Medicine |
| 5 | Ahmadu Bello University Zaria | Conferences; Workshop papers, Theses and Dissertations Journal Articles | http://www.abu.edu.ng/pages/researchworks | DSpace, Version: 5.5 | 7970 | Science Agriculture, Food and Veterinary Arts and Humanities |
| 6 | Ambrose Alli University Ekpoma Institutional Repository | Journal Articles, Theses and Dissertations | http://154.68.224.61:8080 | DSpace | | Multidisciplinary |
| 7 | American University of Nigeria (AUN) Digital Repository | Journal Articles, Theses and Dissertations, Book Chapters and Sections, Other Special Item Types | http://digitallibrary.aun.edu.ng:8080/xmlui/ | DSpace | | Multidisciplinary |
| 8 | Covenant University Ota Electronic Theses and Dissertation Repository | Theses and Dissertations | http://eprints.covenantuniversity.edu.ng/ | Institutional | 10 | Multidisciplinary |
| 9 | Covenant University Repository | Journal Articles | http://eprints.covenantuniversity.edu.ng/ | EPrints, Version: 3.3.7 | 13259 | Science Technology Social Sciences Law and Politics |
| 10 | dspace.funai.edu.ng | Journal Articles, Conference and Workshop Papers, Theses and Dissertations | http://dspace.funai.edu.ng/ | DSpace | 256 | Multidisciplinary |
| 11 | Ebonyi State University Abakaliki | Journal Articles, Theses and Dissertations | http://ir.ebsu.edu.ng:8080/ | DSpace, Version: 1.7.0 | 814 | Multidisciplinary |
| 12 | EUSpace | Journal Articles, Book Chapters and Sections | http://repository.elizadeuniversity.edu.ng | DSpace | 1220 | Arts and Humanities Science Social Sciences Technology |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | Federal University Dutsin-ma Institutional Repository | Journal Articles, Bibliographic References, Conference and Workshop Papers, Theses and Dissertations ,Book Chapters and Sections | http://dspace.fudutsinma.edu.ng/jspui/ | DSpace, | | Multidisciplinary |
| 14 | Federal University Lokoja | Journal Articles | http://repository.fulokoja.edu.ng/ | DSpace, Version: 5.2 | 89 | Science General Arts and Humanities Genera |
| 15 | Federal University Ndufu-Alike Ikwo | Journal Articles; Report and Working Papers | http://dspace.funai.edu.ng/ | DSpace | 256 | Multidisciplinary |
| 16 | Federal University of Technology Minna | Journal Articles; Theses; Learning Objects | http://dspace.futminna.edu.ng/jspui/ | DSpace, Version: 1.8.2 | 4454 | Multidisciplinary |
| 17 | Federal University of Technology Akure | Journal Articles, Bibliographic References, Theses and Dissertations | http://dspace.futa.edu.ng:8080/jspui/ | DSpace, Version: 1.7.2 | 2346 | Multidisciplinary |
| 18 | Federal University Oye-Ekiti institutional repository | Journal Articles | http://repository.fuoye.edu.ng/ | DSpace | 1166 | Multidisciplinary |
| 19 | Federal University Oye Ekiti Repository | Journal Articles, Reports and Working Papers, Learning Objects, Other Special Item Types | http://www.repository.fuoye.edu.ng/ | DSpace | 1166 | Science and Technology, Agriculture, Social Sciences |
| 20 | Landmark University Omu Aran | Journal Articles | http://eprints.lmu.edu.ng/ | EPrints, Version: 3.3.12 | 507 | Multidisciplinary |
| 21 | Landmark University Repository | Journal Articles, Bibliographic References, Conference and Workshop Papers, Theses and Dissertations | http://eprints.lmu.edu.ng/ | EPrints, Version: 3.3.12 | | Multidisciplinary |
| 22 | Open Resources University of Nigeria Nsukka | Journal Articles, Theses and Dissertations, Reports and Working Papers | http://unn.edu.ng/chart/repo | UNSPECIFIED | 22828 | Multidisciplinary |
| 23 | Theses and Dissertations Covenant University | Journal Articles Conference and Workshop Papers, Theses and Dissertations Learning Objects | http://theses.covenantuniversity.edu.ng/ | DSpace | 233 | Science , Technology Social Sciences Business and Economic Law and Politics Psychology |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24 | UILSPACE | Journal Articles, Theses and Dissertations | https://uilspace.unilorin.edu.ng | DSpace | 734 | Multidisciplinary |
| 25 | University of Ibadan Repository | Journal Articles. Bibliographic References, Conference and Workshop Papers, Theses and Dissertations, Books, Chapters and Sections | http://ir.library.ui.edu.ng/ | DSpace | 5104 | Multidisciplinary |
| 26 | University of Ilorin | Journal Articles, Theses and Dissertations | http://uilspace.unilorin.edu.ng:8080/jspui/ | DSpace | | Multidisciplinary |
| 27 | University of Jos | Bibliographic References, Conference and Workshop Papers, Learning Objects, Other Special Item Types | http://dspace.unijos.edu.ng/ | DSpace, Version: 3.2 | 1837 | Multidisciplinary |
| 28 | University of Lagos | Journal Articles, Conference and Workshop Papers, Theses and Dissertations, Learning Objects | http://repository.unilag.edu.ng:8080/xmlui/ | DSpace, Version: 3.2 | 674 | Multidisciplinary |
| 29 | University of Nigeria Nsukka | Journal Articles, Theses and Dissertations. Books, Chapters and Sections | http://repository.unn.edu.ng:8080/xmlui/ | DSpace, Version: 6.0 | 8674 | Arts and Humanities<br>Medicine<br>Agriculture, Food<br>Physics and Astronomy<br>Social Sciences<br>Technology |
| Total | | | | | 85182 | |

Table 1 shows that from (2009-2020) a total of 29 open access institutional repositories have been established in Nigeria with a total of 85,182 uploaded. The University of Nigeria, Nsukka has the highest upload of 22,828 items. There was no metadata count record from OpenDoar for four institutional repositories under study.

## Results

This study analysed the establishment of institutional repositories in Nigeria with OpenDoar institutional repositories statistical record for Nigeria educational institutions based on content, software, metadata count, subject type and security threats.

**Table 2: Year, Number and Adoption of Institutional Repositories in Nigeria from 2009-2020**

| YEAR | NO OF IR |
|---|---|
| 2009 | 1 |
| 2010 | 1 |
| 2011 | 1 |
| 2012 | 1 |
| 2013 | 3 |
| 2014 | 4 |
| 2015 | 5 |
| 2016 | 3 |
| 2017 | 2 |
| 2019 | 7 |
| 2020 | 1 |
| **Total** | **29** |

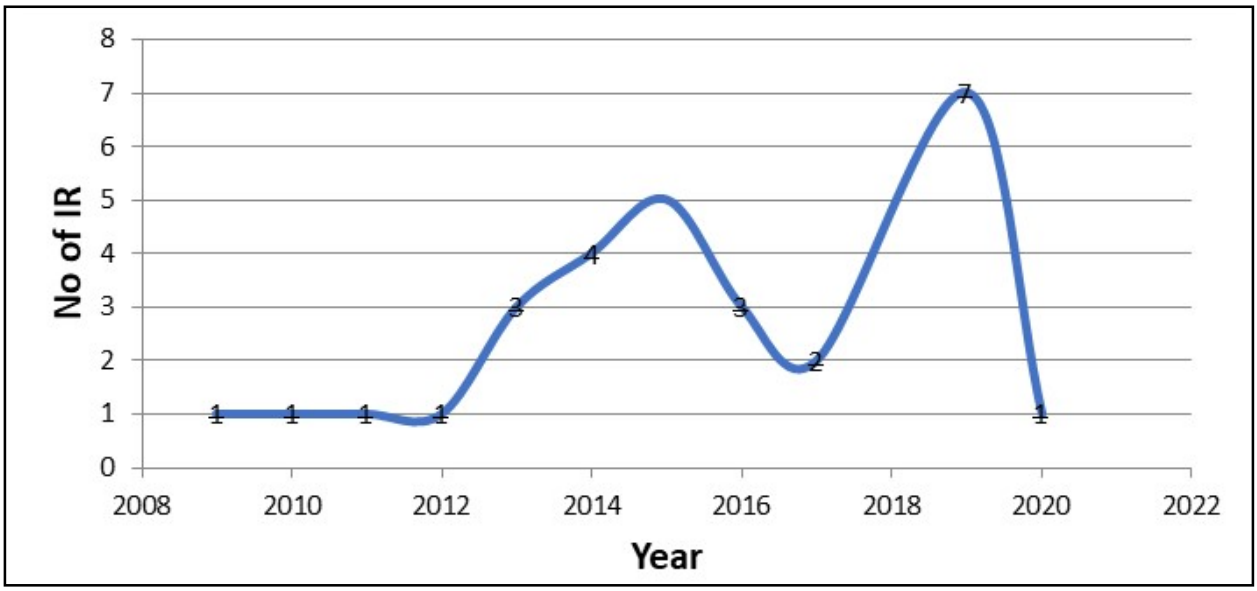


**Figure 3: Year, Number and Growth of Institutional Repositories in Nigeria from 2009-2020**

Data presented in Table 2 and figure 3 show the growth of institutional repositories in Nigeria from 2009-2020. The survey sample of 29 institutions show that 2019 had the greatest number (7) (24%), of institutional repositories, followed by 2015 which is (5) (17.2%) , 2014 were (4) (13.7%), 2016 and 2013 were (3) (10.3%), while 2017 had (2) (6.8%). Finally, 2009-2012 and 2020 were all (1) (3.4%). The table shows a slow growth rate of established institutional repository at 12.5% from 2009 to 2020 with its peak in 2019.

**Table 3: Software Platform Overview**

| SOFTWARE | FREQUENCY OF USE |
|---|---|
| DSpace | 23 |
| Eprints | 4 |
| Institutional | 1 |
| Unspecified | 1 |

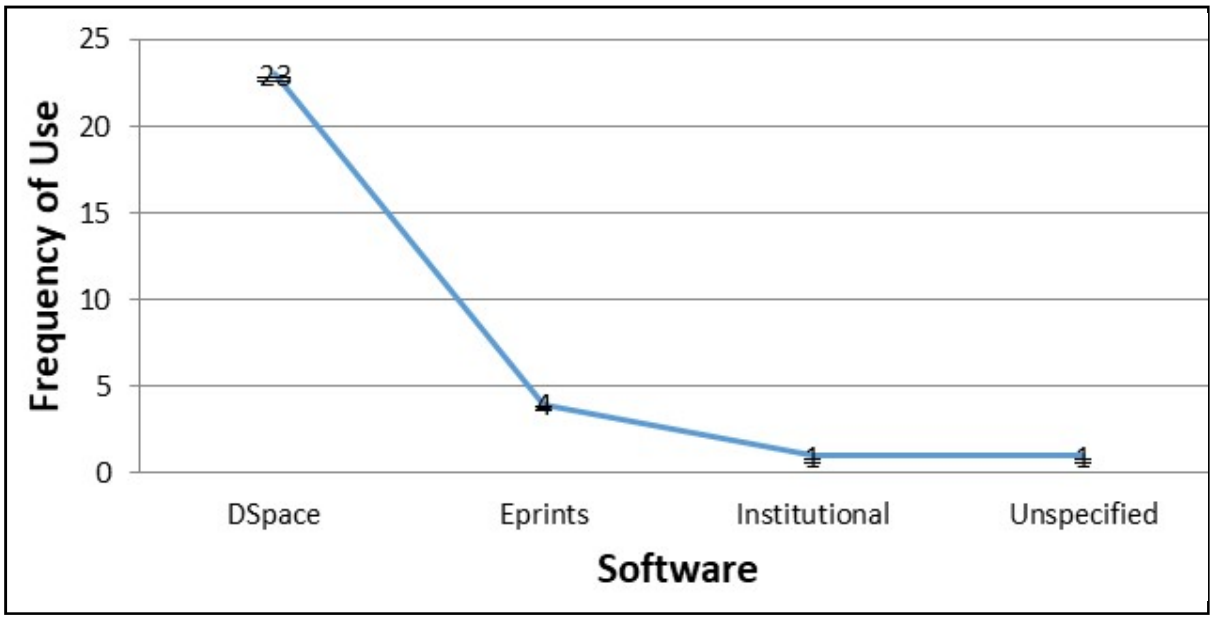


**Figure 4: Frequency of Use of Software**

Table 3 and figure 4: comprise of information on the software platform overview. The table shows that among the 29 institutions on the use of software, the majority indicated that (23) (79.3%) uses DSpace. Four used Eprint (4) (13.7%) and Institutional and Unspecified were (1) (3.4%) each.

**Table 4: Content Types Overview**

| TYPES | NO OF UNIVERSITIES |
|---|---|
| Journal Articles | 26 |
| Theses and Dissertations | 19 |
| Book Chapters/Sections | 4 |
| Conferences and Workshop Papers | 8 |
| Report and Working Papers | 4 |
| Bibliographic References | 4 |
| Learning Objects | 4 |
| Other Special Item Types | 4 |

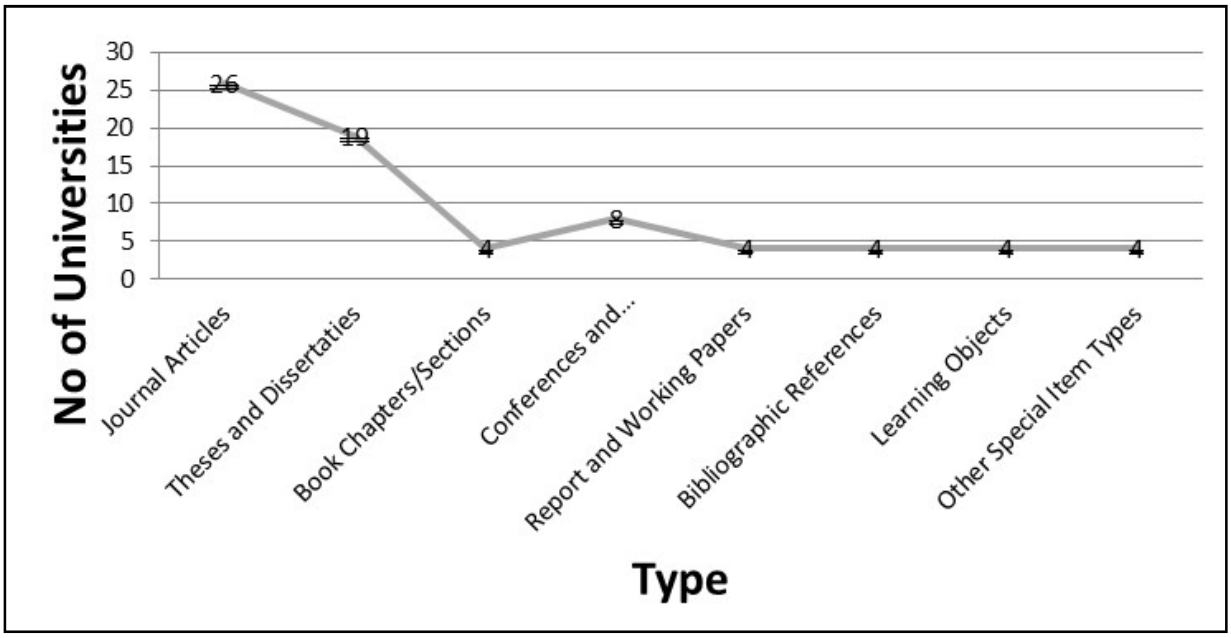


**Figure 5: Content Types Overview**

Presented on table 4 and figure 5 is information on the content types overview. The findings show that journal articles were the highest with (26) (89.6%), Theses and Dissertations had (19) (65.5%), Conferences and Workshop Papers (8) (27.5%), while others had (4) (13.7%) each.

**Generaland Technical Survey: Cybersecurity Threats on Institutional Repositories in Nigerian Universities**

Table 5
presents data from 29institutional repositories of Nigerian universities cybersecurity threats.

62 responses from librarians and information, communication and technology (ICT) staff, were classified into groups-

**Physical**: Referring to threats by human actors on system hardware. This class of attack includes breach of physical access control and damage of equipment and data.

**Software**: Referring to malicious pieces of computer code and programs designed to damage digital systems, and steal personal or financial information.

**Infrastructure**: Referring to threats to components of a network, including routers, firewalls, switches, servers that transport communications needed for service and content delivery.

Using a modified Likert scale, respondents offered insights on threats to library resources they had experienced while working. Responses were recorded to the question: Threat risk to the confidentiality, integrity and availability of institutional repositories.

Responses were also recorded for the indifferent option, for cases were the threat fell outside their domain of oversight.

**Table 5: Security Threats on Institutional Repositories in Nigerian Universities**

**Question: Threat Risk to the Confidentiality, Integrity and Availability of Institutional Repositories.**

| General Survey- Cybersecurity Threats of Institutional Repositories in Nigerian Universities | | | | | | Proportions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hardware Threats** | **Strongly Agree (SA)** | **Agree (A)** | **Disagree (D)** | **Strongly Disagree (SD)** | **Indiffe-rent** | **Strongly Agree (SA)** | **Agree (A)** | **Disagree (D)** | **Strongly Disagree (SD)** | **Indiffe-rent** |
| Intrusion | 35 | 24 | 2 | 0 | 1 | 56.45% | 38.71 % | 3.23% | 0.00% | 1.61% |
| Vandalism | 34 | 14 | 6 | 2 | 6 | 54.8% | 22.6% | 9.7% | 3.2% | 9.7% |
| Theft | 39 | 17 | 4 | 0 | 2 | 62.9% | 27.4% | 6.5% | 0.0% | 3.2% |
| Component Failure | 34 | 18 | 6 | 4 | 0 | 54.8% | 29.0% | 9.7% | 6.5% | 0.0% |
| EMI (electro-magnetic interference) | 10 | 16 | 5 | 5 | 26 | 16.1% | 25.8% | 8.1% | 8.1% | 41.9% |
| | | | | | | | | | | |
| **Software Threats** | **Strongly Agree (SA)** | **Agree (A)** | **Dis-agree (D)** | **Strongly Disagree (SD)** | **Indiffe-rent** | **Strongly Agree (SA)** | **Agree (A)** | **Disagree (D)** | **Strongly Disagree (SD)** | **Indiff e-rent** |
| Malware/Mali cious Code | 24 | 33 | 2 | 3 | 0 | 38.7% | 53.2% | 3.2% | 4.8% | 0.0% |
| Ransomware | 31 | 24 | 2 | 2 | 3 | 50.0% | 38.7% | 3.2% | 3.2% | 4.8% |
| Phishing | 26 | 28 | 3 | 3 | 2 | 41.9% | 45.2% | 4.8% | 4.8% | 3.2% |
| Unauthorized Installation | 38 | 24 | 0 | 0 | 0 | 61.3% | 38.7% | 0.0% | 0.0% | 0.0% |
| IP Theft | 28 | 18 | 4 | 6 | 6 | 45.2% | 29.0% | 6.5% | 9.7% | 9.7% |
| SQL Infection | 19 | 25 | 9 | 5 | 4 | 30.6% | 40.3% | 14.5% | 8.1% | 6.5% |
| Password Attacks | 24 | 25 | 4 | 6 | 3 | 38.7% | 40.3% | 6.5% | 9.7% | 4.8% |

| Infrastructure Threats | Strongly Agree (SA) | Agree (A) | Dis-agree (D) | Strongly Disagree (SD) | Indiffe-rent | | Strongly Agree (SA) | Agree (A) | Disagree (D) | Strongly Disagree (SD) | Indiffe-rent |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Packet Sniffing | 21 | 16 | 10 | 6 | 9 | | 33.9% | 25.8% | 16.1% | 9.7% | 14.5% |
| IP Spoofing | 18 | 12 | 8 | 10 | 14 | | 29.0% | 19.4% | 12.9% | 16.1% | 22.6% |
| DOS/DDos | 14 | 16 | 16 | 8 | 8 | | 22.6% | 25.8% | 25.8% | 12.9% | 12.9% |
| Session Hijacking | 13 | 13 | 14 | 10 | 12 | | 21.0% | 21.0% | 22.6% | 16.1% | 19.4% |
| Port Scans/Probes | 14 | 17 | 16 | 4 | 11 | | 22.6% | 27.4% | 25.8% | 6.5% | 17.7% |
| | | | | | | | | | | | |
| **Total** | 422 | 340 | 111 | 74 | 107 | | | | | | |
| **Average** | 24.82353 | 20 | 6.529412 | 4.352941 | 6.294118 | | | | | | |
| **Proportion (%)** | 40.03795 | 32.25806 | 10.53131 | 7.020873 | 10.1518 | | | | | | |

Analysing data from Table 5 hardware threats are widely regarded as the most important threats to service delivery in institutional repositories in Nigeria. Thirty-nine (62%) respondents strongly agreed that theft is the biggest threat facing repository resources due to insecurity in many regions of the country, followed closely by intrusion 35 (56%), vandalism and component failure 34 (54% each. Electromagnetic interference was the lowest with 10 (16%).

Analysing hardware threats, theft, intrusion, vandalism and component failure were the most commonly encountered threats to service delivery, while electromagnetic interference was the least common. Librarians and ICT workers believed that theft severely degrades repository performance. A further 27.4% of professionals in proportion (Table 5) corroborates this assertion in agreement that theft is a major cause for concern.

Software threats, majority of respondents acknowledged software threats as severe, with unauthorised installation 38 (61%) being the most probable software threat. Ransom ware 31(50%) IP theft 28 (45%) phishing 26 (41%) Malware and Password Attack 24 (38%) each, with SQL Infection being the least at 19 (30%).

Infrastructure threats produced the most even chart. A sizable number of respondents believed infrastructure threats are severe threats with Packet Sniffing 21(33%) and 25% agreed in proportional table 5.IP Sniffing 18 (29%), DOS and Port Scanning / Probes 14 (22%) each, and Session Hijacking 13 (20%).

On an interview checklist, a significant number of respondents 12 (19%) also stated that these threats fall outside of their technical domain.

It became evident that a sizable proportion of librarians believed that some cyber threats existed outside their domain of work. The electromagnetic interference {EMI} threat class particularly highlights this important variance in proportional Table 5 as Indifferent with 26 (41.9%). These librarians were unable to provide analytic feedback on security in this domain. Results from the software threats class also offer insight on a reasonable percentage of librarians in proportional Table 5 as indifferent with (IP Spoofing: 14 (22.6%), Session Hijacking: 12(19.4%), Port Scans/Probes: 11 (17.7%) who did not provide actionable information because they lacked technical oversight of these domains. As such, it became necessary to perform a more technical survey of cybersecurity issues according to data from 31 Information Communication and Technology technical workers and librarians involved in the infrastructure management, security management, security operations, disaster recovery and related roles. So another questionnaire was used to elicit information on core technical domain of institutional repository cyber security. See Table 6.

The Weighted Point Average is calculated as a

mean value using the formula:

$\sum(Entries * WP)/5$, where the number of individual responses recorded for any scale value (VLR, LR, MR, HR, VHR) assigned the value for "Entries". WP referred to the weighted point value (1, 2, 3, 4, 5) for any scale level. The product of Entries and WP (Weighted Points) was divided by 5, to derive a weighted point average for each threat class.

**Table 6: Survey Technical Security Threats on Institutional Repositories in Nigerian Universities**

| Technical Survey – Cybersecurity Threats of Institutional Repositories in Nigerian Universities | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S/N** | **Hardware Threats** | **Very High Risk-5** | **High Risk-4** | **Medium Risk-3** | **Low Risk-2** | **Very Low Risk-1** | **Weighted Points** |
| 1 | Intrusion | 15 | 12 | 1 | 2 | 1 | 26.2 |
| 2 | Vandalism | 16 | 14 | 1 | 0 | 0 | 27.8 |
| 3 | Theft | 27 | 4 | 0 | 0 | 0 | 30.2 |
| 4 | Component Failure | 10 | 9 | 6 | 4 | 2 | 22.8 |
| 5 | EMI | 0 | 0 | 0 | 6 | 25 | 7.4 |
| | **Average** | | | | | | **22.8** |
| | | | | | | | |
| 6 | **Software Threats** | **Very High Risk- 5** | **High Risk-4** | **Medium Risk- 3** | **Low Risk- 2** | **Very Low Risk- 1** | **Weighted Points** |
| 7 | Malware/Malicious Code | 29 | 2 | 0 | 0 | 0 | 30.6 |
| 8 | Ransomware | 1 | 1 | 1 | 13 | 15 | 10.6 |
| 9 | Phishing | 16 | 11 | 3 | 1 | 0 | 27 |
| 10 | Unauthorized Installation | 5 | 5 | 13 | 4 | 4 | 19.2 |
| 11 | IP Theft | 17 | 13 | 0 | 1 | 0 | 27.8 |
| 12 | SQL Infection | 0 | 0 | 4 | 3 | 24 | 8.4 |
| 13 | Password Attacks | 16 | 15 | 0 | 0 | 0 | 28 |
| | **Average** | | | | | | **21.65** |
| | | | | | | | |
| | **Infrastructure Threats** | **Very High Risk- 5** | **High Risk-4** | **Medium Risk- 3** | **Low Risk- 2** | **Very Low Risk- 1** | **Weighted Points** |
| 14 | Packet Sniffing | 0 | 0 | 0 | 1 | 30 | 6.4 |
| 15 | IP Spoofing | 0 | 1 | 1 | 3 | 26 | 7.8 |
| 16 | DoS/DDoS | 2 | 5 | 3 | 20 | 1 | 16 |
| 17 | Session Hijacking | 1 | 1 | 1 | 15 | 13 | 11 |
| 18 | Port Scans/Probes | 1 | 0 | 2 | 2 | 26 | 8.2 |
| | **Average** | | | | | | **9.88** |

**Weighted point benchmark is 31**

Table 6 presents the most important cybersecurity threats to institutional repositories. In reference to a weighted point benchmark of 31 points, the table above reveals that the highest threats to library repositories are hardware threats, with a weighted point average of 22.88, followed by software threats at 21.65 and finally infrastructure threats at 9.88.

The above result reinforces some of the findings in Table 5 given high value indifferent score. With this finding in technical survey, the study has been able achieve a better result by streamlining the data source. Evaluation of the technical survey revealed hardware threats to be quite prominent at 22.8 weighted average points, with most threats in this class being high risk or very high risk. Theft stood as the highest risk threat with 27 very high risk weighted points and 30.2 points on average. Theft is followed by vandalism at 27.8 average points, and intrusion at 26.2. EMI scored lowest with 7.4 points on average.

Considering software threats, Malware and Malicious code stood to pose the highest risk with 30.6 average weighted points, closely followed by Password Attacks, IP Theft and Phising. The least hazardous threats in this category were shown to be SQL Infection and Ransomware. Cummulatively, the software threats class has a mean weighted average of 21.65, right behind hardware threats in terms of severity.

Data shows that infrastructure threats at 9.88 mean-weighted points, held the lowest risk level against software and hardware threats. Most prominent threats in this category were rated as low risk or very low risk. The highest risk threat here was DOS/DDOS, followed by Session Hijacking. The lowest risk threats on the other hand are shown to be Packet Sniffing and IP Spoofing.

The weighted point is a 5-Point Likert Scale value (1, 2, 3, 4, 5)**,** where Very High Risk (VHR-5), High Risk (HR-4), Medium Risk (VLR-3), Low Risk (VLR-2), Very Low Risk (VLR-1) and frequencies of occurrence.

**Table 7: Cybersecurity Risk to Institutional Repositories Nigerian UniversitiesFrequencies of Occurrence.**

| Risk Rating | Risk Impact (Confidentiality, Availability, Integrity) | Frequency (Estimate) |
|---|---|---|
| Very High Risk (VHR-5) | Drastic, critical impact on service delivery and/or permanent asset loss | Once in 3 months |
| High Risk (HR-4) | Severe impact on service delivery and/or high technical and financial cost of asset recovery | Once in 6 months |
| Medium Risk (VLR-3) | Considerable impact on service delivery and/or difficulty with asset recovery | Once every year |
| Low Risk (VLR-2) | Minor impact on service delivery and/or quick asset recovery | Once every two years |
| Very Low Risk (VLR-1) | Negligible impact on service delivery and/or minimal asset loss | Once every 3 years |

Table 7 shows that, drastic, critical impact on service delivery and/or permanent asset loss and severe impact on service delivery and/or high technical and financial cost of asset recovery occurred and once in three months and once in six months respectively. Hence a high need for universities in Nigeria to look inwards and support open research initiative achieved through institutional repositories and security of its hardware, software and infrastructure.

## Discussion of Findings

Findings show that out of the 198 federal, state and private universities, only 29 representing 14.6% have established institutional repositories with slow growth rate of 12.5% from 2009 to 2020 at its peak in 2019. This collaborate the findings of Oguche (2018) that, Nigeria took nine years to register 23 repositories despite the number of higher institutions in Nigeria. Nene, Uzo and Baro (2021) assert that, universities in Nigeria are still struggling to overcome the many challenging issues. A study by Adam and Kaur (2021) buttresses the findings that implementation of institutional repositories has been very slow and the performance of the implemented repositories operates below expectation. This paper found that DSpace open repository software has 80% use among institutions. This confirms (Lynch, 2003) assertion that development of open access repository software, such as Dspace and Eprint also facilitated the development of institutional repositories. Adewole-Odeshi and Ezechukwu (2020) identify DSpace software as the preferred software for most of the repositories in Nigeria. Velmurugan (2013) maintains that the platform serves a variety of digital archiving needs. The finding also shows that journal articles has the highest content archived, this in line with Ukwuoma and Okafor (2017) finding that Covenant University and University of Nigeria Nsukka archived more journal articles. In addition, it justifies the assertion of Jamkar (2009) that the development of open access journals facilitated the establishment of institutional repositories in Nigeria. Analysing security, we were able to synchronise both security surveys. The general survey showed that a tiny percentage of respondents in Table 5 proportional value (6.5% -9.7%) disagreed that hardware threats were severe threats in all classes, while a sizeable number of professionals (42%) were unfamiliar with EMI threats. The technical study corroborates this by showing very high weighted points for all hardware threats except EMI. Furthermore, the general study put malware and malicious code as leading the software threat, in direct agreement with the technical study. Finally, the general survey revealed some bias against results of the technical one. The study also revealed packet sniffing and EMI to be the least severe threats.

## Conclusion

Data security is the key to growth of Nigerian institutional repository content. The inability to secure an integrated database impedes investment in the innovative open access project. As more digital content of research output are deposited into institutional repositories, it is a huge concern for institutions and authors losing their published research to network hacking, cyber theft and virus attacks. Institutional repository security efforts should comprise of: management of identity, access and operations, secure networks, applications, data, and implement platform protection framework. Since the recovery process of cyber incident is expensive, security of data should be the utmost concern of institutions in preventing cyber-attacks with a view to growing Nigerian intellectual, scientific, cultural, scholarly heritage content sustainably.

## Recommendations

The recommendations arising from this study are:

- Integration and compliance to a modern cybersecurity framework in libraries, addressing specific requirements of digital environments.
- Regulation review of the sector through development of standards, guidelines and policies to enhance cybersecurity resilience in Nigerian university libraries.
- Education and training of librarians on cybersecurity compliance in digital resource management.
- Sensitisation of users and the general public on benfits of adherence to established cybersecurity best practices.

- Development of mechanisms for redundancy and rapid response to mitigate data loss.
- Institutions special security operations monitoring centers to protect repositories.
- Decentralisation of data and networks.

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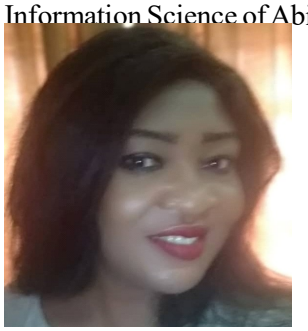
**Ifeoma S. Njoku** is a Senior Librarian and the Coordinator, Research Training and Statistics Unit of the Library, Federal University of Technology Owerri, Imo State, Nigeria. She is a Certified Librarian of Nigeria and has a PhD in Library and Information Science of Abia State University, Uturu.



**Buniechukwu Chidike Njoku** is an Integration Engineer with a Master degree in Advanced Electronic Systems Engineering program from Université de Bourgogne, France. He holds a Bachelor of Engineering degree in Electrical and Electronics Engineering (Communication Engineering) from the Federal University of Technology Owerri, Nigeria. He holds professional certifications including: Juniper Automation and DevOps Associate- 2020, Google Cloud Associate Cloud Engineer- 2020, Nokia Routing Specialist 1- 2019, Cisco CCNA CyberOps (Cybersecurity Operations) - 2018.

**Scholastica A.J Chukwu** is a Senior Librarian and a staff of the Federal University of Technology Owerri, Imo State, Nigeria. A Certified Librarian of Nigeria.

**R. Ravichandran** works at the Resource Centre National Institute of Technical Teachers Training and Research, Taramani Chennai, Tamil Nadu, India. He has experience of 34 years and has educational qualifications of four master's degree and Ph.D.

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# The Influence of Archives in Conflict Resolution: A Case Study of Botswana and Namibia

**Olefhile Mosweu**
*Department of Information and Knowledge Management*
*University of Johannesburg.*
*Johannesburg. South Africa*
*olfmos@gmail.com*

and

**Tshepho Mosweu**
*Department of Library and Information Studies*
*University of Botswana ,*
*Gaborone, Botswana*
*lydhoss@gmail.com*

## Abstract

*Archival materials are repeatedly consulted to settle disputes before the courts of law. The main purpose of the paper is to examine the use of archival materials in the ultimate settlement of the border dispute between Botswana and Namibia over the disputed ownership of the Sedudu/Kasikili Island. This paper took a qualitative approach where documentary review of archival materials and other documentary sources were used to answer the research questions. The findings indicate that archival materials in their various forms such as drawings, maps, plans, reports, scientific documents, and correspondence by colonial authorities played a significant role as evidence that informed the International Court of Justice (ICJ) to legally settle the boundary dispute between Botswana and Namibia. This paper also established the need for archivists to preserve the reliability and authenticity of records over time for them to be trusted as evidence. The fact that the case was solved with access to archival materials among other evidence presented, is an indication of the importance of archives in the society. Although this paper contributes to literature on the role of archives in the resolution of boundary conflicts, it is limited in that the findings are restricted to a review of archival materials in the holdings of the Botswana National Archives and Records Service (BNARS) exclusive of archival materials from the National Archives of Namibia.*

**Keywords**: Archives, Boundary Dispute, Botswana. Namibia, International Court of Justice,

## Introduction

### The Roots of Post-Independence Boundary Conflicts in Africa

Many boundary disputes in Africa are historically connected to the drawing of country boundaries imposed by former colonial powers. The causes of many interstate conflicts between African countries have been attributed to these disputed boundaries (Bujra, 2002). In agreement, Okumu (2010) observes that boundary disputes in Africa are a colonial creation arising from among others, improperly delimited and poorly demarcated colonial borders by countries such as Belgium, Germany, Great Britain, Italy, and Portugal. For example, in East Africa, the borders of the region reflect the imperial interests between 1885 and 1925. This has not helped independent African states which did not correct these colonial errors (Okumu, 2010).

Some key features of African borders which were the basis for claims to change them and claims which led to border conflicts have been cited as imprecise borders which were straddled by a large

ethnic group considered strategic by one side of the border and those that passed through strategic terrain desired by countries on both sides of the border. According to the Ministry of Justice of the UK (2015) boundary disputes relate to the position of a boundary and the ownership of the relevant land falling on either side of that boundary. The ownership of the disputed land would have been recorded somewhere. Land records such as cadaster, maps, possession lists, survey field reports and textual records have been handy in the settlement of border disputes (Manirakiza, 2014). Over the years, there have been several boundary disputes between African states, and these include disputes over the Ethiopia-Eritrea border, the Eritrea-Djibouti border, the Somalia-Ethiopia-Kenya borders, the Sudan-Kenya border, the Uganda-Democratic Republic of Congo (DRC) border, the Sudan-Chad-Central African Republic (CAR)-DRC-Uganda borders, and the Kenya-Uganda border. Other boundary disputes were those of Tanzania–Mozambique, Tanzania–Malawi, Tanzania–Uganda, Uganda-Rwanda, and the Kenya-Ethiopia borders (Okumu, 2010). Elsewhere, there have been disputes in West African region over borders between Liberia-Guinea, Mali-Mauritania, Ghana-Cote d'Ivoire, Liberia-Cote d'Ivoire, Ghana-Togo, Burkina Faso-Niger, Mali-Burkina Faso, Ghana-Burkina Faso, and Cameroon-Nigeria (Kornprobst, 2002; Lentz, 2003; Dougueli, 2021). Most of the West African border disputes were resolved through agreements between the states, not a third party as is the case with the one between Botswana and Namibia, which was settled by the International Court of Justice (ICJ) in 1999.

## Archives Role in Territorial Conflicts

Before discussing the role of archives in resolving territorial conflicts, it is crucial to highlight the definitions of records and archives. Administrative processes generate records. While IRMT (International Records Management Trust) (1999) defines records as all the documents created and received by institutions or individuals during their administrative and executive duties (IRMT, 1999), InterPARES Trust (2018) adds that a record is an intellectual object that was made or received during an activity as an instrument or a by-product of such activity and set aside for action or reference. Archives, are, however, non-current records of enduring value selected for permanent preservation are normally preserved in an archival repository (IRMT, 1999). Archives repositories hold records that can be trusted to support boundary dispute claims. Trustworthy and genuine boundary-related material is best sourced from our respective national archive collections (Ongoiba, 2013).

For an archival material in the archives custody to be acceptable in resolving disputed boundaries, it must be reliable and authentic. Duranti (2009) defines an authentic record as the one which is trustworthy as a record and has not been tampered with or corrupted, either accidentally or maliciously. A reliable record is the one which is complete as a statement of fact, as to content (Duranti, 2009). Archival materials therefore must be corroborated against other sources. Alone, they cannot be taken to be the truth and nothing but the truth especially if their preservation over time was questionable. This is because MacNeil (2000) avers that "legal and historical practitioners both need to ensure that records are trustworthy so that justice may be realised, or the past understood. For records created by bureaucracies, that trustworthiness has been ensured and protected through the mechanisms of authority and delegation and through procedural controls exercised over recordkeeping." Thus, some records will be accepted as reliable and trustworthy. It is for this reason that all colonial documents relating to boundaries must be fully accurate (Mnjama, 2012). For example, in a boundary dispute between Nigeria and Cameroon, the alignment of the boundary between Cameroon and Nigeria was not clear in the treaty that established it (Macdonald, 2013). Its wording made no sense when applied to a modern understanding of the topography. However, a document, which sets out quite clearly a description of the boundary agreed to by British and French administrators in 1930, was discovered in the National Archives of Nigeria. A field visit in 2000 revealed that two of the cairns (boundary monuments) referred to in the document were still in existence and in good order. This evidence was sufficient for the ICJ to accept the Nigerian claim. Weissberg (1963) cautions against the reliance on maps as sole evidence and observed that:

> *"In determining the location of a boundary, international as well as national, tribunals have in the past been reluctant to place much evidentiary value on maps, regardless of their number or designation. Such a tendency had been particularly noticeable whenever the map describes territory of which the authors have had little knowledge, is geographically accurate, or is sketched in order to promote a country's claim. Even official maps that are those issued or approved by a government agency have been treated with considerable reserve.*

This brings out the need to undertake extensive research when dealing with archival materials needed for informing decisions like boundary dispute resolution. According to Ongoiba (2013), the African Union Border Programme Steering Committee understands the need for, and relevance of, introducing archival research into boundary delimitation and demarcation processes. In that regard, Mnjama (2012) is of the view that African archivists have a role to play in alleviating some of these border disputes and that can be done in two ways. He argues that African archivists can be proactive by assembling a list of all relevant sources, whether agreements, maps, memorandum of understanding available locally in the national archives. Secondly, they should be prepared to spend considerable amount of time and resources locating archival documents relating to their national borders, where ever they are located.

## Study context

The contextual setting of the study is Botswana and Namibia in the southern part of the African Continent. A brief account of the two countries is presented in the next section.

## Botswana

Botswana is a landlocked Southern African country surrounded to the south by the Republic of South Africa, to the west and north by Namibia, and to the east by Zimbabwe, and Zambia to the north. It has a border with Zambia at Kazungula on the Zambezi River in the northeast (Acemoglu, Johnson and Robinson, 2001). It is comparatively a small African country in terms of population but has played a significant role in the political and economic history of the region with its diamond led economic growth since independence (Hilbom and Bolt, 2018). The population of Botswana is estimated to be 2.3 million (Statistics Botswana, 2022). The British declared it a protectorate in in 1885, more for its strategic and military reasons than for its economic resources (Mogalakwe, 2006). This was at the height of the Scramble for Africa waged by European colonial powers whose genesis was the Berlin Conference of 1884 where Africa was unknowingly apportioned among colonial powers (Gathara, 2019). Botswana got independence from British rule in 1966, through a smooth political process with Sir Seretse Khama becoming the first President of democratic Botswana.

## Namibia

Namibia was declared a protectorate by the Germans following the Berlin Conference in 1884 and named German South - West Africa (SWA). This also happened to modern day countries such as Cameroon, Togo, German East Africa (today Tanzania, Rwanda, Burundi) and parts of Papua-New Guinea (Humanity in Action 2022). By 1915, during the First World War, the Germans lost control of SWA to the South African and allied forces. The country was known as South-West Africa during its colonial rule by imperial Germany (Nebe, 2021). After the end of the First World War, South West Africa was placed under the administration of South Africa by the newly formed League of Nations, the predecessor to the current United Nations (UN) (South African History Online, 2019). Germany lost all its colonies due to the Versailles Treaty of 1919 (Humanity in Action, 2022). Namibia got its independence from South African rule in 1990 following a UN brokered peace initiative. As of January 2022, the population of Namibia was 2.61 million people (Kemp, 2022).

## From Decolonisation to Migrated Archives

When colonial powers lost control of former colonies as the newly independent states controlled their own administration, the colonisers took away with them

some of the administrative records back to Europe. Colonial Britain holds records of central government departments which undertook colonial administration such as the Colonial Office, Dominions Office, Foreign and Colonial Office, including other departments involved in colonial administration matters (Banton, 2020). According to Livsey (2022), some of these records include irregular archives from 37 former colonies during the transfer of power between the 1940s and 1980s. In agreement, Mnjama (2015) posits that some records that belong to countries in East and Southern Africa have been repatriated to the United Kingdom. The same author further highlights that the exact nature of these records is little known due to the reluctance of the Foreign and Commonwealth Office to release the records to their former colonies. The records or archives removed from the context of their creation and usually disputed, are known as migrated archives (Lowry, 2019). It is archives like these whose removal from the place of their creation to foreign lands which create gaps in archival holdings as alluded to by Mosweu (2021). Although Mnjama (2020) argues that these records need to be located, retrieved, and brought back home where they belong, Mosweu (2021) also advocates for the acquisition and preservation of private archives of the local people to fill the gaps in the national repositories of African countries faced with this problem such as Botswana.

The importance of archives in conflict resolution has been demonstrated in the literature. In Zambia, Mulauzi and Munsanje (2014) aver that chiefdom wrangles over boundaries are attributed to lack of documentation or knowledge on the existence of such records. In fact, according to Nyamboga and Kiplang'at (2008), societal conflicts have their roots on the deficiency of information, misinformation, inaccurate information, or simply missing information. Archival materials normally contain original and untainted information required as evidence to settle boundary disputes. Mulauzi and Munsanje (2014) argue that "it is impractically impossible for any chief or subject to resolve wrangles in the absence of archives and records." The absence of some crucial archives for conflict resolution can partly and arguably be due to the removal of archives from former colonies, an act described by Mnjama and Lowry (2017), and Mnjama (2020) as one of the unresolved injustices emanating from colonialism. Coincidentally, the very same records or archives have been used successfully in the conflict resolution processes to right the wrongs of colonialism, as established in this paper.

The British have a long history of taking part in international boundary demarcations. This tradition by the British enabled her to acquire expertise in the practice of accurately surveying and mapping international boundaries. Treaties were commonly used to define boundaries between Britain and neighbouring colonies of other European nations. Maps to depict the boundaries were then drawn by an international boundary commission, which always had a British commissioner even when the British had no direct interest in a territory. Their expertise was revered. The records generated from the surveys were usually deposited in the archives of the countries concerned, and a certified copy deposited in the Foreign Office archives. It is these archives which became handy when there was a need to provide evidence to help settle international border disputes.

Today, most of the archives from former colonies are likely to be found in the records of the Foreign Office and the other government departments responsible for handling foreign affairs and British interests' overseas matters. Specifically, archives documenting international boundaries at the National Archives of United Kingdom are likely to have come from the following colonial offices:

- The Foreign Office
- The Foreign and Commonwealth Office
- The Dominions Office
- The Colonial Office
- The War Office
- The Cabinet
- The pre-1782 Secretaries of State

## An overview of the Sedudu/Kasikili Island Boundary Dispute

As earlier observed, territorial or boundary disputes between countries or regions are common across the world, whether in the form of land, sea and even islands. Normally, what lead to disputes are the

economic value derived from resources in such territories. This was the case with the territorial dispute over the island known as Senkaku and Diaoyu in Japan and China respectively, leading to military threats between the two nations (Sumrahyadi, 2020). The territorial dispute between Botswana and Namibia played out in a comparable manner over a small island located on the Chobe River. The island is referred to as Sedudu Island in Botswana while in Namibia it is known as Kasikili Island (Le Roux, 1999). Both countries claimed ownership of the three-square kilometre island in the Chobe River 20 km (about 12.43 miles) upstream of its confluence with the Zambezi River (Alexander, 1999). The island is teeming with game such as herds of elephant, buffalo and antelope which graze on fertile plains (Chevallier and Harvey, 2016). This is a good ground for game hunting by hunters from the two countries. For this paper, the names Sedudu Island and Kasikili Island are used interchangeably although usage of the Sedudu may seem pronounced because of the location context of the authors.

The nations of Botswana and Namibia made efforts to peacefully resolve the boundary dispute. Le Roux (1999) observes that in 1992 in Kasane, Botswana, the then Presidents of the two countries Sir Ketumile Masire of Botswana and Sam Nujoma respectively met under the leadership of President Robert Mugabe of Zimbabwe. A decision was made that an amicable solution must be found over the ownership of the disputed island. The two Presidents agreed that a team of six technical experts, three from each country, be set up to determine the border between the two countries (Le Roux, 1998; 1999). It was further decided that until the matter was successfully solved, the two nations should withdraw their troops from Sedudu Island. According to Le Roux (1999), by 1995, the two countries had not found an acceptable solution over the disputed ownership of the Sedudu/Kasikili Island. This resulted in Botswana and Namibia agreeing to refer the matter to the International Court of Justice (ICJ). Prior to that on 24 May 1992, Botswana and Namibia had appointed a Joint Team of Technical Experts to determine the boundary between Namibia and Botswana around Kasikili/Sedudu Island based on the Treaty of 1 July 1890 between Great Britain and Germany respecting the spheres of influence of the two countries in Africa and the applicable principles of international law (Gurirab and Merafe, 1996).

The Joint Team of Technical Experts was unable to reach a conclusion on the question referred to it and recommended that the boundary dispute be settled through a peaceful settlement based on the applicable rules and principles of international law in accordance with the principles of both the Charter of the United Nations and the Charter of the Organization of African Unity, now African Union (Gurirab and Merafe, 1996). The agreement to refer the matter to the ICJ was reached on 15 February 1995 in a summit attended by the former Presidents of Botswana and Namibia. The agreement to refer the matter to the ICJ was made in the presence of former President Robert Mugabe of Zimbabwe who was the mediator. The two countries agreed that the ruling on the matter by the ICJ would be final and binding (Gurirab and Merafe, 1996; Le Roux, 1998; 1999). Eventually, the dispute was settled by the ICJ, in favour of Botswana. Some of the evidence which the court used to make the award was derived from archival materials. These included photographs, maps, and drawings. Oral History also played a part in helping the court to make the ruling. On 13th December in 1999, the Court delivered its official judgment that the boundary between Namibia and Botswana around Sedudu Island followed the thalweg in the northern channel of the Chobe River, thus making the island part of the territory of Botswana.

## The Role of BNARS in the Botswana-Namibia Boundary Conflict Resolution

National archival institutions exist because of their legal mandate which set out their mission. Thus, archival legislation is the basis for archives and records management in any country (Mosweu and Ndabambi, 2018). Without such a legal framework, an archival institution is bound to experience operational constraints (Mnjama, 2014). The Botswana National Archives and Records Services (BNARS) played a significant role in the resolution of the conflict between Botswana and Namibia over the Sedudu Island. BNARS is mandated by the National Archives and Records Services Act to make for the provision for preservation, custody, and control of public archives of Botswana (Government of

Botswana 1978, amended in 2007). It has in its possession, records in all formats such as paper files, microforms, photographs, audio tapes, videotapes, CDs, and maps. As the custodian of public archives in Botswana, BNARS played a significant role in the resolution of the boundary dispute between Botswana and Namibia over the Sedudu/Kasikili Island through the provision of archival materials. For instance, archival maps from Botswana National Archives Services proved valuable in determining the disputed boundary between the two states (Mnjama, 2012). Alexander (1999) states that in the boundary dispute between Botswana and Namibia on Kasikili/Sedudu Island, maps dating back to 1890 and aerial photographs dating back to 1925 were important items of evidence in the dispute. The archives held by archival institutions provide evidence of previous events. Mnjama (2012) argues that archivists can and should make a major contribution by assembling a list of all relevant sources, whether agreements, maps, memorandum of understanding available locally in the national archives as well as giving advice on the exact nature of materials that their country may require to resolve the border dispute. Records and archives have been used for disputes resolutions in many countries. Archival materials including maps and colonial records provided by BNARS proved valuable in determining the boundary dispute between Botswana and Namibia which had been referred to the International Tribunal at The Hague in February 1999 (Lekaukau, 1993). In similar cases, Salleh (2008) indicates that the National Archives of Malaysia assisted the government by providing access to documents pertaining to boundary matters. The Nigeria-Cameroon boundary dispute over the Bakassi Island was decided by the International Court of Justice at the Hague where with evidence presented before it, this informed the handover of the peninsula to Cameroon (Mnjama, 2012). In Sierra Leone, archival materials were used to support the country's claim of ownership over the Island of Bonthe (Kargbo, 2005).

Pratt (2013) opines that in most cases, the principal sources of information on the evolution of a country's international boundaries will be government archives. Brownlie (1979) in agreement also acknowledges that the evidence of the existence of boundaries and their status in terms of acceptance and recognition by states is found in a variety of sources such as international agreements, unilateral declaration by governments or individual officials, press releases, and statements by ministers in national assembly debates. Other evidence includes the resolution of the United Nations (UN) organs or of regional intergovernmental organisations such as the Organisation of African Union (now African Union), official maps, archival material, administrative reports of lands and surveys and national institutions amongst others. Accordingly, such archival material includes the archives of neighbouring states and, where applicable, those of former colonial powers. Mnjama (2012) points out that the National Archives in the United Kingdom holds several collections useful in understanding border issues relating to Africa. Mnjama (2012) and Salleh (2008) underscore the importance of archives in boundary dispute resolution. To this end Salleh (2008) noted that:

> "The records of old make peaceful resolution of conflicts a possibility by providing for negotiated settlements to boundary disputes… Given the present scenario of international conflicts, nations of the world, especially in the developing world are increasingly expected to become more conscious of the value of archives for their relevance and bearing on national sovereignty and rights."

The authors underscore the influence of archives in border disputes resolutions as demonstrated by the Botswana-Namibia border dispute. Archives, especially maps have proved to be useful in solving border disputes. Hence there is need for national archival institutions to acquire and preserve records for future use and access. The ability of archives to serve as evidence emanates from their being trustworthy. According to Duranti (2007), an archival institution is trusted as a custodial authority for records. The mere fact that archival materials reside in the archives give them evidential weight because as a place, the archival institution is a trusted place. The preservation of archival materials in the archives elevates trust in them as custodians of memory. That is why even migrated archives sourced from imperial Europe were accepted by the ICJ as evidence that

assisted to resolve ownership of the Sedudu/Kasikili island.

The records that were used in the Sedudu/ Kasikili case were transferred to the Botswana National Archives and Records Services (BNARS) at the closure of the case from the Office of the President, Botswana and are available for public inspection. The records inventory at BNARS indicates the materials cover records from 1905 to 2005. The inventory shows that the collection consists of 14 books, 29 files, speeches, maps, and photographs (Botswana National Archives and Records Services, 2005). The list of documents used as evidence in the Sedudu/Kasikili Island Case with reference to some of the original files at the Botswana National Archives and Records Services can be found in the Appendix.

### The International Court of Justice (ICJ) and the Resolution of the Disputed Sedudu Island

International organisations such as the ICJ played a significant role in the process towards bringing the issue at hand to finality. International boundary disputes are common around the world, including in Africa. For example, according to Donaldson (2011), since the beginning of decolonisation in Africa in 1957, the ICJ has resolved several such disputes. They include amongst others, Burkina Faso/Mali in 1983 - 1986, Libya/Chad in 1990 - 1994, Cameroon/ Nigeria in 1994 - 2002, Benin/Niger in 2002 – 2005 and Botswana/Namibia in 1996 – 1999. The Organisation of Africa Union Charter cited by Mnjama (2012) Article II(C) and Article III (4) respectively allows each state "To defend their sovereignty, their territorial integrity and independence" and provides for "Peaceful settlement of disputes by negotiation, mediation, conciliation or arbitration." Accordingly, when the states of Botswana and Namibia could not agree on the exact boundary between the two countries at the disputed island, over the two countries agreed to refer the matter to the ICJ for determination.

## Conclusion and Recommendations

It has been shown in this paper that archival materials play a significant role in assisting the courts in the settlement of boundary conflicts. The ICJ accepted archives as evidence in the court settlement. The role played by national archival agencies was notable. Where warring parties disputed archives brought before the court, new records of the boundaries were recreated. This brought about the issue of the reliability and authenticity of archives, that is., only those deemed to be reliable and authentic were admitted as evidence. It has also become clear that boundary disputes resolution is a complex undertaking, whose resolution at times go beyond the states involved in the dispute. This was evident with the dispute between Botswana and Namibia which could not be resolved bilaterally by the states, SADC (Southern African Development Community) and ended at the ICJ for resolution.

To promote archives as viable evidence in the border conflict resolution process, the following recommendations are suggested to national archival institutions that are mandated by legislation to be the custodian of public archives and records:

- Migrated archives, including those that document the mapping and drawing of country boundaries by former colonial powers should be repatriated and brought to their mother countries in Africa for the benefit of the local people.
- African governments should resource national archival institutions to enable them to effectively manage archives. Proper storage equipment is a necessity, including humidity and temperature controls necessary for archives preservation. Funds should be made available for the implementation of the whole archives agenda.
- Continuous capacity building by national archival institutions is of paramount importance in enabling archivists to manage archives and preserve their reliability and authenticity, lest they be rejected as evidence in the event they are needed for border conflict resolutions.
- National archival institutions should take part in national boundary commissions, including joint commissions for the resultant records to be acquired and archived properly for future reference. The Commission of African Union (2013:41) notes that "once joint commission project (such as a joint survey or demarcation) concludes much of the documentary and cartographic material can easily disappear."

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**Appendix 1: List of copies of evidence in the Sedudu/Kasikili Island Case at BNARS**

| File No | File Description |
|---|---|
| **OP2/1** | - Correspondences concerning the application for Prospecting License in the<br>- Caprivi Strip dated 5/12/28.<br>NB: The originals of these copies are in the File No: S27/2.<br>KEYWORDS: W J Lusk, Caprivi Zipfel. |
| **OP2/2** | - Correspondence concerning introduction of cattle into Union from Bechuanaland Protectorate |
| **OP2/3** | - Correspondence relating to Zambezi; Bechuanaland Protectorate. Question of Survey of area outside Susman concession in conjunction with MJD Martin. NB: These copies' originals can be found in the file S.437/7.<br>KEYWORDS: Kabulabula Beacon, Chobe River. |
| **OP2/4** | - Muntunjobusa Island Chobe River dated 12/09/50.<br>- Correspondence relating to Kasikili Island: Chobe District: Mr Nettelton's letter to Mr Atkinson dated 8 July 1949<br>- Boundary between the Bechuanaland Protectorate and the Eastern Caprivi Zipfel: Kasikili Island: A joint report by Messers. L.F.W. Trollope and N.V. Redman respectively by Magistrate of the Eastern Caprivi Zipfel and District Commissioner at Kasane, Bechuanaland, 19 January 1948. |
| **OP2/5** | - Correspondences relating to Caprivi Strip: Transfer of Administration of Eastern Caprivi Zipfel to Union South Africa (Native Affairs Department) ranging from 1939 to 1949.<br>NB: The original copies can be found in File No: S49/9.<br>KEYWORDS: Trollope, Kruger. |
| **OP2/6** | - Correspondence relating to the Caprivi Strip ranging from 1914 to 1925.<br>NB: The originals of this copies can be in the File No: S.26/5 |
| **OP2/7** | - Correspondence on the people ploughing illegally on the Botswana side of the Boundary dated 31/07/97.<br>- Correspondence relating to Namibia's case for Okavango River water dated 26/11/96.<br>KEYWORDS : Ebu village, Sera Village, Mutikila. |
| **OP2/8** | - Furniture purchased in London for officers Mess, Maun by Capt, Stig and dated 29/04/23.<br>- Correspondence relating to complaint of Kuruman Kajitase.<br>- Notice Board relating to the introduction of cattle into Union from Bechuanaland Protectorate dated 23/03/23.<br>NB: The originals of the copies can be in the File No: S.3/4 |

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| **OP2/9** | - Extract of tour report of Ghanzi, Ngamiland and Chobe by Lt. Colonel R.M. Daniel dated 4' May 1925<br>- Complaint Judah Mologasele dated 17 March 1948.<br>- Appointments, resignations of the Botswana in Chobe District.<br>- Extract from the report of Commissioner's tour, May - June 1933. The resident<br>NB: 2 copies see folio no.S.442/7 |
| **OP2/10** | - Correspondence relating to Masubia and their history how they came under the Barotse Kingdom.<br>- Liliqis request to graze cattle in Caprivi Zipfel.<br>- Correspondence relating to the conditions on which the Barotse in the neighbourhood of Sesheke may be allowed access to Caprivi Strip.<br>- Cultivation of the Barotse on the strip.<br>- Complaint by Disho Kaheru son of the Chief Libebe Caprivi |
| **OP2/11** | - Proclamation by his Royal Highness the High Commissioner No.56 of 1923.<br>- Correspondence concerning the impending retirement of Bathlone and approval of Lt. Colonel R.M. Daniel to act as Retirement Commissioner dated 25 November 1927.<br>- Delimitation and renaming of the Magistrates in the Bechuanaland Protectorate.<br>NB: See also File no. S.366/6/1 |
| **OP2/12** | - Correspondence relating to Caprivi Zipfel boundary Commission dated 4/05/1930.<br>- Demarcation of the boundaries of the Caprivi Strip.<br>- Correspondence relating to discussions held in his Excellency's office on the May 16th 1930 boundaries of Caprivi Strip. |
| **OP2/13** | - Administration of the Eastern Caprivi Zipfel<br>- Correspondence concerning to the climatic allowances paid to officers in the B.P. Caprivi Strip<br>NB: Refer to File No: S.49/9. |
| **OP2/14** | - Correspondence concerning Lesthwame, the late Headman<br>- Appointment of successor to Headman Lesthwame.<br>- Geological table of the Basubiya tribe<br>- Correspondence relating to the Bafui, Mayeyi and Mampukushu tribes finished by the Chief Mamili.<br>- Application of Headman Chika Leshirane for a school.<br>NB: Refer to File No: S.349/1 |
| **OP2/15** | - Annual reports on the Caprivi Strip: 1924 - 25.<br>- Cultivation of land in the Caprivi Strip by certain Barotse natives<br>- Fishing in the Caprivi Strip by fisher men sent by the Paramount Chief at Lealiu.<br>- Proposed taxation of natives in the Caprivi Strip<br>- Report on the Caprivi Zipfel for the period January 1st January? 1927 to 31st December 1927.<br>- Conviction of Chief Immiko's fisher men |

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| **OP2/16** | - Demarcation of the main channel of the Linyanti River - Chobe-Anglo German boundary to the North of the Bechuanaland Protectorate.<br>- A series of maps showing the demarcation of boundaries.<br>Refer to File No: S.35/12. |
| **OP2/17** | - Correspondence relating to alleged encroachments on Sekgoma's reserve: Attitude of Government towards.<br>- Correspondence concerning a despatch from Acting Administration of North Western Rhodesia respecting an alleged violation by Sekgoma of Barotse territory.<br>Refer to File No: R.C.6/7. |
| **OP2/18** | - Award of His Majesty the King of Italy respecting the Western boundary of the Barotse Kingdom.<br>- Extract from declaration between Germany and Portugal respecting the limits of their respective possession and spheres of influence in South West and South Eas Africa. Lisbon 30th 12, 1886.<br>- Caprivi - Zipfel boundaryRefer to File No: S 35/10 |
| **OP2/19** | - Proclamation of the Kaiserlichen Governor of Dutch South Africa with regard to the traffic to and in the Caprivi Zipfel.<br>- Interview between Mathibe and German officer in the strip.<br>- Lawless acts in German strip - suggested foundation of Protectorate Station.<br>Refer to File No: S.38/1 |
| **OP2/20** | - Meeting with Namibian Home Affairs Minister 22/8/96 - 57 missing goats.<br>- Agenda points for the proposed meeting in Gaborone Botswana 3rd September 1996.<br>- Case concerning Botswana/Namibia Kasikili/ Sedudu Island<br>- Visit to Botswana by the Namibian Minister of Home Affairs.<br>- H.E. President Nujoma's letter to H.E. President. |
| **OP21** | - Botswana/Namibia boundary dispute draft special agreement and notes.<br>- Permission to visit Sedudu/Kasikili by the editor of Mr Era.<br>- Complaint against Veterinary officials by Mr Vister Molapo Moruti.<br>- Botswana/Namibia boundary dispute draft special agreement for submission to I.C.J.<br>- Botswana/Namibia boundary dispute |
| **OP2/22** | - Question of policing the B.P. boundary on the Caprivi Strip.<br>- Note on the movement of certain villages from the Batawana reserve to the Caprivi Strip.<br>- Boundary: Caprivi/Zipfel<br>- Poaching: Eastern Caprivi/Zipfel<br>- Southern Boundary: Eastern Siambisso's village Caprivi Zipfel:<br>Refer File No: S. 396/4 |
| **OP 2/23** | - Proposal administration of by South West Africa: Caprivi Strip<br>- Transfer of Caprivi Strip to S. WA. Administration<br>- W.S. Chadwick |

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| **OP2/24** | - Matters relating to Caprivi/Zipfel<br>- Report upon portion of the Caprivi Strip under the jurisdiction of the Resident Magistrates.<br>- Proposed taxation of Natives in the Caprivi Strip. |
| **OP2/25** | - Prospecting in the Caprivi Strip.<br>- Application by W.J. Lusk for prospecting license: Caprivi/Zipfel. |
| **OP2/26** | - Correspondence concerning Kasikili/Sedudu Island<br>- Memorial of the Republic of Botswana |
| **OP2/27** | - Newspaper cutting titled Nugoma takes up border dispute by Moses Dispute from "NEW ERA" 19 – 25 March 19923<br>- Newspaper cutting on Botswana of Namibian origin extract from Botswana "Daily News" March 30, 1992, titled "Reconsider your desire" by Tarcisius Mudongo. BOPA |
| **OP2/28** | - Revised scheme of memorial 15/10/96<br>- The Relations of Botswana with neighboring states since independence in 1966 by Molosiwa L. Selepeng.<br>- Chapter 2, The Geographical context, and the character of Botswana interest.<br>KEYWORDS: Submissions, Anglo-German agreement 1890. |
| | - International Court of Justice case concerning Kasikili/Sedudu (Botswana/Namibia), second round speech Professor F.T.K.Sefe<br>- The Pretoria Agreement of 1984 and the Joint Survey report of 1985<br>- International Court of Justice case concerning Kasikili/Sedudu Island (Botswana/ Namibia) first round speech, advocate A.B. Tafa (Deputy Attorney General, Republic of Botswana 23/02/99) |

**Dr. Olefhile Mosweu** is a Postdoctoral Research Fellow in the Department of Information and Knowledge Management, University of Johannesburg, South Africa. He is a National Research Foundation of South Africa C2 rated researcher (established researcher category).

**Dr Tshepho Mosweu** is a Senior lecturer at the Department of Library and Information studies, University of Botswana.

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# Discharging Records Management Activities Using Artificial Intelligence at the Council for Scientific and Industrial Research, South Africa

**Mashilo Modiba**
*Department of Information Science*
*University of South Africa*
*Pretoria, South Africa*
modibmt@unisa.ac.za

**Patrick Ngulube**
*School of Interdisciplinary Research and Graduate Studies*
*University of South Africa*
*Pretoria, South Africa*
ngulup@unisa.ac.za

and

**Ngoako Marutha**
*Department of Information Science*
*University of South Africa*
*Pretoria, South Africa*
emarutns@unisa.ac.za

## Abstract

*Artificial intelligence (AI) has been highly dominant universally in the wake of the Fourth Industrial Revolution (4IR). 4IR has to do with the application of Internet of things (IoT), cloud computing, big data, blockchain technology, intelligent robotic machines, and AI for the management of records. AI can be used to perform records management activities faster than human intelligence (HI). The study sought to investigate how records management activities can be discharged using artificial intelligence (AI) at the Council for Scientific and Industrial Research (CSIR) in South Africa. The study investigated the state of records at CSIR and identified records management activities that can be managed through AI and intelligent robotic machine. Convergent mixed-methods research was conducted, and data were collected using interviews and questionnaires. Data were analysed thematically and statistically and presented in tables and figures. The study reveals that AI can be used to discharge records management functions at the CSIR throughout the life cycle of records, which includes the creation, digitisation, classification, storage, maintenance, and retrieval of records. The study proposed a framework that may assist the CSIR to use AI for records management in support of service delivery. It is hoped that the framework proposed may serve as a benchmark and guideline for the implementation of AI in archives and records management industry.*

**Keywords:** Records Management, Artificial Intelligence, Robotic Management, Council For Scientific and Industrial Research(CSIR), South Africa

## Introduction and Background of the Study

Artificial intelligence (AI)has become increasingly prevalent throughout the world as a result of the Fourth Industrial Revolution (4IR). 4IR refers to global changes that enable people to move in digital environments and online spaces, and to use interrelated technologies such as blockchain technology, big data, cloud computing, robotic machines, the Internet of things and the web of things to manage their lives (Atzori, Lera and Morabito, 2010; Liao, Deschamps, Loures and Ramos, 2017;

Manesh, Pellegrini, MarziandDabic, 2020; Bakogiannis, Mytiliuis, Doka and Goumas, 2020; Chung, 2021; Lund, 2021). Archivists and records management practitioners can apply disruptive technologies such as AI to overcome the challenges presented by archives and records management in South Africa (Modiba, Ngoepe and Ngulube, 2019). Disruptive innovations such as AIare affecting the archives and records management industry (Kim, 2020). The technologies that have become available as a result of 4IR offer solutions to problems experienced in the archives and records management sector (Prigg, 2017; Ahmat and Hanipah, 2018; Kim, 2020). The application of AI affects the whole library and information science industry, as robotic machines are used to perform library services. For example, a robot called Libby has been acquired by the library of the University of Pretoria to provide reference and information services to students (Mathibela, 2019). Institutions across the world consider using AI to perform several archives and records management functions that are presently performed by individuals. Such functions would include records classification, digitisation, storage and retrieval (Jarrahi, 2019). AI can ensure that records are safely stored in a cloud facility, protected by encrypted security codes and easy to retrieve(Liu, 2011).

Hence, this study investigates the records management activities that can be discharged through AI at CSIR. A framework is proposed on how AI can be applied to discharge the records management activities at CSIR. CSIR is an African research and innovation institution that its head office is in Pretoria, South Africa. CSIR receives enormous number of records from various institutions such as the Department of Science and Technology and Armscor in South Africa. CSIR generates records through research projects that are conducted across the world. Various intervention has been made to ensure that records are managed effectively at CSIR (Matroko, Mniki and Van Deventer, 2007; Van Deventer, 2011; CSIR, 2017; Modiba, 2021).

## Problem Statement

The CSIR is making an effort to conduct its records management activities properly, yet it does not manage its records effectively and efficiently due to administrative and technical errors encountered by its records management practitioners. The CSIR records management activities need to be improved to ensure that the organisation provides high-quality services to users. Paper-based records are retrieved physically by visiting the registry or archives. Electronic records are maintained by the ICT division according to CSIR IT policies. Paper-based records are maintained manually (Van Deventer, 2011; EE Publishers, 2017). The CSIR ensures that the records are not exposed to sunlight and the temperature of the registry is controlled to protect records. However, these practices are not effective and efficient, and records management practitioners spend a lot of time performing administrative responsibilities related to records management (Matroko, et al. 2007; Van Deventer, 2011; Patterton, 2017). Hence, possible AI records management systems should be investigated as using AI for records management could help the CSIR to manage its records far more effectively and efficiently than is currently the case. AI can be used to perform and manage records effectively, and records management activities can be digitised robotically using automated classification algorithms. Records can then be placed in cloud storage that is embedded in robotic machines and the local server. Once the digitisation process has been completed and all records have been converted to a digital format, the CSIR will have easy access to all its records. Digital records can be retrieved from secure databases via devices such as laptop or desktop computers, tablets and cell phones. Hence, a framework is proposed for records management activities that can be performed using AI and robotic machines. The framework will give the CSIR clear guidelines on how AI can be used to perform its records management activities. This will assist the CSIR in managing its records effectively with the help of AI and robotic machines.

## Purpose and Objectives of the Study

The purpose of the study was to investigate how records management activities at the CSIR could be performed using AI. The objectives of the study were to:

- determine the state of records management at the CSIR
- identify records management activities that can

be performed using AI at the CSIR

- propose a framework for the performance of records management activities at the CSIR using AI.

## Literature Review

This section presents literature review for the study. The literature review is based on records management activities and AI usage to perform records management activities. Records creation is an activity of records management. Smith (2016) states that records are created every time when someone in an organisation writes an email or a report, drafts a brief, adds information to a spreadsheet, makes a film, a sound recording or transcripts, or takes a photograph. Records are created as part of corporate procedure and they must be properly administered to ensure that they can be examined, distributed, recycled and repurposed, and add value to the institution (Shepherd and Yeo, 2003; Ngoepe and Marutha, 2021). Records are created in both paper-based and electronic formats. According to Franks (2018), paper-based records can be created as soon as the first relevant documents are produced to ensure that all related documents are stored together without the risk of loss. Although the term "electronic records" is mainly understood to refer to information deposited in electronic systems, these records can include information in both analogue and digital formats (Asogwa, 2012). Electronic records normally include records created in an electronic format (born-digital records), but they can also be images of records in other setups (reborn-digital or born-analogue records) (Franks, 2018).

Records storage is another activity of records management. Records can be stored manually and electronically. Manual records include client records, staff files, business documents and classified information, and are usually kept in secure physical storage facilities. Such records storage facilities ensure that important information is safe and protected against data hacks and hard drive malfunctioning (Ngoepe and Marutha, 2019). Records should be stored to secure them against vandalism and loss. Paper records should be stored in a way that allows easy access to authorised staff members yet offers enough security to prevent unauthorised access to information (Patel and Chotai, 2011). For example, protected filing shelves may be used (Cunningham and Montana, 2006). Electronic records require software such as EDRMS (Electronic Document and Records Management System) for their safekeeping and easy retrieval (Duranti, Eastwood and MacNei, 2002). EDRMS is a cohesive system created for the management of institutions' electronic records throughout the record life cycle, from creation to disposal (Patel and Chotai, 2011). The latest technology that is used for storing electronic records is cloud storage. Askhoj, Sugimoto and Nagamori (2011) define cloud storage as secure and easily accessible storage. It is proving to be an extraordinary platform for the safe storage of most organisational data (Franks, 2018).

Classification is the records management activity. Classification is the process of assigning records to one or more classes or categories based on certain criteria. This ensures that records can easily be retrieved and accessed (Duffus, 2016). In the records management sector, classification means that records are categorised based on the information they contain, and files are stored in an organised manner that allows quick retrieval and easy access as it narrows down the places where records may be found in an organisation (Duffus, 2016). Classification also includes giving records unique locator or reference numbers according to the specific rules of classification (Mokhtar and Yusof, 2017). The classification of records often takes into account the current structure and activities of the organisation and its branches. For example, an organisation's files may be arranged to reflect the work they record, which makes it easy to decide where records should be stored and also to locate them (Foscarini, 2009).

Records retrieval is a records management activity which has the ability to search for records by keywords and other features, such as dates and authors. It implies that the record has been indexed on all suitable fields, and that keywords have been selected based on its title and textual content (McLeod and Hare, 2005). Read and Ginn (2015) state that records retrieval is all about accessing the right records and making them available to the right people at the right time (McLeod and Hare, 2005). Franks (2018) defines records retrieval as finding or locating an available record in the organisation upon

the request of a user. For records to be retrieved, standards and procedures must be put in place that assist records management practitioners or researchers in locating those records (McLeod and Hare, 2005).

Preservation is the general protection of records against conservational risks or other physical damages (Duranti and Rogers, 2019). It includes a variety of activities that are aimed at maintaining materials in a usable state, whether in their original physical format or in any other usable format. Furthermore, it ensures that archivists and records management practitioners will be able to consult and use records in the future as those records will still be accessible and in a good condition (Kootshabe and Mnjama, 2014).

Preservation plays a role in the handling and storage of records. Iyishu and Nkanu (2013) state that preservation includes identifying impaired resources and treating or copying them to retain their value and ensure continued access to the information they contain. Records are preserved and archives are managed to prevent sources of information from disappearing. Papers and media materials are preserved (e.g., by protecting them against staining) to prevent a loss of information (Rhys-Lewis and Forde, 2013). According to Garaba (2015a), records disposal as a records management activity refers to the final stage of record management in which records are either destroyed or enduringly stored in an archival repository. Records disposal starts with a decision about the fate of records, namely whether they will be destroyed or archived (Harris and Schur, 2006). Institutions only hold records for as long as they are required; when the records are no longer required, they are disposed of in a suitable way, for example by transferring them to an archival repository (Rhys- Lewis and Forde, 2013).

However, records imaging is one of the records management activities that can be discharged via AI. Robotics companies like Ripcord have combined robotic scanners and AI-powered software to create robotic machines that can perform all records management activities, including classification and digitisation (Nichols, 2019). The activities that are performed by such robotic machines include removing staples and scanning records, mechanically converting scanned records into searchable text and uploading them to a cloud server (Ripcord Company, 2019; Demaitre, 2020). The robotic machine can scan all forms of records, from business cards to large architectural drawings. Ripcord has the capability to automate 80 percent of the records conversion process, which includes paper treatment, quickly removing staples and digital imaging (McKinsey Global Institute, 2017). The robotic machines collect loads of paper, pull out any staples and place one sheet at a time on a conveyor belt for rapid scanning of up to one sheet in a second (Jackson, 2011; Ripcord Company, 2019).

AI has the capacity to package and ship records (Demaitre, 2020). Upon receipt, the records are logged, allocated a unique barcode and tracked as they move through the digitisation process (McKinsey Global Institute, 2017; Ripcord Company, 2019). AI uses machine-learning algorithms to perform functions that would take many staff members many hours to complete. These tasks include records classification, removing staples from documents and scanning one piece of paper at a time. Robotic machines can complete such tasks fast, effectively and efficiently (Weckerk and McDonald, 2007; Ripcord Company, 2019). Robotic machines organise and prepare records for automated digitisation. They then digitise each record in full colour and create a fully accessible, high-resolution PDF file for each record (Demaitre, 2020). The next step is the classification of records, which is driven by enhanced machine learning. Records are then stored and made accessible to clients. Clients of the Ripcord Company, for example, can access their records on any device via Canopy, a sophisticated cloud-based record management platform (Ripcord Company, 2019; Petropoulos, Marcus, Moes and Bergamini, 2019). The CSIR could introduce AI in the way described above to store its records safely and cost-effectively, while ensuring that these records remain accessible and can easily be retrieved. AI-powered document management systems (DMSs) have incredible potential to streamline content and paper development workflow. Although no software application leaders have emerged during this study, software applications like Grammarly illustrate how AI can be used to pre-edit papers without human involvement (Bailey, 2019). This is one instance where the capability of an AI-powered DMS to read, understand and bring

shape to unshaped remarks could streamline a process (Parmenter, 2019).

Ripcord's Canopy allows records management practitioners to search and trace their records swiftly using keywords, Boolean searches and filtered searches (Ripcord Company, 2019). This means that the needle in the haystack is just a few keystrokes away – an organisation no longer needs a team of people to search through mountains of files to get the information it needs (Bowser, Sloan, Michelucci and Panwels, 2017; Ripcord Company, 2019). Records management practitioners can use computer programs to retrieve records from anywhere in the world. Records can then be downloaded, sent via email, printed and used by researchers (McKinsey Global Institute, 2017). Unlike ordinary electronic records management systems, Canopy is an embedded facility that is linked to robotic machines like the Ripcord robotic machine and allows for records to be searched using computer technology. Canopy has been designed in such a way that it cannot work on its own – it must be linked to a robotic machine (Ripcord Company, 2019).

Security is another activity of discharging records management activities with AI. The more files are stored in offices, file rooms and third-party storage facilities, the more difficult it becomes to adhere to security and compliance legislation (Reddy, Fox and Purohit, 2019; Iron Mountain, 2019a). Robotic machines such as those used by Ripcord also work with existing identity providers (IDPs) like Microsoft Active Directory, which has been developed for the Windows domain and integrates with most Microsoft Office and Server products. Robotic machines such as Ripcord Canopy's analytics and reporting dashboard allow records management practitioners to quickly recognise records prepared for disposal (Jackson, 2011; Ripcord Company, 2019). Parmenter (2019) states that security has become more problematic than ever, especially when it comes to sensitive documents in financial or healthcare services. An AI-powered DMS can offer excellent file protection at scale. AI can learn to recognise confidential and private identifiable information (PII) in files and then flag those files for different treatment (Bailey, 2019). Automated classification and processing can guarantee that no records are left at unsafe sites before they are actioned. Irregularity discovery can also be arranged to detect and flag possible fraudulent files (Parmenter, 2019; Lepak, 2019).

Document clustering is a unique form of data clustering. Data clustering is defined as the grouping of documents into subsets of similar texts called clusters (Tarczynski, 2011). Clustering algorithms are used in web search engines to arrange webpages into categories that users can then browse. Parmenter (2019) explains that the results of web searches have been based on the concept of using software to perform cluster analysis on a body of documents for quite some time. However, the application of AI to perform this function comes with a far higher level of complexity and precision. An AI-powered DMS can accurately cluster the files in a business's vast library according to different topics or hierarchies. This is especially helpful when themes and levels are not known. AI can also identify relationships between records in a broader context, make inferences, formulate hypotheses and identify similarities between files (Bailey, 2019).

## Research Methodology

The research methodology used in this study was mixed-method research (MMR) with convergent design and parallel sampling methods.The study used ontological pluralism and pragmatism as epistemological perspectives. The convergent design was selected so that the researchers could simultaneously collect qualitative and quantitative data from participants, analyse the data independently and combine the responses during data interpretation. The study further used parallel sampling as sampling technique to collect both qualitative and quantitative data from the same population, but using different samples (Creswell and Creswell, 2018; Creswell and Plano-Clark, 2018). Records management practitioners and record managers were the population of this study. They provided information about their knowledge, expertise and expectations regarding the use of AI for records management. The population of this study consisted of eight (8) respondents, all of whom were employed by the CSIR. The respondents were one (1) portfolio manager, one (1) records manager, three (3) indexers, two (2) archives technicians and one (1) data

librarian.The portfolio manager and records manager contributed qualitative data to the study. Three (3) indexers, two (2) archives technicians and one (1) data librarian contributed quantitative data to the study. Data were collected in April 2021.

## Findings of the Study

### The CSIR's Current Records Management Activities

The study investigated the current state of records management at the CSIR to establish whether its records management activities could be performed using AI. The respondents were asked to state whether they agreed, were unsure or disagreed with statements about the current records management activities at the CSIR. Table 1 presents the findings. Two respondents (33%) agreed that the CSIR had effective storage capacity, two (33%) were unsure and two disagreed. Four respondents (67%) agreed that the CSIR had effective retrieval capacity, one (17%) was unsure and one (17%) disagreed. Furthermore, five respondents (83%) agreed that the CSIR had effective records classification, one (17%) was unsure and none disagreed. Five respondents (83%) agreed that the CSIR had effective records access control and measurement, two (33%) were unsure and none disagreed. Three respondents (60%) agreed that the CSIR had reliable records movement tracking system, one (17%) was unsure and three (50%) disagreed. Four respondents (67%) agreed that the CSIR had records safety and security measures, three (50%) were unsure and one (17%) disagreed. Three respondents (50%) agreed that the CSIR had an effective disposal system, three (50%) were unsure and none disagreed.

**Table 1: Rates of records management activities at CSIR (N=6)**

| RECORDS MANAGEMENT ACTIVITIES | | RATINGS | | |
|---|---|---|---|---|
| | | AGREE | UNSURE | DISAGREE |
| CSIR have effective storage capacity | No | 2 | 2 | 2 |
| | % | 33 | 33 | 33 |
| CSIR have effective retrieval capacity | No | 4 | 1 | 1 |
| | % | 67 | 17 | 17 |
| CSIR have reliable records backup system | No | 5 | 1 | 0 |
| | % | 83 | 17 | 0 |
| CSIR have effective records classification system | No | 5 | 1 | 0 |
| | % | 83 | 17 | 0 |
| CSIR have effective records access control measures | No | 5 | 2 | 0 |
| | % | 83 | 33 | 0 |
| CISR have reliable records movement tracking system | No | 3 | 1 | 3 |
| | % | 60 | 17 | 50 |
| CSIR have records safety and security measures | No | 4 | 3 | 1 |
| | % | 67 | 50 | 17 |
| CSIR have effective disposal system | No | 3 | 3 | 0 |
| | % | 50 | 50 | 0 |

NOTE: **No. = number** % = **percentage**

## Records Management Activities that may be Performed Using AI

The study established that AI can be used to perform some or all of the CSIR's records management activities. Respondents were asked about records management activities that could be performed using AI at the CSIR. Figure 1 presents the findings. As illustrated in the figure 1, three respondents (50%) indicated that AI could be used for records creation, six (100%) indicated that AI could be used for records retrieval and four (67%) indicated AI could be used for records classification. Four respondents (67%) indicated that AI could be used for records storage and four (67%) indicated that AI could be used for records maintenance. Five respondents (83%) indicated that AI could be used for records movement tracking and safety, while four (67%) indicated AI could be used for records disposal.

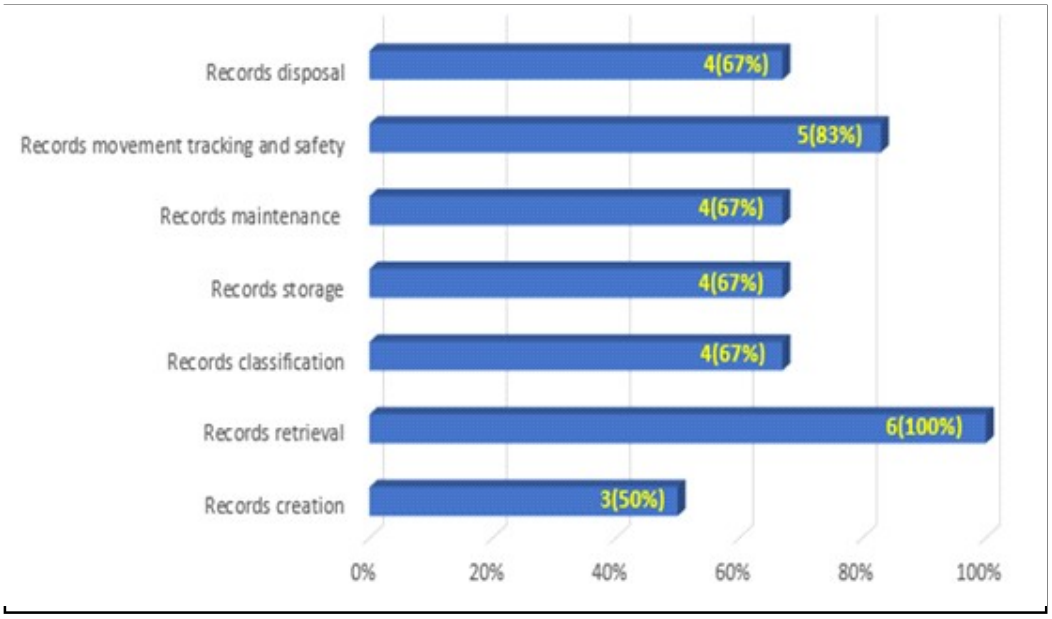


**Figure 1: Records management activities performed using AI (N=6)**

The questionnaire completed by respondents included an open-ended question about the records management activities that could be performed using AI at the CSIR. Respondents indicated that AI could be used for records creation, retrieval, maintenance, classification, storage, disposal, tracking and safety. The responses were as follows:

Respondent 1: "AI can be used for records creation."

Respondent 2:"AI can also be used for records retrieval."

Respondent 3:"AI can also be used to maintain records."

Respondent 4:"AI can also be used for records classification."

Respondent 5:"AI can be used for records storage."

Respondent 6: "AI can be used for records tracking and safety."

The interviewed participants were also asked about records management activities at CSIR that could be performed using AI. Participants indicated that the records management activities that could be performed using AI includes records creation, records maintenance, records retrieval and records disposal. They further stated that AI could be used to classify and digitise records, and to track the movement of records at the CSIR. The responses were as follows:

Participant 1: "Records management activities such as records creation, records maintenance, records retrieval and disposal of records can be performed using AI at the CSIR."

Participant 2: "AI can be used to classify, digitise and track the movement of records at the CSIR."

## Discussion of the Results

This section discusses the findings of the study based on the objectives.

### The CSIR's Current Records Management Activities

Records management activities include the creation, use, classification, storage, maintenance and disposal of records (Ambira, 2016). Organisations such as the CSIR require a reliable records management system to ensure that they perform their records management activities effectively. The majority of respondents (83%) agreed that the CSIR had an effective records classification system and effective records access control and measurement. The CSIR classifies records according to the CSIR file plan and prescribed archival procedures. Records are accessed both manually and electronically.

Four respondents (67%) agreed that the CSIR had effective record retrieval capacity and safety and security measures. It is easy for records management practitioners to retrieve records at the CSIR. Records are securely stored in the archives and a cloud storage facility. Three (50%) respondents agreed that CSIR had a reliable records movement tracking system and an effective disposal system. Users are required to complete a register with all the details of a record before they use it.

The CSIR uses a file plan and archival procedures to ensure that records are properly disposed of. Two respondents (33%) agreed that CSIR had effective storage capacity. Paper records are stored physically in the archives. Electronic records are stored in the electronic system and the cloud. One respondent (17%) disagreed that CSIR had effective retrieval capacity or had a reliable records movement tracking system. The CSIR uses different systems and users cannot identify which storage capacity works better. Without reliable storage capacity, it would not be easy to track the movement of files at the CSIR. Respondents further indicated that the storage space was too small. Although electronic records are effectively stored, paper records are often misplaced. Some records seem to be missing as they have not been captured, but there is an effective electronic records management backup system. Most records are not captured in the system, but it is easy to retrieve records that have been captured on electronic records management system.

The CSIR uses an alpha-numeric classification system, which is an in-house classification system. It also uses a file plan classification system that has been approved by the National Archives of South Africa. Respondents indicated that only authorised staff had access to the archives. Security codes and passwords are required to access electronic records. Micro Focus Vibe tracks the movement of electronic records. The registry is equipped with climate control and a security system. Electronic records are secured by firewall applications. The disposal of records is guided by the CSIR file plan. Participants indicated that the records management system at the CSIR provided for the effective storage, retrieval, use, maintenance, and disposal of records at the CSIR, as well as for the effective creation, classification, and digitisation of records.

### Records Management Activities that can be Performed Using AI

Ripcord's robotic machines can be used for automated classification and digitisation. They can even remove staples from documents that are to be digitised. They upload records to the cloud and facilitate quick and reliable access to records (Ripcord Company, 2019). This shows that AI has the capacity and ability to perform different records management activities. Although mostrecords management activities can be performed using AI, the CSIR must decide which records management activities it wants to entrust to AI. The quality of records management activities determines whether effective and efficient records management services can be rendered to users. All the respondents (100%) indicated that AI could be used for records retrieval. AI-empowered software and platforms such as Ripcord's Canopy track the movement of records and keep records safe by using encrypted passwords and security codes (Demaitre, 2020). The majority of respondents (83%) indicated that AI could be used for records movement tracking and safety. Four

respondents (67%) indicated that AI could be used for records classification, records storage, records maintenance and records disposal. Three respondents (50%) indicated that AI could be used for records creation. The respondents further specified that AI could be used for the following: records creation, records retrieval, records maintenance, records classification, records storage, and records tracking and safety. Participants also indicated that records management activities at the CSIR, such as records creation, records maintenance, records retrieval and the disposal of records, could be managed using AI. AI can be used to classify, digitise and track movement of records at CSIR. AI and robotic machines provide for the reliable storage of records in an embedded cloud storage facility and ensure that records can be retrieved anywhere as long as there is access to internet (Liu, 2011). AI can therefore be used for records retrieval.

AI and robotic machines make provision for the retrieval of records from a cloud storage facility or a server via devices such as laptop or desktop computers, cell phones and tablets. AI can also be used to classify records as it uses automated classification algorithms embedded in robotic machines. AI can be used for records maintenance. Machine learning algorithms enable robotic machines to detect records that need maintenance and to alert records management practitioners to maintenance requirements. AI-empowered programs and platforms embedded in computer technology have the ability to create electronic records and convert them into digital records using tools such as Ripcord's Canopy (Demaitre, 2020). AI can therefore be used to create records. Born digital records are created and transferred to digital archives using robotic machines. AI can also be used for records storage. Cloud storage facilities and servers provide big data technology that can be used to store records. AI can also be used for records disposal. Through machine learning embedded in robotic machines, records that are due for disposal can be flagged using machine learning algorithms. Records with enduring value can then be transferred to digital archives for permanent storage.

## Conclusion

In conclusion, AI can be used to manage the CSIR's records efficiently. AI and robotic machines can be used to perform the records management functions, including records creation, records maintenance, the digitisation of records, records retrieval, records storage and the disposal of records. The CSIR has reliable records movement tracking, records retrieval and disposal, and records classification systems. However, the management of the CSIR has concluded that although some records management activities are effective, most of them are not. Records management practitioners at the CSIR have indicated records are effectively disposed of, but management is of the view that the records disposal system is unreliable. AI and robotic machines can be used to improve the efficiency and effectivity of records management activities are at the CSIR.

## Recommendations

This study recommends a framework for records management activities using AI and robotic machines. It is hoped that this framework will help the CSIR to perform it records management activities more successfully and timeously. Robotic machines can be used to digitise and classify records automatically, store them in the cloud and dispose of them at the right time.

### Proposed Framework

This section presents the framework for records management activities using AI at the CSIR, as shown in Figure2 which llustrates the flow of records management using the AI and robotics model, the records life cycle model and the continuum model. These models are all known for their ability to deal with the application of AI and robotics machines, and the life cycle of manual and electronic records.

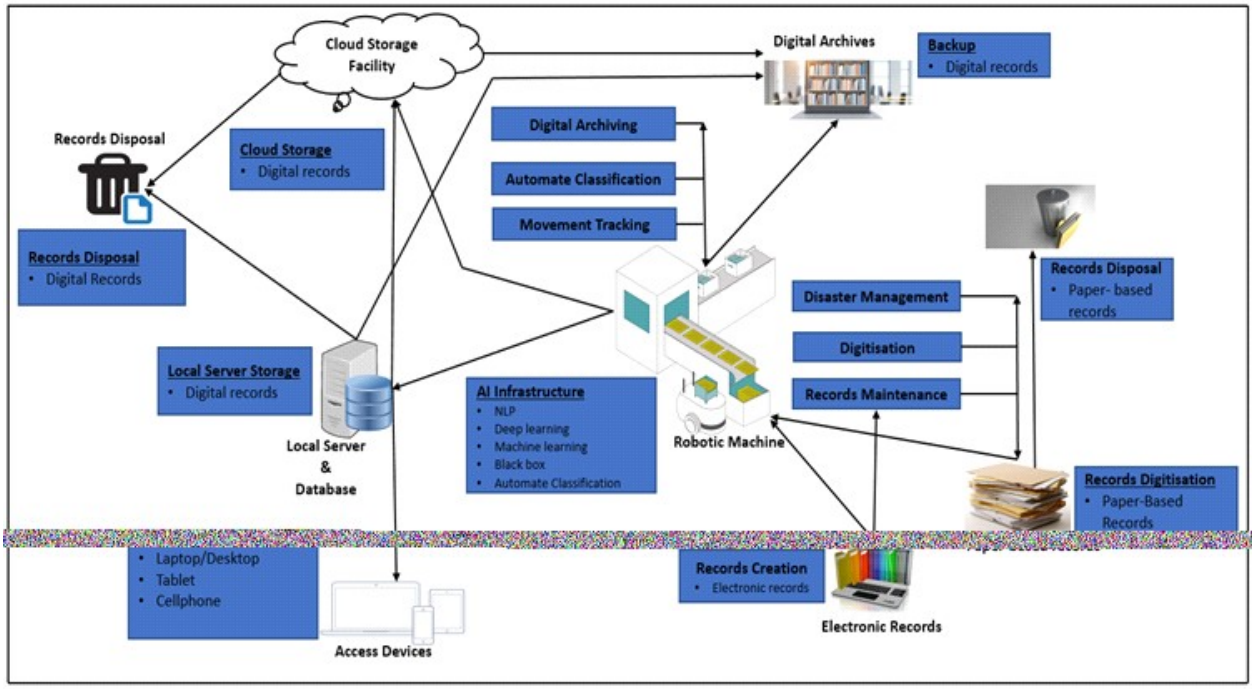


**Figure 2: Framework for records management activities using AI**

This proposed framework begins with the creation of records in an electronic format. The creation of electronic records is followed by the digitisation of paper-based records. However, before the digitisation process starts, records are checked for damage. Damaged paper-based records are fixed and those that cannot be fixed are disposed of immediately. Paper-based records that have reached their disposal period are also disposed of before the digitisation process starts. Following this, all the available paper-based records are digitised using an automated classification algorithms embedded in the robotic machine, and then converted to digital records. The robotic machine uses an automated classification algorithms to ensure that records are classified by subject. The creation of paper-based records is then discontinued, and records are only created in an electronic format. After the digitisation processes have been completed, all paper-based records are shredded. The CSIR henceforth only creates and maintains electronic records. Electronic records include both digitised and born-digital records (i.e., records that have been created electronically). Such records are then checked to ensure that they are error free before they are transferred through the embedded robotic machines to a storage facility (a server or the cloud). Once all CSIR records have been converted to digital records using robotic machines, they are automatically classified according to specified criteria using the automated rules algorithms embedded in robotic machines. This will ensure that records with similar subjects are grouped together.

The robotic machines then use machine learning algorithms to track the movement of records. This will ensure that all records captured move from digitisation and transfer to the records retrieval stage. After records have been digitised or transferred and classified using automated classification algorithms, they will be stored in the cloud and on a local server. The CSIR will ensure that the digital records are protected and securely stored, whether in the cloud or on the local server. Records can be protected by using encrypted passwords and security codes to ensure that only authorised people have access to them. Robotic machines use deep learning algorithms and machine learning algorithms to detect when the lifespan of digital records will expire. Expired records are automatically deleted from the cloud and/or local servers. The disposal process is continued based on machine learning and neural network algorithms. Robotic machines do not need to be reprogrammed

to perform records management activities that have already been performed. They use the neural network algorithms to process new information on their own. Digital records with enduring value are transferred automatically from the cloud and the server to the digital archives for archiving purposes. The digital archives will be used as a backup for digital records produced and managed by the CSIR. It will only be possible to access and retrieve the CSIR's digital records using an NLP algorithms embedded in the robotic machines. Users will be able to retrieve digital records that are stored in the cloud, a local server, and the digital archives, depending on where the records are located when they are needed. Records management practitioners will use devices such as laptop or desktop computers, tablets, or cell phones to retrieve digital records. They can either search for a digital record using a subject, a Boolean search or any other strategy that will help them to retrieve the required record from a database in the cloud, on a server or in the digital archives. All records with similar subjects are then displayed on the screen of the user's device. A records management practitioner can then browse through the search results, choose the record needed and open it. The digital record can then be printed, emailed, or saved on the device.

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**Mashilo Modiba** is a lecturer in the Department of Information Science at the University of South Africa, Pretoria, South Africa.

**Patrick Ngulube** is Professor in the School of Interdisciplinary Research and Postgraduate Studies. University of South Africa, Pretoria, South Africa.

**Ngoako Marutha** is currently working as a Professor in the Department of Information Science at the University of South Africa (UNISA). He holds Bachelor of Information studies and Bachelor of Information Studies honour from University of the North (UNIN)-now known as University of Limpopo (UL), Master of Information Science and Doctor of literature and philosophy from University of South Africa (UNISA).

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# Ghanaian University Libraries' Preparedness for the Fourth Industrial Revolution

**Gloria Bosomtwi Amoah**
*Sam Jonah Library*
*University of Cape Coast*
*Ghana*
*gloria.amoah@ucc.edu.gh*

and

**Mabel K Minishi-Majanja**
*mabelmajanja@gmail.com*

## Abstract

*As the world is experiencing technological development, the Fourth Industrial Revolution (4IR) is taking prominence in the provision of information to library clients. In a doctoral study which investigated performance management in Ghanaian university libraries, one of the objectives explored was how the fourth industrial revolution has affected the performance of Ghanaian university libraries. Using a mixed methods research approach, the views of 218 university librarians were elicited from selected universities in Ghana. The study found that a significant proportion of Ghanaian university libraries did not apply any 4IR technologies although they were aware of their benefits. Furthermore, the few libraries which did, only applied the aspects of Internet of Things (IoT), cybersecurity and cloud computing. Moreover, most of the libraries were not adequately prepared for implementing 4IR technologies. The study recommends that in order for Ghanaian libraries to remain relevant, address clients' changing needs in terms of information provision and yield high performance, library management should strive to adopt and use most of the 4IR technologies.*

**Keywords:** 4IR, University Libraries, Ghana.

## Introduction

The world is currently witnessing innovative technological developments such as the Internet of things (IoT), artificial intelligence, robotics, nanotechnology, 3D printing and other technologies with diverse applications. The amalgamation of such technological discoveries is the fourth industrial revolution (4IR). 4IR is the current and developing technological revolution that changes how modern people live and work. It describes the information technology evolution towards greater automation and interconnectedness (Lund, 2021). The 4IR builds on the fundamentals established by previous industrial revolutions. The invention of the steam engine in the 18th century triggered the first industrial revolution, allowing for the first-time mechanisation of production and driving social change as people became more urbanised. Electricity enabled mass production during the second industrial revolution. Beginning in the 1950s, a third industrial revolution (the digital revolution) saw the development of computers, electronics, and digital know-how to mechanise production. The 4IR follows in the footsteps of the digital revolution but is distinct from it (Schwab, 2016).

As Gray (2016) states "Change will not wait for us: business leaders, educators, and governments all need to be proactive in upskilling and retraining people so everyone can benefit from the 4IR". Therefore, the responsibility to generate the models and settings to permit it to occur needs to be taken, or else we will consume a generation with a lack of skills for the new demands of the labour market and that turns out to be a huge problem to society. Kamble et al. (2018), among others, remind us that the term 4IR is not necessarily new, but it is among Germany's ten "target items of the high-tech strategy action plan of the 2012 project", which envisaged the

amalgamated manufacturing with IT and led to the development of factories that are smart, efficient and adaptable to new technological changes or demands. According to Kamble *et al.* (2018), 4IR technologies include the Internet of Things (IoT), big data analytics, cloud computing, augmented reality and robotic systems, simulation prototypes, and 3D printing. The transformed roles, innovative services, and future of academic libraries have been the focus of attention by many researchers around the world (Catalano et al., 2018; Cox et al., 2019; Dempsey and Malpas, 2018; Schulte et al., 2018) and in South Africa (Chiware and Becker, 2018b; Hodonu-Wusu and Lazarus, 2018; Kwanya and Stilwell, 2018; Moll and Moll-Willard, 2019; Ocholla et al., 2016; Ocholla and Ocholla, 2017;). The result has been the creation of new library spaces and services, which are suitable for the needs and orientation of individual institutions (Dempsey and Malpas, 2018; Ocholla et al., 2016), in response to the rapidly changing landscape of higher education, influenced by strong research, teaching and learning agenda; ICTs; university ranking; community engagement (for contextualising research and teaching) and the 4IR, all of which demand that library services be accessible anytime, and anywhere.

This 4IR is differentiated from earlier revolutions by the speed of technology, the pervasiveness of its scope and the tremendous impact of new systems, which has dramatically affected this generation.

Human beings and machines are now speedily connecting. Mobile computing, artificial intelligence, online learning of every trade and automation has become the necessity of our day (Hussain, 2019). 4IR Integrates technologies such as robotics, IoT, virtual reality (VR), 3D printing, nanotechnology, autonomous vehicles and artificial intelligence (AI). The impact of 4IR is being felt in almost all spheres of life. Virtually all aspects of human endeavour are being altered by it. Concerning libraries, the fourth industrial revolution is currently changing the responsibilities and roles of librarians worldwide. This situation has called for a fundamental rethink to reequip librarians with the necessary competencies to ensure effective and efficient delivery of services to clients whose needs are dynamic. That is, this era has provided librarians with an excellent opportunity to reinvent themselves. According to Chisita and Chibanda (2019), digital technologies are causing revolutionary changes in libraries by changing how work is done or accomplished

**Statement of the Problem**

Beyond the global recognition of the benefits of the 4IR in the attainment of general development scope with education inclusive, not much research work has been done on how the principles of 4IR affect performance, especially amongst library staff who are expected to utilise this more. University libraries are evolving into digital and virtual libraries that use technology to improve their services. Literature from around the world also suggests that academic librarians should adopt new technology as part of their transition to digital platforms in order to remain relevant to today's users (Cao, Liang and Li 2018; Gul and Bano 2019). Librarians should be conscious of the new products and services brought about by the Fourth Industrial Revolution.

According to Hussain (2019), the 4IR has had a significant impact on libraries, and their continued existence is dependent on their ability to align with the 4IR's design principles. It is against this background that this study sought to find out the extent of adaptation of 4IR technologies and how this may be affecting performance of Ghanaian university libraries.

**Objective of the Study**

The objective of this study was to explore the extent to which Ghanaian university libraries have adopted the 4IR technologies to address the changing needs of clients. Specifically, the study investigated the 4IR awareness level, 4IR technologies used by Ghanaian university libraries, libraries' preparedness towards the implementation of 4IR technologies, the role of library staff in the face of 4IR and how 4IR has affected staff performance in Ghanaian university libraries.

## Literature Review

The Fourth Industrial Revolution (4IR) was characterised by the fusion of the digital, biological, and physical worlds and the growing use of new technologies such as artificial intelligence, cloud computing, robotics, 3D printing, and the Internet of things (IoT), and advanced wireless technologies. It

has ushered in a new era of digitised education and library operation (Ndung'u and Signé, 2020). In their study, Ahmat and Hanipah (2018:57) indicate how these innovative technologies affect libraries and information centres. They further indicate how digitalisation has affected most libraries and information environments and how clients can access all information needed without physically being on the library premises and even sometimes without the assistance of library staff. Libraries have no option but to move into this revolution where information professionals fear that some of the 4IR technologies will take over the library.

Some degree of artificial intelligence has already been used by our library systems worldwide. According to IFLA (IFLA Report, 2017), libraries will be proponents and facilitators of the 4IR, in which people design and manufacture their own devices and objects. According to Lund (2021), some of these technologies seem a bit unrealistic, but the library's goal is to serve the information needs of its clients in the best possible way. Therefore, libraries have no option other than to play along to provide effective and efficient service delivery. In whichever form it has come, 4IR will not spell doom for libraries and librarians but rather upgrade it: staff may now work from home, the adoption of artificial intelligence, more connections and communications for libraries, online monitoring of staff performance and monitoring services from home. All these have taken a new dimension in the bid for libraries to remain relevant. 4IR has and will continue to change some job duties of librarians: greater emphasis has now been placed on library instruction but has not made the librarian or the library work irrelevant. Great ideas adopted by leaders in the library field such as OCLC, IFLA and others suggest that libraries will never be left behind (Lund, 2021).

According to Engerer and Sabir (2020), the role of information professionals was divided into three, namely, research librarians, I humanists and information specialists,. According to them, a research librarian provides adequate support to researchers. The I humanist builds the architecture used in identifying research areas, and an information specialist provides the collaborative and communication tools needed in research. As Kirkwood (2018) says, information professionals will remain relevant and should not feel the danger of being replaced by 4IR technologies. 4IR instead creates modern knowledge, the perfection of duties and redefines skills and jobs needed by the information professional, leading to quality and fast service. 4IR improves performance and augments labour by reducing routine and repetition. Therefore, Ayinde and Kirkwood (2020) encourage information professionals to build up their skills and knowledge regarding 4IR technologies to survive even though the extent to which these innovations are adopted is likely to differ from one library to another.

In a special Global Vision discussion conducted by the International Federation of Library Associations and Institutions in July 2017, there was a discussion on how libraries can unite to tackle the challenges associated with 4IR (Cassell et al., 2017). An agreement that was arrived at states that: "*Libraries enable literate, informed and participative societies. When we look at the future, according to the debates in our teleconference, libraries will be trustworthy information brokers; will do more with new technology; provide universal access to information and scholarly works, whether it be media or information we already know or new media; preserving and providing access to information in all formats and providing trusted and effective support for political and social engagement. Libraries will be advocates for and facilitators of the Fourth Industrial Revolution, where people create their own devices and objects.*"

Flecker *et al* (2017), on the other hand, stated that "*Personalisation will be increasingly important. Due to the nature of new technologies solving new and meaningful problems for customers, we will start to see them expecting services on their terms according to their ideals and needs. Thus, we will need to develop new business models that cater for our customer's needs on their terms.*"

On strategic actions for libraries, Ahmat and Hanipah (2018) admit that librarians and all library stakeholders provide the support needed to prepare action and strategies to stabilise libraries in the 4IRera. Ahmat and Hanipah (2018) advance four main strategic actions to be taken by librarians and library leaders to adequately propel libraries to manage any changes that may crop up due to change.

With all the necessary support provided by the parent institution, libraries must adopt new techniques by restructuring the activities mentioned earlier to effectively deal effectively with all the issues of concern in the 4IR. New roles, behaviours, processes and skills must be acquired rather than concentrating only on sophisticated technologies such as artificial intelligence. If effective attention is paid to these components, there would be high-level service optimisation, and the libraries' position in our communities will remain relevant.

## Research Methodology

The study was conducted in Ghana, precisely in selected university libraries across the country. The mixed method research approach was adopted for this study. The mixed-method research approach has been described by Cameroon (2009) as a silent revolution because of its emphasis on overcoming contradictions between qualitative and quantitative approaches. Collecting data for mixed-method usually involves using questionnaires and interviews, hence the reason why the mixed method approach is adopted to examine the extent of adaptation of 4IR in Ghanaian university libraries (Johnson and Onwuegbuzie, 2004). The two main data collection tools used for the study were questionnaire and semi-structured interview. The questionnaire was used to solicit data for the quantitative phase of the study, and the semi-structured interview was for the qualitative phase. In Ghana, there are 36 accredited universities, each with a library. However, because university libraries are often homogenous (similar in structure and objectives, it was deemed unnecessary for all 36 university libraries to be included in this study. The researchers relied on a sampling technique that subdivided all the universities based on three main characteristics, chartered private universities, public universities and technical universities. After stratification, the researchers sampled all the strata to ensure representation of all the universities.

The researchers also considered the location and the state of the university, among others. All library staff in the selected university libraries were eligible to participate in the study. In the first sampling level, the universities were categorised into three primary strata or groupings: public, private and technical universities. There are 14 public universities, 12 chartered private universities and eight technical universities (nab.gov.gh/index, accessed on 18th October 2021). Thus, the stratified sampling technique was used to ensure that all three types of universities were included as proportionately as possible. That is, to proportionately sample the 36 Ghanaian universities, the researchers used a formula provided by Kish (1965). For the sake of representation, Kish encourages using a sample fraction of 1/4 to draw the libraries for the study (Kish, 1965). Each stratum should have the same

**Table 1: Sample size of university libraries in Ghana**

| Library | Public universities | Private universities | Technical universities | Total |
|---|---|---|---|---|
| Population size | 14 | 12 | 8 | 36 |
| Sampling fraction | ¼ | ¼ | ¼ | ¼ |
| Final sample size | 4 | 3 | 2 | 9 |

**Source:** Amoah and Majanja (2021)

Thus, the sample size for public universities was calculated as (¼ x 14) = 4, which is approximately four universities (Kish, 1965). In the view of Kish (1965), the sampling fraction in each stratum should always be made equal to the sampling fraction for the entire population. The actual university libraries that participated in the study were purposively selected to balance the different geographical, socio-economic, size, age and other factors relating to the varieties of university libraries in Ghana. After the university libraries were selected, all staff from these selected university libraries were used for the study (218), thus adopting the census approach. Harding (2006) defines the census method as the process of

data collection where all units of a population are studied. This gives an accurate measure of the study's population.

The researchers respected the rights of the study participants and ensured that informed consent was sought and obtained from all study participants prior to the conduct of the interviews. The quantitative data was analysed using the Statistical Product and Service Solutions (SPSS) software version 22.0. It is presented using frequencies, tables, graphs, pie charts and percentiles to ensure an easy understanding of the analysis. The qualitative data was managed and analysed manually. Open coding was undertaken through a line-by-line reading of the narrative data to organise and group interview transcripts under specific research questions. The codes were then organised into sequential categories and further collated into initial themes according to their similarity. Heads of the nine libraries sampled were interviewed.

## Findings

To know the extent to which Ghanaian university libraries have adopted to 4IR technologies to meet the changing needs of clients, one of the study's objectives was to know the awareness level of staff concerning the concept under study. How are these technologies being used for libraries to provide timely and adequate information to their clients? This and many other questions were posed to elicit data from the various librarians who partook in the study.

### Awareness of 4IR

First, the awareness level of questionnaire respondents was sought. Data revealed that the majority 156 (71.5%) were aware of 4IR, with 13 (6.0%) having no idea about it as presented in Figure 1 below.

### Awareness of Different 4IR Technologies

Respondents were asked to indicate the exact 4IR technologies of which they were aware. This multiple response question gave respondents the latitude to select as many as applied. Eighty (36.7%) respondents had heard of IoT, followed by cyber security and cloud computing with 70 (32.1%) and 69 (31.1%), respectively. Full details are shown in Table 2 below.

**Table2: Respondent's awareness of 4IR technologies(218)**

| 4IR technologies | Frequency | Percentage (%) |
|---|---|---|
| Internet of things (IoT) | 80 | 36.7 |
| Cyber security | 70 | 32.1 |
| Cloud computing | 69 | 31.7 |
| Robotics (artificial intelligence) | 68 | 31.2 |
| Sharing economy | 53 | 24.3 |
| Augmented reality | 24 | 11.1 |
| None of the above | 20 | 9.2 |
| Others | 3 | 1.4 |

**Source: Field data, Amoahand Majanja (2021).**

### 4IR Technologies Used by Respondents' Libraries

The study further sought to enquire from respondents which of the 4IR technologies mentioned in Table 2 were used in their respective libraries. The results revealed that, out of the 218 most of the respondents 75 (34.4%) used the Internet of things, and 64 (29.5%) used none of them showing that they were aware of the 4IR technologies, but their libraries used none of them. A considerable number of respondents, 31 (14.2%), stated they had no idea what was used in their libraries. The rest of the data is presented in Table 3.

**Table 3: 4IR technologies used by respondents' libraries (218)**

| 4IR technologies used by respondents | Frequency | Percentage (%) |
|---|---|---|
| Internet of things (IoT) | 75 | 34.4 |
| Cloud computing | 19 | 8.7 |
| 3-D Printing | 13 | 5.9 |
| Sharing economy | 8 | 3.7 |
| Cyber security | 7 | 3.2 |
| Robotics (Artificial Intelligence) | - | - |
| Augmented reality | - | - |
| Others | 1 | .5 |
| None of the above | 64 | 29.5 |
| No idea | 31 | 14.2 |
| **Total** | **218** | **100** |

**Source:** Field data, Amoahand Majanja (2021).

Interviews with head librarians revealed that the Internet of things, cyber security, library management system and 3-D printing as the 4IR technologies in use and hence corroborates the findings of the study.

The interviewees indicated that libraries have to change to always keep abreast with the times, thus embracing the 4IR technologies. Some of the responses received from the interviewees are:

> *"Cloud computing allows us to host our data not necessarily on a local server, but on a server on the Internet and will not be the only people who have access to it, so cloud computing is applied. Then we have the Internet of things; we are using RFID, which is an application of the Internet of things. All our books have a device in them that uses a sensor, and wherever the book is, you can always track it. Then cyber security; you saw how biometric devices are all over the place, both in the library and around the University. It's an application of cyber security.*

Both qualitative and quantitative responses indicated the Internet of things (IoT) as the major 4IR technology used in almost all the libraries. This was followed by cyber security, 3D printing and cloud computing. It was quite interesting to note that some libraries did not have any of the technologies at all, despite the advancements in technology and the changing needs of the clients.

## Preparedness of Libraries for the Implementation of Innovative Trends

Having ascertained the level of usage of 4IR technologies among respondents, the study sought to find out how ready and prepared the libraries were to implement these innovative trends. The findings elicited are presented in Table 4.

**Table 4: Level of Preparedness for 4IR (N=218)**

| 4IR technologies Preparedness to Innovative Trends | Frequency | Percentage (%) |
|---|---|---|
| Somehow prepared | 72 | 33 |
| Adequately prepared | 30 | 13.8 |
| Unprepared | 48 | 22 |
| Not sure | 59 | 27 |
| No idea | 9 | 4 |
| **Total** | **218** | **100** |

Most of the respondents 72 (33.0%) stated their libraries were somehow prepared to implement the innovative trend. A further 30 (13.8%) indicated their libraries were adequately prepared, and 48 (22.0%) said their libraries were unprepared for these innovative trends. In a quest to confirm the quantitative findings, the researcher posed the same question to the qualitative respondents. Data is present in Table 5 below.

**Table 5: Qualitative responses on the library's preparedness for the implementation of new trends**

| Librarian | Indication |
|---|---|
| LIB1 | *We are all prepared, but we need to add more of the 4IR technologies.* |
| LIB2 | *Not all that prepared because we are now reorganising our library because of the transition.* |
| LIB3 | *We are very prepared; of course, we may have to put in more effort to ensure its effectiveness.* |
| LIB4 | *Not adequately prepared but would love to use some of those technologies for effective service delivery.* |
| LIB5 | *We are prepared and need to upgrade some technologies and also acquire new ones as well as new training for staff members.* |
| LIB6 | *We are very prepared. Ready to purchase as well as upgrade to meet new demands.* |
| LIB7 | *Not very well prepared, because it is mostly a mining and technology university, the university management's attention is not fully on the progress of the library.* |
| LIB8 | *We do not have all it takes, but we are prepared to adopt new technologies to continue to stay in the information business.* |
| LIB9 | *We are not very prepared, but we are ready to upgrade and use some technologies that will change the face of the library.* |

**Source:** Field data, Amoah and Majanja, (2021)

From both quantitative and qualitative responses obtained, it could be realised that the majority of the libraries were not adequately prepared to implement 4IR technologies. Only a few (14%) respondents in the quantitative phase indicated their libraries were well prepared. Only KNUST and UG librarians could indicate their libraries' preparedness to implement the new 4IR technologies. Knowing how to use technologies associated with 4IR is crucial because it helps to increase the performance of staff and the overall performance of the library. In the quest to ascertain more in-depth information from respondents on 4IR, the researcher sought to find out their knowledge or technical know-how in operating in the era of 4IR. The relevance of library staff in the deployment of 4IR technologies by Ghanaian Universities and whether librarians have the necessary equipment to navigate effectively in the 4IR era. The data were analysed using descriptive and is presented in Table 6 below.

**Table 6: Relevance of library staff and the necessary knowledge to operate in the era of 4IR**

| **4IR question** | | **Frequencies** | **Percentages (%)** |
|---|---|---|---|
| Necessary knowledge to operate 4IR | Not sure | 106 | 48.6 |
| | Yes | 64 | 29.4 |
| | No idea | 27 | 12.4 |
| | No | 21 | 9.6 |
| | Total | 218 | 100.0 |
| Role of library staff in the phase of 4IR | Very relevant | 128 | 58.7 |
| | Somehow relevant | 61 | 27.9 |
| | Not relevant | 13 | 5.9 |
| | Not sure | 16 | 7.3 |
| | Total | 218 | 100.0 |
| Necessary equipment to perform effectively in the 4IR era | Somehow | 85 | 39.0 |
| | Not sure | 77 | 35.3 |
| | Very sure | 36 | 16.5 |
| | No idea | 20 | 9.2 |
| | Total | 218 | 100.0 |

**Source:** Field data, Amoahand Majanja (2021).

From Table 6 above, the findings revealed that most library staff, 106 (48.6%), were not sure that they had the necessary knowledge to operate in the 4IR era. Respondents were further questioned on the role of library staff in the face of 4IR. Data obtained revealed that the majority, 128 (58.7%), thought that the role of the library staff would always remain relevant in the era of 4IR. Only 13 (5.9%) indicated that the role of librarians would not be relevant in the phase of 4IR. Furthermore, since the 4IR is a technological shift, the researcher asked respondents whether librarians had the necessary equipment to perform effectively for the libraries' goals to be achieved in this era. Most of the respondents 85 (39%), chose the option 'somehow' showing that librarians are uncertain whether they have the necessary equipment to perform effectively in the 4IR era.

Interviews on the issue of relevance also revealed that library staff will still be needed in this 4IR era; the only difference would be a change in their work routines. Staff have to constantly learn to keep abreast with time to be relevant in this era.

*Very relevant, it has rather become more*

*challenging these days and our importance is even needed the more. The reason is that when you talk of getting information on the Internet these days - what source are they getting? Is it not a popular source? But users are not supposed to even use popular sources; they are supposed to be using scholarly resources, and we [librarians] have what it takes to be able to help them with that (LIB 2).*

Another librarian had this to share:

*The system is changing; as I told you, everything changed with technology. The people will be relevant when they update. There will be so many other things that we were not doing that we will need to do (LIB 5)*

## How 4IR Is Affecting Staff Performance and Service Delivery in Libraries

Tables 5 and 6 respectively represent findings on how the introduction of 4IR has affected staff performance in respondents' libraries and how 4IR has affected library service delivery. Table 7 shows that most of the respondents 92 (35.7%) indicated that they had no idea whether 4IR affected staff performance or not. Data in Table 8 revealed that tmost of the respondents 71 (47.0%), indicated that they had no idea of how 4IR had affected staff performance, and 25.7 % of the respondents stated that 4IR made service delivery fast and effective. The remaining findings are illustrated in Tables 7 and 8 below.

**Table 7: How 4IR affected service delivery**

| How 4IR has affected staff performance | Frequency | Percentage % |
|---|---|---|
| No idea | 92 | 35.7 |
| Fast and effective service delivery | 66 | 25.7 |
| New ways of operations | 58 | 22.5 |
| High performance | 32 | 12.5 |
| Others | 9 | 3.6 |
| **Total** | **257** | **100.0** |

**Source:** Field data, Amoah andMajanja(2021).

**Table 8: How 4IR has affected staff performance**

| How 4IR has affected service delivery | Frequency | Percentage % |
|---|---|---|
| No idea | 71 | 47.0 |
| Improved service delivery | 50 | 33.1 |
| Quick access to information | 16 | 10.6 |
| Information is now on smart devices other than libraries | 11 | 7.3 |
| Increased virtual libraries | 3 | 1.9 |
| **Total** | **257** | **100.0** |

**Source:** Field data, Amoahand Majanja (2021).

The same question was posed to librarians to discover the impact of these innovative technologies on service delivery in libraries. Some of the responses are shown below:

*There is improved security all over the place through the use of biometric devices. So 4IR has improved the performance of our university (LIB 7).*

*It has made service delivery effective and efficient. It has affected it positively (LIB 5). Yeah, positively. In the sense that, if for nothing at all, there was the ease of performing the traditional roles that we used to do. They have now become faster. For instance, there was no need to go to the shelves to identify a book. The RFID would help you identify a book faster wherever you were. Is it not good? It is. There is improved networking, and OPAC confirmation is all improved, so you can sit somewhere in a remote area and find out whether the material is available or not (LIB 6).*

While most of the quantitative respondents did not have an idea of how 4IR affects staff performance in libraries, the interviews with the respondents revealed that 4IR had a positive impact on the performance of librarians. It has also led to the effective and efficient delivery of library services. Because there was a broader reach to patrons and improved security of our information sources and the library premises as a whole, these views corroborated those provided by some quantitative respondents who had an idea of what this particular question required. Some quantitative respondents stated improved service, quick access to information and an increase in virtual libraries as some of the positive impacts of 4IR on libraries.

## Discussions of Findings

According to Schwab (2016), the 4IR builds on the digital revolution that began in the mid-century, blurring the barriers between the physical, digital and biological worlds. However, since its inception in 2016, the 4IR notion has been rare in academic library literature (Catalano et al., 2018; Chiware and Becker, 2018; Moll and Moll-Willard, 2019). Nevertheless, embedded systems, IoT and cyber-physical systems, big data and cloud computing are already widely used in academic libraries (Avuglah and Underwood, 2019; Chiware and Becker, 2018). With the advent of innovative technological advancements such as the Internet of things, artificial intelligence, robotics and 3D printing, libraries have adopted new approaches to deal with client information needs. Knowing how these innovative technologies affect staff performance and how libraries meet clients' information needs in this era cannot be overemphasised. This study has brought out the responsiveness level of librarians, the technologies university libraries in Ghana are using to ensure maximum performance and the relevance of library staff in this era.

The finding that most of the respondents knew about 4IR and saw it partly as a system for building on the digital revolution is significant even if some saw it partly as the amalgamation of technological discoveries and focused on artificial intelligence. These perceptions align with the description and position espoused by Lund (2021) and therefore primes Ghanaian university libraries' participation in this significant revolution.

Concerning the 4IR technologies used by the libraries, it was significant to find that only a few respondents used the IoT and also that 29.5% did not use any of the 4IR technologies, implying that the 4IR technologies are not widely applied in Ghanaian university libraries yet. This finding implies that Ghanaian university libraries seem to be lagging behind this agrees with Chang and Huynh (2016) recommendation that libraries need to move towards greater automation, efficiency and on-time delivery of information to clients. It is disturbing to note that quite a high number of staff averred to the fact that they had no idea what 4IR technologies their libraries used. This is worrisome because as Ahmat and Hanipah (2018) opines, these innovative technologies significantly affect services, such as how clients could access information globally. Ahmat and Hanipah (2018) recommend that libraries move into this revolution if they want to be in business and remain relevant in this era. A move that cannot be achieved without the staff. According to an agreement reached in a special global vision discussion by IFLA (2017), libraries should do more to ensure that staff are conversant with these innovative technologies and

aim to provide universal access to scholarly works and other information to their clients.

Investigating the libraries' preparedness for implementing 4IR technologies revealed that many were prepared to implement innovative trends even though some were not prepared while others were unsure. Knowing how to use 4IR technologies is critical to improving staff and library performance. But the findings revealed that a most of the staff (48.6%) were unsure whether they had the necessary skills to operate in this era. This finding contradicts one of the four strategic activities that librarians are relevant in this era, as proposed by Ahmat and Hanipah (2018), Hopwood et al. (2012) and Harden and Loving (2015). The need for librarians to acquire multiple skills and knowledge to operate in this era is key to the survival of librarians and information professionals. Ayinde and Kirkwood (2020) also identify the need to build the skills and competencies of librarians for continuous survival.

The role of library staff of how 4IR has affected staff performance and library service delivery in respondents' libraries surprisingly revealed that many did not know whether or not the 4IR affects staff performance (47.0%), 58.7% of the respondents felt the role of library staff is still relevant in the 4IR age. It is hoped that the 35% might in future be persuaded by Dargar and Srivastava (2020), who opined that the role of librarians would still be relevant. However, it would be restructured into three main areas, information specialists, research librarians and I-humanists. Kirkwood (2018) further indicated the relevance of the role of librarians and added that perfection of duties and redefinition of skills and jobs are to be focused on for quality service provision. While only25.7% of respondents felt that 4IR makes service delivery fast and effective. This was quite an instructive finding because staff performance at this phase is very important for libraries, considering the fact that librarians above other library stakeholders provide the needed support to comprehensively prepare action and implement strategies to stabilise the library in the face of the 4IR.

## Conclusions and Recommendations

The study, therefore, concluded that, even though staff were uncertain about the knowledge needed to operate in the 4IR era, their role will always be relevant, despite technological advancement. Librarians will assume new roles to ensure the proper delivery of information to clients, which will go a long way to impact staff performance and the overall performance of libraries positively. It was again concluded that the 4IR impacts library staff performance positively, leading to fast and effective service delivery, new ways of operation and high performance. The 4IR can increase virtual libraries, leading to a broader reach for patrons and improved security in libraries by using biometric devices. The 4IR was acknowledged to have improved service delivery, access to information and overall library staff performance. Based on the conclusions above, the study recommends that library management should strive to adopt and use most of the 4IR technologies that will effectively disseminate information. This will increase staff performance and the library as a whole because of the changing needs of the clients in terms of information provision. Management should also improve staff training to improve the readiness and preparedness of the library to take advantage of the modern technological trend and continue to exist in the era.

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**Gloria Bosomtwi Amoah** is the Head of Cataloguing Section of Sam Jonah Library, University of Cape Coast, Ghana. She holds a doctorate degree in Information Science from the University of South Africa, M-Phil in Information Studies from the University of Ghana, Legon, M.A Information Studies from the University of Ghana, Legon. Gloria read B.A degree in Social Sciences from the University of Cape Coast, Ghana.

**Mabel K. Minishi-Majanja** is a retired Professor of the University of South Africa (UNISA) Department of Information Science. She holds a DPhil-LIS from Zululand University, MLS from Pittsburgh University, PGDE from Kenyatta University and BA Librarianship from North London.

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# Evaluation of User Education Programmes and Resources used by Undergraduates of Two Selected Federal University Libraries in South East, Nigeria

**Rebecca Chidimma Ojobor,**
*Nnamdi Azikiwe Library*
*University of Nigeria, Nsukka*
*rebecca.ojobor@unn.edu.ng*

and

**Victor N Nwachukwu.**
*Department of Library and Information Science*
*University of Nigeria, Nsukka*
*victor.nwachukwu@unn.edu.ng*

## Abstract

*his study evaluates user education programmes of two federal university libraries in South East, Nigeria, for enhanced access and use of digital resources. A population of 6,249 undergraduate users was studied using descriptive survey. A sample size of 376 was determined using Taro Yemen's formula. Data was obtained via questionnaire and quantitatively examined using mean and standard deviation. The findings of the study reveal provision of library orientation ($\bar{X}$=3.65), course-related instruction (=3.06) individualised instruction (=2.87) and library tours (=2.67) to users of the libraries under study; the grand mean of 2.93 (SD=1.00) indicates that the programmes enhance users' access and use of digital resources to a high extent. This notwithstanding, inconsistent power supply and a lack of ICT infrastructure were identified challenges to the success of the programmes in the study area. However, a supportive environment and creative teaching strategies were suggested for the programmes' effectiveness.*

**Keywords**: User Education Programme, Academic Libraries, Digital Resources

## Introduction

The digital revolution and the advancement of innovative information and communication channels deprived libraries of the monopolistic power of information providers to their member communities. Today most information seekers find little or no incentive to visit the library because they have access to other information sources/resources**.** Again, the emergence of Information and Communication Technologies (ICTs) has resulted in the changing mode of information resources, making most library resources harder to access for users who lack the necessary abilities. According to Anene, Achebe and Uzoechina (2020), with the rapid development of ICTs, accessing and retrieving information from libraries has become more difficult.

Access to library resources is the ability of the user to get in touch with the required material and use that material to meet his or her information needs. Currently, developments in computer technology have resulted in a vast expansion of library resources, posing considerable challenges to its access and use.

The majority of the library's present resources are now available in digital format, and new services such as digital libraries and institutional repositories have emerged as a result of the advent of digital technologies (Abubakar and Cholom, 2017). In most university libraries, the use of online cataloguing databases like the Library of Congress (LC) Cataloguing Scheme, Online Computer Library

Center (OCLC), and other platforms like TINLIB and Koha has increased, encouraging the use of Online Public Access Catalogue (OPAC) for greater visibility of library resources. The emerging developments in libraries pose major obstacles to library users due to inadequate skills to access and use information stored in electronic format.

The current method of information packaging necessitates the acquisition of fundamental skills in order to access and utilise the available information resources. Because a university library is one of the most sophisticated information systems, students can only get the most out of it if they are taught how to get the information they need through user education (Abubakar and Cholom, 2017). This agrees with Ejiroghene (2020) that library training (user education) is necessary to encourage effective and efficient exploration of library resources as well as build awareness for later usage of library resources. User education is a service in which librarians teach users the skills they need to explore the library and its resources effectively and independently. Users can access the service through a variety of educational programmes referred to as User Education Programmes (UEP). The UEP is a library-sponsored educational programme that teaches users how to access, and retrieve library resources within and outside the library in order to promote lifelong learning. According to Liu, Lo, and Isumura (2019) UEP educates and influences users' opinions and attitudes about library usage, as well as inspiring their search for knowledge, which is critical for individual and societal growth. Its primary goal is to educate to convey knowledge, skills, and attitudes that encourage users to make efficient use of library resources (Audu, Olokpo, Ohem, Nwafornso, and Ugela, 2020).

The need for a User Education Programme in Nigerian institutions of higher learning is greater, as the majority of students have no prior familiarity with libraries. Even if students have had prior library experience, the structure of the university library, the volume of resources, and their arrangement may be more complex, requiring users to be introduced to them. In his study, Lalithamma (2017) found that user education programmes have become increasingly important in modern times since recent educational trends have raised the need for library users to be assisted through both instruction and practice. The expert goes on to say that fast advances in information acquisition and teaching methods have elevated the importance of user education by leaps and bounds. Furthermore, tremendous changes in technology and culture have generated an urgent need to teach users how to become more efficient and independent in their information searching (Okeke, 2017). Another issue that necessitates user education programmes is the expansion of inter-disciplinary courses in higher education, which necessitates students being trained to be able to make efficient use of the wide range of resources accessible in the library (David-West, 2020).

Anyim (2018) acknowledged that user education contributed a lot in the past when Information and Communication Technologies have not taken over virtually every aspect of human endeavour, but argued that the method used to render the programme in the past could not adequately expose library resources adequately or assist users in accessing and retrieving information in modern libraries. Besides, overcrowding of library users, a lack of trained and skilled personnel, an insufficient number of computers for practical use, a lack of training and retraining of staff on ICT application and use, a lack of maintenance culture, a lack of infrastructure, epileptic power supply, and the limited time allocated to the programme are all factors that contributed to the programme's failure. The situation has put enormous strains on librarians working at federal university libraries under study.

The daily decrease in the number of customers in the libraries under study is alarming. The majority of the library's few customers are unfamiliar with the many areas and operations of the library, making it difficult for them to obtain the resources they require to meet their information needs; many of the customers are unable to use the library's OPAC or digital services. As a result, most users waste a significant amount of time at the library and, regrettably, depart it unsatisfactorily. The seriousness of these issues can invariably diminish the library's potential value and services, thus jeopardising the library's commitment to its parent institution in the long run. Researchers in the field of librarianship have expressed worry about the situation, prompting them to conduct a number of studies on user education in order to find ways to improve user education programmes. Among such studies are those

conducted by (Lalithamma, 2017); (David-West, 2020); (Omeluzor, Akibu, Dika, and Ukangwa, 2017); and Audu, Olokpo, Ohemu, Nwafornso and Ugela (2020). To the best of the researchers' knowledge, none of the mentioned studies have focused explicitly on the two selected federal university libraries in the South East of Nigeria, specifically the University of Nigeria, Nsukka and the Federal University of Technology, Owerri. This context underlines the necessity to assess user education programmes in order to improve access to and use of digital information resources.

### Statement of the Problem

Modern libraries are more digitalised, with the majority of their existing resources available in digital formats that require basic skills to access and retrieve. User education programmes are designed to provide users with the necessary skills to effectively explore the library and its resources, as well as to encourage users to visit the library. However, its influence in most libraries is currently unnoticed. The issue spurred the study's problem statement, which reads, "What is the state of user education programmes in modern libraries?" This demands this research into the evaluation of user education programmes aimed at improving undergraduate users' access to and use of digital information resources at the two federal university libraries.

### Purpose of the Study

The study specifically seeks to:

1. identify the types of user education programmes that are provided to users of federal university libraries in Enugu and Imo state.
2. determine the extent to which effective user education programmes could enhance users access and use of digital resources in the libraries understudy.
3. determine how often librarians in the study area provide user education programmes to users.
4. identify the challenges to effective user education programmes in the libraries under study.

### Significance of the Study

The findings of the study are expected to expose the worth of the library and create wider visibility and usage to its resources and services. To the library customers, it is expected to equip them with the basic skills for accessing and retrieving digital information resources from within and outside the library and introduced them to various technological gadgets for improved performance. The outcome of the study is anticipated to unveil the uniqueness of librarians as information scientist and not mere bookkeepers. The outcome of the study is expected to serve as a reference point to researchers of similar interest who may wish to embark on a related study. Finally, the findings of the study are expected to be useful to the entire nation as it will enable the university to produce high-quality graduates who will serve the country.

## Literature Review

Library user education is crucial for strengthening information search, evaluation, and retrieval of digital information resources, as well as creating the atmosphere for effective life-long learning (Okeke, 2017). The service is intended to achieve two main objectives: short-term and long-term objectives. While the short-term goal is to assist users in completing their course: 'Use of Library and Study Skills (GSP111)and familiarising them with finding information in various sections of the library, the long-term goal is to raise awareness and understanding of a variety of new topics, such as communication principles and practices, the structure of specialist literature, and internal and external information; the short and long-term goals are then geared toward equipping library users with the necessary library use skills, allowing them to make efficient use of library resources.(Ilogho, Iroaganachi, and Osinulu, 2016).

Users are educated through a variety of educational programmes, including orientation, library tours, course-related instruction, course-integrated instruction, literature search programmes, and so on which are popularly known as user education programmes. Because their goal is to impart in library users the ability to use the library, exploit information resources, and retrieve needed

information with little aid and supervision from library employees, these programmes are critical for optimal utilisation of library resources (Audu, Olokpo, Ohemu, Nwafornso and Ugela, 2020). The efficiency of the programmes, on the other hand, determines the extent to which users used the library and its resources. This supports David-West (2020) argument that the quality of user education programmes impacts the rate of library use and, as a result, promotes user satisfaction. This means that effective user education programmes are critical for improving library services and maintaining the library's relevance to its users.

Despite this, user education in most libraries across the country is still poor, preventing potential users from benefiting from the programmes' numerous benefits. This assertion concur to the view of David-West (2020), that one of the major issues confronting many academic libraries across the country is how to organise user education more effectively to meet the diverse learning needs and expectations of students.

Because the quality of user education programmes determines the rate at which users patronise library resources and the maximum satisfaction they derive from library services, this study was created with the goal of evaluating the potentials of user education programmes to improve access and use of digital information resources in the study area. The rate of turnover in the use of library resources continues to decline on a daily basis in most libraries across the country, particularly in the study areas. The poor quality of user education in Nigerian libraries is counterproductive to the library's goals. According to Ben-Bura (2015), one of the contributing causes to the poor nature of user education programmes in Nigerian libraries is a shortage of skilled staff and insufficient networked computers. Other challenges to the programme include, but are not limited to, a lack of required skills for the application and use of modern information and communication technologies, as well as technostress caused by the misuse of ICTs, which limits the effectiveness of ICTs in improving services in most organisations (Gaudioso, Turel, and Galimberti, 2017).

## Methodology

This paper adopts a descriptive survey research design, to study a target population of six thousand two hundred and forty-nine (6,249) registered library users of 2020/2021 academic session of two federal university libraries (Nnamdi Azikiwe Library, (UNN); and the Federal University of Technology Owerri Library (FUTO) in South East Nigeria.The study's population comprises three thousand two hundred and seventy-nine (3,279) users of UNN library and two thousand nine hundred and seventy (2970) users of FUTO library.(Source: 2020/2021 users' registration register of the two libraries).

Taro Yamane's formula i.e.

$$n = \frac{N}{1 + N(e)^2}$$

(Where n = sample size; N = population; e = level of significance; 1 = constant);was adopted to determine a sample size of 376 for the study. However, because the population varied across the two libraries under study, Uzoagulu's (1998) statistical

formula $\frac{n}{N} X \frac{p}{1}$

(Where n = sample size; N = population of the study; p = population of the sub components of the study; 1 = constant); was used to allocate a sampled population of 197 to UNN and 179 to FUTO.

Data was collected using a questionnaire. Out of the three hundred and seventy-six (376) copies of the questionnaire administered, three hundred and eleven (311) copies (163 from UNN and 148 from FUTO) were filled and used for the study.

Data were analysed using mean, and standard deviation techniques. Items with mean scores between 2.5 and above were accepted while those with mean scores below 2.5 were rejected. In a four-point rating scale, the weight of the response ranges from 4, 3, 2 and 1; the average is 2.5; which is the bench mark used for the analysis.

i.e. $\frac{4 + 3 + 2 + 110}{4 \quad 4} = 2.5$

The scope of this study is limited to users of Nnamdi Azikiwe Library, UNN, and the library, Federal University of Technology Owerri. It is also restricted to the variables identified in the purpose

of the study and research questions.

**Research Question One:** What types of user education programme are provided to users of the federal university libraries?

**Table 1: Mean responses on the types of user education programme t**

| S/N | Items | HP | P | LP | NP | Response Weight | Mean | Std. | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Library Orientation | 225 | 66 | 16 | 4 | 1134 | 3.65 | 0.64 | HP |
| 2 | Library Tour | 76 | 110 | 72 | 53 | 831 | 2.67 | 1.03 | P |
| 3 | Course Related instruction (GSP 111) | 100 | 139 | 62 | 10 | 951 | 3.06 | 0.81 | P |
| 4 | Course integrated instruction | 53 | 105 | 115 | 38 | 795 | 2.56 | 0.91 | P |
| 5 | Individualized instruction | 123 | 83 | 47 | 58 | 893 | 2.87 | 1.13 | P |
| 6 | Literature search programme | 42 | 65 | 108 | 96 | 675 | 2.17 | 1.02 | LP |
| | **Grand Mean** | 103.2 | 94.7 | 70 | 43.2 | 880.1 | 2.83 | 1.04 | P |

**Key: HP = Highly Provided, P = Provided, LP = Less Provided, Not Provided**

**Table 1** displays the mean response from respondents regarding the provision of each of the user education programmes in the study area. The table shows that, aside from literature search, all programmes have high mean scores that are higher than the 2.50 criterion mean. This resulted in a grand mean of 2.83 (SD=1.04), indicating that user education programmes are provided in the study area.

**Research Question Two:** To what extent could user education programmes enhance users' access and use of digital resources in the libraries understudy?

**Table 2: Extent to which user education programmes enhance users' access and use of digital resources in the libraries (N=311)**

| S/N | Items | VHE | HE | LE | VLE | Response Weight | Mean | Std. | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Library orientation helps users to be conversant with the various unit of the library | 176 | 69 | 43 | 23 | 1020 | 3.28 | 0.96 | VHE |
| 2 | Course-related instruction programmes enable users to easily access and retrieve digital information resources | 123 | 83 | 83 | 22 | 929 | 2.99 | 0.97 | HE |
| 3 | Literature search programme encourages independent use of library resources | 94 | 111 | 86 | 20 | 901 | 2.90 | 0.91 | HE |
| 4 | Library tour builds positive image about the academic library and its resources to users | 69 | 94 | 90 | 58 | 796 | 2.56 | 1.03 | HE |
| | **Grand Mean** | 115.5 | 89.25 | 75.5 | 30.75 | 911.5 | 2.93 | 1.00 | HE |

**Key: VHE = Very High Extent, HE = High Extent, LE = Low Extent, VLE = Very Low Extent**

Table 2 shows the extent to which user education programmes enhance users' access and use of digital resources in the libraries under study. Data presented on the Table revealed a positive influence of user education programmes on users' access and use of digital resources in libraries. Out of the four programmes highlighted on the table, library orientation with a mean score of 3.28 enhances users' access and use of digital resources to a very high extent while others library tour, literature search and course-related instruction with mean range between 2.56 - 2.99 enhances users' access and use of digital resources to a high extent. Significantly, the grand mean generates a mean score of 2.93 (SD=1.00) indicating that user education programmes enhance users' access and use of digital resources to a high extent.

**Research Question Three:** How often do librarians in the study area provide user education programmes to users?

**Table 3: Respondents mean responses on how often librarians in the study area provide user education programmes to users**

| S/N | Items | VO | O | LO | NO | Response Mean | Weight | Std. | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Library Orientation | 137 | 88 | 57 | 29 | 955 | 3.07 | 0.99 | O |
| 2 | Library Tour | 65 | 41 | 110 | 95 | 698 | 2.24 | 1.1 | LO |
| 3 | Course Related instruction | | | | | | | | |
| | (GSP 111) | 95 | 116 | 28 | 72 | 856 | 2.75 | 1.12 | O |
| 4 | Course integrated instruction | 57 | 80 | 80 | 94 | 722 | 2.32 | 1.09 | LO |
| 5 | Individualized instruction | 30 | 57 | 135 | 89 | 650 | 2.09 | 0.92 | LO |
| 6 | Literature search programme | 51 | 44 | 127 | 89 | 679 | 2.18 | 1.03 | LO |
| | **Grand Mean** | 72.5 | 71 | 89.5 | 78 | 760 | 2.44 | 1.10 | LO |

**Key: VO = Very Often, O= Often, LO = Less Often, NO = Not Often**

The data in Table 3 shows that only library orientation and course-related instruction (GSP 111) are often provided to users of the two libraries under study. The two programmes have a mean score of 3.07 and 2.85 respectively which are above the benchmark of 2.50. The remaining four programmes have mean scores that range between 2.09 – 2.32 which are below the criterion mean (2.50). The grand mean of the data shows a low mean score of 2.44 and SD= 1.10 indicating that user education programmes are not often provided in the study area. The Table also shows high Standard Deviation values ranging from .92 - 1.12 meaning that the respondents were homogeneous in their responses.

**Research Question Four:** What are the challenges to effective user education programmes in the libraries under study?

**Table 4: Respondents mean responses on the challenges to effective user education programmes in the libraries understudy**

| S/N | Items | SA | A | D | SD | Response Weight | Mean | Std. | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Inadequate number of librarians | 7 | 3 | 50 | 251 | 388 | 1.25 | 0.58 | Disagree |
| 2 | Insufficient time allotted for the programme | 20 | 18 | 167 | 106 | 574 | 1.85 | 0.8 | Disagree |
| 3 | Inadequate facilities/resources | 114 | 144 | 5 | 48 | 946 | 3.04 | 1 | Agree |
| 4 | Lack of ICT skill for application and use of innovative technologies | 130 | 46 | 90 | 45 | 883 | 2.84 | 1.12 | Agree |
| 5 | Increased number of users | 140 | 118 | 33 | 20 | 1000 | 3.22 | 0.88 | Agree |
| 6 | Lack of fund | 130 | 115 | 46 | 20 | 977 | 3.14 | 0.9 | Agree |
| 7 | Users' ignorance of the programme | 102 | 146 | 51 | 12 | 960 | 3.09 | 0.8 | Agree |
| 8 | Users' indifference in pre-information literacy skill | 3 | 2 | 30 | 276 | 354 | 1.14 | 0.44 | Disagree |
| 9 | User education has been more of theory instead of practical | 147 | 120 | 20 | 24 | 1012 | 3.25 | 0.89 | Agree |
| 10 | Irregular power supply | 126 | 147 | 29 | 9 | 1012 | 3.25 | 0.74 | Agree |
| | **Grand mean** | 91.9 | 85.9 | 52.1 | 81.1 | 810.6 | 2.61 | 1.16 | Agree |

**Key: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree**

As indicated in Table 4, the respondents identified a number of variables that limit user education programmes' efficacy in the study area. Except for the low mean scores of 1.25, 1.85, and 1.14 assigned to items numbers 1, 2, and 8 respectively, all of the mean scores for the other items are higher than the critical mean values of 2.50.This means that inadequate facilities/resources, lack of ICT expertise for application and use of innovative technologies, increased number of users, a lack of funding, users' ignorance of the programme, user education been more of theory instead of practical, and irregular power supplypose challenges to the effectiveness of user education programmes in the concerned libraries. The grand mean score of 2.61 demonstrates the programmes' difficulty in the study area.

## Discussion of Major Findings

Based on the data presented in Table 1, the study revealed that all the under-listed programmes are provided in the study area except for the literature search programme that has a mean score of 2.17 (SD=1.02) below the benchmark of 2.50. The finding of the study coincides with Abah, Chorun, and Mbatsoron (2016) that library orientation and course-related instruction (GSP 111) are user education programmes that are formally provided to the students as every other one is provided on request

Data presented in Table 2 revealed the contribution of user education programmes to users' access and use of library resources. The programmes encourage independent use of library resources, easy access and retrieval of digital information resources, and update users skills and knowledge of library users to a high extent. The grand mean score of 2.93 is a clear indication that user education programmes significantly enhance users' access and use of library resources**.** The findings correspond with the findings of Audu, Olokpo, Ohemu, Nwafornso, and Ugela (2020) that user education imparts knowledge, skills, and attitudes that induce users to access library resources efficiently. The findings also concede with Anyim (2018) that user education enhanced the use of library resources to a high extent.Despite the potentials of user

education on library use, the study in Table 3 disclosed infrequent provision of the programmes in the study area. The finding concur with Abubakar and Cholom (2017) who had earlier foreseen the diminishing rate of users' access and use of library resources and advised the university authorities in Africa and other developing countries to recognise the need to provide the necessary competence for their students in order to facilitate their use of library resources in university libraries, to ensure increased research output. David-West (2020) affirmed that the major issue confronting many academic libraries across the country is how to organise user education programmes more often and effectively to meet the diverse learning needs and expectations of students.

The study however, identified various limiting factors in Table 4. Among the challenging factors to effective user education programme in the study area are inadequate facilities/resources, lack of ICT skill, and irregular power supply. The findings correspond with the findings of Ejiroghene (2020) that inadequate technological equipment, poor network/Internet connectivity, and epileptic power supply are some of the challenges confronting user education programmes. The findings also agree with Gaudioso, Turel, and Galimberti (2017) that technostress resulting from the misuse of ICTs limits the effective use of innovative technologies to improve user education programme and other services in libraries.

## Conclusion and Recommendations

Based on the study's findings with regard to its goals, it is concluded that user education programmes are offered in the study area with the aim of enhancing library use since access to and use of library resources depend greatly on library use skills, which are not inherited but acquired through the programmes. The study came to the additional conclusion that user education programmes are only seldom delivered as a result of several identified constraints, which lessens their efficacy in the study area. Since most library resources are now in digital format and require specialised skills for easy access and retrieval, the study contends that user education programmes are crucial in the library environment, especially in this IT-driven era. The study found that user education programmes were underutilised in the study area. The finding implies that the bulk of the library's clients will be unfamiliar with the library's different sections and activities, making it difficult for them to get the resources they need to meet their information demands. This could have a long-term impact on the institution's products and research output. Therefore, there is a need for development, namely in the area of ICT adaption and use in libraries, as poor ICT facilities were identified as one of the most limiting factors to the programme's efficacy. Hence, this study recommends

- Organising user education programmes at regular intervals to equipped users with the required skills to explore the library and its resources with less stress.
- Training and retraining of librarians for skill acquisition and application of innovative teaching methods in providing user education programmes.
- Provision of ICT facilities to enable the librarians to teach and practise the necessary skills that can assist the users to make independent use of the library and its resources.
- Conducive atmosphere in terms of space, light, time, and recruitment of competent librarians to encourage the effectiveness of the programmes.

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**Rebecca Chidimma Ojobor** is a librarian at Nnamdi Azikiwe Library, University of Nigeria, Nsukka. She obtained her B.Sc. (Hons.), MLS, and Ph.D from the Department of Library and Information Science, University of Nigeria Nsukka (UNN).

**Victor N. Nwachukwu** is a Professor of Library and Information Science, University of Nigeria, Nsukka. He holds B.A, MLS, Ph.D (Nig.). Prof Nwachukwu is a Chartered Librarian registered with the LRCN.

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# Anti-Corruption Investigators' Perception of the Role of Records and Records Management in Nigeria

**Aliyu Abubakar Lawan**
*Information Studies and Interactive Media Doctoral Programme*
*Faculty of Information Technology and Communication Sciences (ITC)*
*COMS / Information Studies*
*Kanslerinrinne 1, Pinni B 0017 A*
*FI-33014 Tampere University, Finland*
*aliyu.lawanabubakar@tuni.fi*

**and**

**Pekka Henttonen**
*Faculty of Information Technology and Communication Sciences (ITC)*
*COMS / Information Studies*
*Kanslerinrinne 1, Pinni B 2098 A*
*FI-33014 Tampere University, Finland*
*pekka.henttonen@tuni.fi*

## Abstract

*This study aims to explore records' contributions to anti-corruption investigations. The study answers the question: what is the perception of anti-corruption investigators on the role of records and records management in their work? The goal is to produce new knowledge of the role records plays in investigating corruption-related offences. It presents findings from a qualitative explorative case study. Fifteen Nigeria's anti-corruption investigators were interviewed in the year 2020. Interview data collated are analysed using thematic analysis. The study reveals that adequate records alone cannot ensure accountability despite the nexus between proper recordkeeping and corruption. Enhancing the integrity and authenticity of records as the most acceptable accountability tool will add significant value for ease of use by accountability forums.*

**Keywords:** Accountability Forums, Accountability Tools, Anti-Corruption Investigations, Corruption, Records Management.

## Introduction

Corruption is a menace to society. It stands in the way of realising all human rights; civil, political, economic, social, cultural, and even the most critical rights to development (Hough, 2013;Peters, 2018;Rose-Ackerman, 2004;World Bank Group, 2000). Human rights as a product of good governance are at risk, which calls for confrontation. Defining what corruption means has proven difficult due to its varying nature and ever-changing circumstances. Nevertheless, it refers to acts in which the power of the public office is in use for personal gain in a manner that contravenes established operational guidelines. Illegal acts like fraud, money laundering, drug trades and black-market operations are out of the scope of the given definition due to their lack of requiring public power. However, they thrive with public officials and politicians' direct or indirect involvement (Gray and Kaufmann, 1998;Jain, 2001).

Like many countries, corruption in Nigeria developed over time (Dike, 2003; Osoba, 1996). Its prevalence in most developing economies has attributes of a combination of factors that include strong motivation and opportunities to engage in some form of corruption, which could be the likelihood for its steady growth (Gray and Kaufmann, 1998). Common ground among key stakeholders is that corruption is inimical for developing any society

(Olken and Pande, 2012). Thus, the need for a deeper understanding of its peculiar facets towards blocking systemic loopholes that serve as catalysts for its progression. The enormity of the devastating effects of corruption and other related offences on national image, growth, and development necessitates establishing special anti-corruption agencies in countries with endemic presence. The fight against corruption became imperatively inevitable for any meaningful progress. The high level of corruption and its sustained evolution in Nigeria facilitated the establishment of the Independent Corrupt Practices and other related offences Commission (ICPC) in 1999. The mandate of the ICPC, in line with its Act, is to prohibit and prescribe punishment for corruption, fraud, embezzlement, bribery, and forgery perpetrated by Nigerians within and outside the country. Under the purview of the ICPC, are all Nigerians in the private and public sectors, including political office holders, with constitutional immunity (ICPC, n.d.).

The fight against corruption is global, and records are required tools of reference used by anti-corruption professionals for evidentiality. Ideally, records are reliable and complete documents that can convey information used in transactions and reach their production purposes. Its management amounts to systematic control of an organisation's records throughout its life cycle to meet operational business needs, statutory, fiscal requirements, and community expectations (Harries, 2009). For any record of serving its purpose of creation, it must conform to a particular context, form, organisation, structure, and version/copy (Öberg and Borglund, 2012). It is indeed a requirement that records must meet for productive use. Palmer (2000) argues that records management ensures accountability and safeguards against corruption, fraud, and maladministration. Its absence impacts transparency and accountability, which hinders good governance. In the same vein, a well-established records management system in public organisations makes it more likely for civil servants to be accountable, transparent and have high integrity in their decisions and actions. On the other hand, mismanagement of records also supports fraud and corrupt practices prevalent in developing countries (Rodreck, 2017).

The main objective of this study is to increase understanding of the value of records in anti-corruption investigations in Nigeria. The research question is: what is Nigeria's anti-corruption investigators' perception of the importance of records and records management in their work?

Anti-corruption agencies as accountability forums create, acquire, and use records. Their job lifelines depend solely on recorded evidence (Meijer, 2000). This category of record-intensive professionals fights against corruption and corrupt practices in fairness and strict adherence to the rule of law. However, records management professionals have reiterated the importance of records and their management among professionals (de Boisdeffre, 2006;Dearstyne, 2007;Dikopoulou and Mihiotis, 2012;Duranti and Rogers, 2019;Kautto and Henttonen, 2020;Ryan, 2006; Shepherd, 2006; Sundqvist, 2007). No prior study empirically examines the role of records in the fight against corruption from the investigators' perspective. The present investigation fills the gaps in the domain by exploring the value of records in anti-corruption investigations.

## Literature Review

Special accountability forums such as anti-corruption agencies see records and archives management as part of the same continuum. In their quest to secure the rule of law, they use relevant records irrespective of state, medium or stage within its lifecycle to make a case. Records serve as a means of accountability due to their power to provide adequate evidence of rights, entitlements, and obligations that support their efficiency. An essential category that shows the use of records in this regard, according to Sundqvist (2007), is the accountability purpose of proving that organisations meet legal or other regulatory requirements, which portrays a strong relationship between accountability and evidential value. Anti-corruption investigators build case files to reconstruct memory using records (Meijer, 2000). It shows that the record as an accountability tool is central to the agencies' ability to fulfil their crucial obligation of fighting corruption.

Corruption can best be fought indirectly (Casadesús de Mingo and Cerrillo-i-Martínez, 2018). At a time, accounting forums employ blocking loopholes that breeds corruption as an indirect measure because the porousness of a system could

trigger corrupt tendencies of certain public officeholders. According to the World Bank Group (2000), effective records management practices are essential in blocking loopholes in the system. In line with the Council of Australasian Archives and Records Authorities' position in CAARA Policy 04 – Corporate Memory in the Electronic Age (2010), well-managed records and information provide a cost-effective deterrent to fraud and corruption. However, when corruption occurs, authentic and reliable records can serve as evidence to identify abuse, misuse and non-compliance with financial institutions and other laws and regulations (Palmer, 2000a). Fighting corruption in all government sectors depends on proper records management (Okello-Obura, 2013).

Records as carriers of valid information must remain trustworthy to serve both primary and secondary creation purposes. Maintaining the integrity of records ensures that they remain secure, intact, accessible, and intelligible throughout their life span (Cox, 2001;Shepherd and Yeo, 2003). Such are the kinds of records that safeguard against all forms of corruption and corrupt practices. Since corruption provides the enabling environment for fraud, it almost always involves tampering with or falsifying records (Okello-Obura, 2013).

The nexus between proper record keeping and corruption continually proves that fighting corruption might not be possible without accurate and complete records that serve as evidence of transactions (Adu, 2020;Cox and Wallace, 2002;McKemmish and Upward and, 1993; Sharman, 1993). Record is a crucial indispensable tool used by accountability forums as evidence of any wrongdoing (McKemmish et al., 2005). They gather information from various sources to reconstruct what transpired for analysis and appropriate sanctions (Meijer, 2000). Even though Hurley (2005) portrays that no amount of articulating or theorising about recordkeeping principles will ensure responsible behavior, Meijer (2000) asserts that an agency can adhere to improved recordkeeping practices in anticipating accountability processes preparatory to such exercises, which shows some form of influence in behavior towards better records management as required by the forums. Looking into the experiences of special accountability forums that specifically target corruption and corrupt practices, such as anti-corruption agencies, regarding the role of records in their work will provide insights into their activities to better position records and records management.

Scholars in records management have touted the importance of records and the need for their proper management to support the global fight against corruption. Their position portrays a barrier to meaningful progress without using valid evidence to prove any wrongdoing. Records and its management, without a doubt, produce the most widely acceptable accountability tool used by accountability forums in the discharge of their duties. Nevertheless, this is the first empirical research investigating those who do the actual work, viewing records and records management from the point of view of anti-corruption investigators.

## Methodology

The study centres on the question; what is the perception of anti-corruption investigators on the role of records in their work? It is an explorative-qualitative case study. The research question in focus requires an extensive and "in-depth" description of some social phenomenon. According to Taylor et al. (2015), a case study seeks to preserve the wholeness and integrity of the case. However, a well-defined research problem must be established geared to a specific feature to achieve some focus (Silverman, 2010). This approach is most suitable when investigating cases because it will enable the researcher to describe the elements and impacts of the phenomenon under investigation (Creswell, 2018;Taylor et al., 2015;Yin, 2009).

Africa's largest economy and the most populous country Nigeria has corruption as a single pervasive threat to achieving its potential (Osoba, 1996;Page, 2018). The enormous amount of corruption-related cases in the country and the centrality of corruption as a topic of national and international discourse make it a suitable target for this study. The case in this study is records and records management, where anti-corruption investigations help understand their role in investigation work. The case study organisation was Nigeria's Independent Corrupt Practices and other related offences Commission (ICPC). The ICPC being Nigeria's first anti-corruption agency (established in 1999), has broad experience in fighting corruption at the grassroots,

putting them in the best position to provide the needed research information. The high level of reliance of the operations department of the ICPC on recorded evidence for investigation necessitated their choice. Aside from their core mandates of fighting financial crimes and corrupt practices in government Ministries, Departments and Agencies (MDAs), the ICPC also examines public bodies' practices, systems, and procedures and where such systems aid corruption to direct corruption and supervise their review. Moreover, they are duty-bound to enhance transparency and accountability for good governance in the country.

Investigating the role of records by a unique accountability forum that relies heavily on records as a source of information makes the records lifecycle concept with segmented phases best suited for system vulnerability testing during an investigation. The four stages of the records lifecycle concept, including creation, distribution, maintenance and use, and appraisal and disposition, bring the critical constructs in alignment with this research field's variables(Shepherd and Yeo, 2003). It has the power to simplify diagnosis/troubleshoot and understand records management-related leakages and point to the exact trail that requires urgent attention for prompt guided treatment. The record lifecycle remains one of the valuable and helpful ways to look at records management and interpret it to professionals in other disciplines (Hoke, 2011). The record life cycle model forms the basis for formulating the research questions and the interview guide for the study.

The research data were gathered in 2020 using a semi-structured interview guide through recorded interviews. The interview questions were open-ended and designed to elicit responses that unveil the anti-corruption investigators' perception of the importance of records and records management in their work. Questions such as, what was it like interfacing with a poorly managed record system if experienced, further probed by how it affects their work, were raised, backed by other general questions accordingly. The themes of this study analysis were derived from the records lifecycle model that foregrounds the purposeful creation of records and their maintenance for appropriate use.

Investigation-related units were formally informed about the research data collection by the Director of Operations (DG OPS). The snowball sampling technique was used to draw the fifteen research participants from the six units of the Operations Department of the ICPC. The snowballing got kick-started with the first Principal Investigator introduced by the DG OPS as a possible interviewee. Saturation was observed on the 15th (interview) (Baker et al., 2012). The sole responsibility of the research participants lies in investigating corruption cases using mainly recorded evidence. Their reliance on records as the exclusive accountability tool during an investigation and in the prosecution process makes them the best source of information for this research the participants for the research range from senior, mid-level, and junior Investigation Officers. Overall, two to three staff participated from each investigation unit. Though the staff perform different tasks in their respective teams, they are united in using records to discharge their assigned duties.

Owing to the sensitive nature of the subject and other privacy concerns that ensure best practice, the researcher had to make a series of detailed explanations of the aims and objectives of the study to secure permission for data collection. Centralised investigations warrant conducting interviews at the commission headquarters in individual participants' respective offices. It took between thirty minutes to an hour, depending on the varying length of individual responses to questions asked. No interviewee has exhibited any restraint to questions asked aside from minor interruptions from visitors and colleagues during the interview.

Interview data were transcribed, theme coded and analysed using thematic analysis. The interview guide results from the research question determined from the identified research gap. It points to the question that is categorically meant to elicit responses that correspond to the theme of the importance, value, advantages and place of records and records management being examined. The initial codes of the study data emerged from patterns and meanings derived from the interview. The analysis was done by comparing similarities and differences in the interviewees' responses. Other emerging themes include the role of investigators in records management, prospects of records management and transparency in recordkeeping practice.

## Findings

The findings of this study focussed on the central theme of the perception of anti-corruption investigators on the significance of records and records management in their work. The process of an anti-corruption investigation starts with building a case file. The anti-corruption investigators use accurate and complete records to reconstruct transactions to reduce uncertainties. An anti-corruption investigation is a thorough and careful unveiling process of interpreting evidence to prove any wrongdoing. The use of records is central to any meaningful investigation analysis. When asked about how records feature in their work, an experienced Principal Investigator in the commission gave the following typical representative response.

> "You know, of course, right from the time you get petitions, when we investigate petitions, allegations of malfeasance, and so on and so forth, right from the very moment you get petitions, they come in document form. Now it means that from the get-go, you need to begin to keep that record intact, and there is what we call building of the case file. If you do not keep your records properly, you cannot use case files, and if you have failed to build your case file, you will find it difficult to marshal your evidence towards prosecuting cases in court. So, from the beginning, we must keep these documents, but they… like I said earlier, they are physical (manual) documents that we have to keep on our own. We have files, case files and administrative files, and for cases that we are investigating, they are in case files; for administrative matters, they are in admin files. But the onus is on us as investigators, as supervisors to ensure that the records are kept, but how you keep them is down to you, down to you in the sense that if it is secured, it is your duty; if it is not, it is your responsibility." **(Interviewee I)**

As far as anti-corruption investigation work is concerned, nothing else matters more than records and records management. The two are considered inseparable as the availability of complete, accurate and reliable records is determined by proper records management. It determines what makes or mars the entire process of anti-corruption investigation from start to finish. The records used in anti-corruption investigations now are mainly manual. They are carefully managed by individual investigators or teams assigned to a case. This explanation shows that the primary role of investigators, aside from the investigation, is responsible for managing investigation records in their custody. They do so with little or no professional guidance on records management's professional principles and practices as lamented thus.

> "If you are robbed, if you are bugled, and everything… sensitive information might be at the disposal of whoever stole it." **(Interviewee II)**

In the same vein, another participant reiterated the use of records by anti-corruption investigators accordingly. He puts it differently, emphasising the value of records and the importance of records management to anti-corruption investigation work.

> "Our job is mainly centered on records. You know the art of investigation is finding out the true position of things, most especially when it becomes a financial investigation. Every financial transaction is done basically on records, and in terms of looking at what happened, where it happens and why it happens, the key issue is that you have to look for records. It could be a cheque; it could be a voucher, it could be an authority that is from one department to another department, from one agency to another agency, from the government itself, even the procurement rules are records, your financial regulations if you are going to implement one… the financial rules are also on record, so a record is very germane to our activities in ICPC." **(Interviewee III)**

For special accountability forums such as the ICPC to function effectively, proper records management must be in place in public and private sectors within their area of coverage. Records management facilitates the creation of an accurate record in the first instance for appropriate use. An accurate and complete record is crucial to the function/existence of such accountability forums. To establish the actual position of things in any anti-corruption investigation, reliable backing evidence is always required.

The role played by records in investigations is undeniably critical. Its evidential value provides the scale necessary for making reliable decisions. Records are irreplaceable accountability tools that aid investigations. A participant lamented on the role of records in anti-corruption investigations as follows:

> "The record plays a very big role in generating evidence that will strengthen the case, either strengthen the case positively when I say positively in the sense that this man has not done anything, then you see the data, and then you know that truly what he is saying is true. If what he is saying is not correct and then you see the data, you know that this guy is lying, he is the one that did this, so you have enough evidence to establish that he either committed the offence, or he has not committed the offence." (**Interviewee IV)**

Record, in this case, is regarded as the single most acceptable tool of evidence to determine a cause. It holds the requisite information necessary for a decision from investigation to prosecution and sentencing as portrayed by this participant:

> "In fact, the bulk of the activities we carry out in investigation is dependent on record without record; it will be difficult for you to arrive at any conclusion, period." **(Interviewee V)**

Anti-corruption watchdogs use records as accountability tools to bring public office holders to account. Records do not prevent corruption from happening without being acted upon by the powers that be. They, however, provide the necessary trace during an investigation. A research participant affirmed the assertion above when asked about the link between proper recordkeeping and the fight against corruption. He said ...

> "For instance, in bureaucratic organisations, proper record keeping is such that you follow the laid down rules and procedures at getting things done, getting work done, and if you keep them, then the chances are that you will. It's more or less of a trace rather than preventing the action. For example, there is a place where over one billion Naira was misappropriated, and there are records, but it was misappropriated; the advantage of the record is that it enables us as investigators to trace and follow the money and see where it ends, but it does not totally eliminate corruption, but it gives us an advantage. The advantage is that you can follow it, you can see what has happened, you can see who has spent what and so, but it is good, it is important to keep records and it will to some little extent." **(Interviewee VI)**

The above-given explanation affirms the nexus between proper recordkeeping and a successful fight against corruption. It clearly shows that for corruption to be reduced, it takes a combined effort of adequate creation and appropriate management of the accountability tool to be used in the battle on the one hand and the watchdogs performing their jobs on the other. Knowing that one will not get away with corruption, in the long run, could deter public office holders from the practice that proper records creation and management provide. Good recordkeeping can instill fear of being busted, thereby preventing those who intend to commit such offences due to inevitable awaiting consequences.

However, despite the immense value placed on records and records management in an anti-corruption investigation, what is paramount is safeguarding their integrity to serve the purpose for which they are created. Therefore, only complete,

accurate and adequately managed records become reliable evidence supporting the fight (against corruption), thus emphasised.

> "My brother, record management could be very beautiful and records well-managed, but if those records that are 'well-managed' are created artificially or fictitiously, will it aid in fighting corruption? The answer is no. You can see a well-arranged and well-managed record system, but the document there are cooked. We used to hear about the cooked financial statement that impacted negatively on the investing public during the period of the shares awarded, and they roll out a financial payment that is fictitious and cooked and people buying in because that's what they saw." **(Interviewee VII)**

The significance of records in an anti-corruption investigation depends on the integrity of its content. Records and their management tend to lose every bit of their usefulness once altered, doctored, lost, or unlawfully destroyed. It implies that those responsible for records and records management must do so for maximum productivity. It also shows the need for continued capacity building and professional ethics to yield the right workforce if the desired accountability tool is to be produced and managed for the ease of use by accountability forums.

## Discussion

To categorically address anti-corruption investigators' perception of the role of records in their work, the findings of this study build on existing evidence on the nexus between records management and corruption, affirming the role of records and records management as crucial. The data suggests that the success of any fight against corruption and other related offences is undoubtedly dependent on the creation of adequate records and proper records management. The bulk of the anti-corruption investigation work center on access to accurate and complete records. These findings match various scholarly standpoints that acknowledge using records by accountability forums as a reliable source of credible evidence. (Casadesús de Mingo and Cerrillo-i-Martínez, 2018;McKemmish and Upward, 1993;Meijer, 2000;World Bank Group, 2000).

The study views the record as primarily an accountability tool that simplifies bringing public servants to account. The data clarifies that records do not prevent corruption without being acted upon by anti-corruption watchdogs. Instead, they aid anti-corruption work by providing the desired information that serves as deterrents to such practices. They make corruption and corrupt practices difficult to perpetrate since they hardly occur without falsifying existing evidence. They offer accountability forums the advantage of a trace during an investigation and serve as evidence in court during prosecution. The study confirms the said perspectives as shared with (Adu, 2020; Hurley, 2005; Okello-Obura, 2013;Palmer, 2000b;Rodreck, 2017).

Safeguarding the integrity of records is a prerequisite that must be met at every stage of the record life cycle. Since the record tends to lose its validity once altered, doctored, lost, poorly managed, or unlawfully destroyed, the workforce's capacity must be determined alongside professional ethics to ensure its safety. Maintaining the integrity of records in its management is paramount to functioning effectively. Records in whatever form must be complete and accurate to become a reliable organisational asset that provides the much-needed evidential backing when the need arises. This position aligns with the various professional definitions of records and their requirements to become a helpful resource. (Shepherd, 2006;Shepherd and Yeo, 2003).

Nevertheless, the above discussion denotes that proper records management products are invaluable anti-corruption investigation tools if the fight against corruption must succeed. Therefore, it is essential to safeguard their integrity to maintain their validity. It is paramount to ensure that those charged with records management responsibility are trustworthy; otherwise, their actions or inactions will jeopardise the entire effort of producing the desired accountability tool that determines their success. It is evident that falsifications of records hardly occur without public officials' complicity (Jain, 2001).

It is beyond the scope of this study to cover electronic records because the research case is mainly dependent on manual records. The sampled

participants do not cover all the staff that generates, keeps, uses, and manages records in the ICPC. Only those directly involved with investigations and dealing with investigation-related evidence participated in the research.

## Conclusion

The place of records and their management in the global fight against corruption is irreplaceable since the job lifelines of accountability forums rely heavily on reliable recorded evidence. Records management produces the much-needed accountability tool for anti-corruption investigations. When acted upon by anti-corruption watchdogs, accurate and complete records deter corrupt practices. This study presents a records management approach to fighting corruption and other related offences. Further research should examine the processes and social structures necessary to use records in the anti-corruption fight.

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**Aliyu Abubakar Lawan** is currently a doctoral candidate in Information Studies and Interactive Media at the Faculty of Information Technology and Communication Sciences, Tampere University, Finland. He holds a Bachelor of Library and Information Science degree and a Master of Records and Archives Management. He is a lecturer at the Department of Library and Information Science, Ahmadu Bello University, Zaria, Nigeria.

**Pekka Henttonen** is an Associate Professor at the Faculty of Information Technology and Communication Sciences of Tampere University, Finland, and an Adjunct Professor at the University of Jyväskylä, Faculty of Humanities. He holds DsocSci, MHist.

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# Internal Processes as Determinants of Customer Perceived Service Quality: A Case of Selected Public Libraries in Botswana

**Bogale Keorapetse Ditebo**
*Department of Library Studies*
*Tonota College of Education*
*Botswana*
*Bogzditebo@gamil.com*

and

**Olugbade Oladokun**
*Department of Library and Information Studies*
*University of Botswana*
*Gaborone, Botswana*
*Oladokun@ub.ac.bw*

## Abstract

*There is increasing awareness that attaining the ideals of the United Nations 2030 Agenda for Sustainable Development Goals (SDGs) requires effective support of government. Public libraries that are well-supported and well-managed provide quality information services and have a role to play in contributing to improved outcomes of the SDGs. Public Libraries under the aegis of Botswana National Library Service (BNLS) could not be said to lack good support of Government. They ought therefore to be seen to be working towards attaining the envisioned sustainable development by providing quality information service adopting measures to attract users' positive word-of-mouth, loyalty and re-patronage behaviours. The purpose of this study was to investigate the extent to which BNLS provides quality information services from users' perspective, and to establish those internal factors that influence such users' experiences. Anchored on the Gap Theory, the study used mixed method approach to collect data from two sets of respondents. A stratified random sampling technique identified 254 registered users, from whom quantitative data were collected through a modified self-completion SERVQUAL instrument. Qualitative data were collected from 18 frontline employees (FLEs) through face-to-face interviews and document analysis, so as to account for users' perceptions in the quantitative phase. The findings revealed that the quality of service at the BNLS branches is appreciably low on the dimensions users consider important. An average quality gap of -1.2 was realised, indicating that the quality of service delivered fell short of what customers expected. Qualitative data further revealed four factors in the service environment that contribute significantly to customers' low perception of the quality of service. The study concludes by recommending a realignment of internal processes to ensure good quality service to patrons, and in the process enhance the libraries' ability to help Botswana attain sustainable development goals.*

**Keywords:** *Public Libraries, Sustainable Development, Service-Provider Gaps, Gaps Model of Service* Quality, SERVQUAL.

## Introduction

There is increasing awareness that attaining the ideals of the United Nations 2030 Agenda for Sustainable Development Goals (SDGs) requires effective government support and prudent resource management. The SDGs, a United Nations framework of 17 Goals spanning economic, environmental and social development (Bradley, 2016), require members to pursue these goals actively to better their people's lives. Within this unfolding

global sustainable development context, libraries are essential partners as they ensure access to information across the SDGs. The International Federation of Library Associations and Institutions (IFLA)contends that libraries are integral to achieving this roadmap, in the march towards a knowledge-based society (IFLA, 2017; 2018). Public libraries that are well-supported and well-managed are likely to contribute to improved SDGs outcomes; they provide quality information services to their patrons, facilitate access to information and help people to develop the capacity to use information in decision-making, and ensure sustainable access for future generations (Bradley, 2016). Libraries aid individuals in achieving success in their education by providing the resources and an enabling environment that fosters intellectual, emotional and social development (Bamigboye, 2007).Libraries are centres for innovation and information, and cultural stewards, playing a vital role in linking society with information which may help break the cycle of poverty and support sustainable development (IFLA, 2018).

Public libraries in Botswana provide information and knowledge free of charge in its 33 branches located across the country. Since they strive to meet the knowledge and information needs of their customers, it is appropriate for the libraries to spearhead Botswana's efforts towards attaining sustainable development. To do this, they must adopt measures that help to attract external users' positive word-of-mouth and patronage behaviours. One such measure is providing service at quality levels acceptable to customers. Providing quality services has numerous payback effects: it sustains a user's confidence, attracts more new customers and few lost ones (Parasuraman, Berry and Zeithmal, 1994). Quality superiority has been found to provide significant performance-related advantages such as customer loyalty, responsiveness to demands and productivity (Petrou et al., 2006). It is therefore important that libraries incorporate high standards of customer service (Miao and Bassham, 2007).Managers who want to attract customers' positive evaluation of their services must be prepared to do a good job with their internal 'prior-to-service' processes. It involves identifying, managing and constantly assessing those internal elements that influence evaluations of the quality of the services delivered (Schneider and Barbera, 2011; Hossain and Islam, 2012). Such assessments may enable the Botswana National Library Service (BNLS) to deliver positive library and information experiences. Studies suggest that libraries aim to provide superior quality service to the customers so as to attract their loyalty and patronage, but they often fail to fully recognise the connection between customer experiences and the internal functioning of such libraries in a library-service quality implementation framework. Despite the visible presence of public libraries in Botswana dating from 1968 to date, there is a dearth of scholarship, assessing the interconnection between the effect of the internal environment quality on customer perceptions of the quality of library services and internal processes and practices. This study evaluated the overall service quality conditions of three selected public libraries located in Gaborone, Lobatse and Ramotswa using the Gaps Theory.

**Statement of the Problem**

The United Nations 2030 Agenda for Sustainable Development Goals, is a framework of 17 goals spanning economic, environmental and social development. These goals, challenge member states to focus their energy on poverty eradication, climate change and human resource development. In this context for global sustainable development, libraries are considered key partners and active contributors towards meeting this grand challenge as they provide access to information services which may impact social development. Service is a concept that is fundamental to libraries, and library users are the focal point of that service (Miao and Bassham, 2007). The processes and practices behind the scenes as well as employees' activities on the frontline, connect the library to its customers. This makes customer's perceptions of service quality important to its overall service strategy (Musaba, Musaba and Hoabeb, 2014). Thus, the quality of these processes, intended to attract customers' positive word-of-mouth, must therefore be constantly monitored, and measured. Customer perceptions of service quality and the internal functioning of the library are intimately tied to each other. Extant literature shows that customer perceptions of the quality of service rendered is as a function of the quality of the internal processes.

However, this interconnectedness between the two has not been properly researched in the context of public libraries in Botswana. The authors therefore set out this study to address this identified void in the literature using the Gaps Model of Service Quality, proposed by Parasuraman, Berry and Zeithmal (1985).

### Objectives of the Study

The central focus of this study was to assess the extent to which the internal environment practices in selected public libraries in Botswana influence the quality of service delivered to their customers. The study aimed to:

a) Assess library users' prior-to-service expectations against their post-service perceptions, through the use of an adapted SERVQUAL instrument;

b) Establish the gaps in the internal functioning of the libraries that might account for users' service experiences;

c) Propose suggestions to the BNLS on service quality management that may help libraries drive towards attaining the United Nations 2030 Agenda for Sustainable Development.

## Literature Review

A universal definition of 'service' is still hard to find (Coetzee et al., 2013). Kotler (2008) defined it as a performance provided by one party to the other which fundamentally is not materialised and does not result in ownership over things. Shahin and Janatyan (2011) perceived it as a series of activities of a less intangible nature, taking place in interactions between customers and employees. Parasuraman, Berry and Zeithmal (1990) also defined it as a product of an interactive process aimed at meeting or exceeding a customer's expectations on a consistent basis.

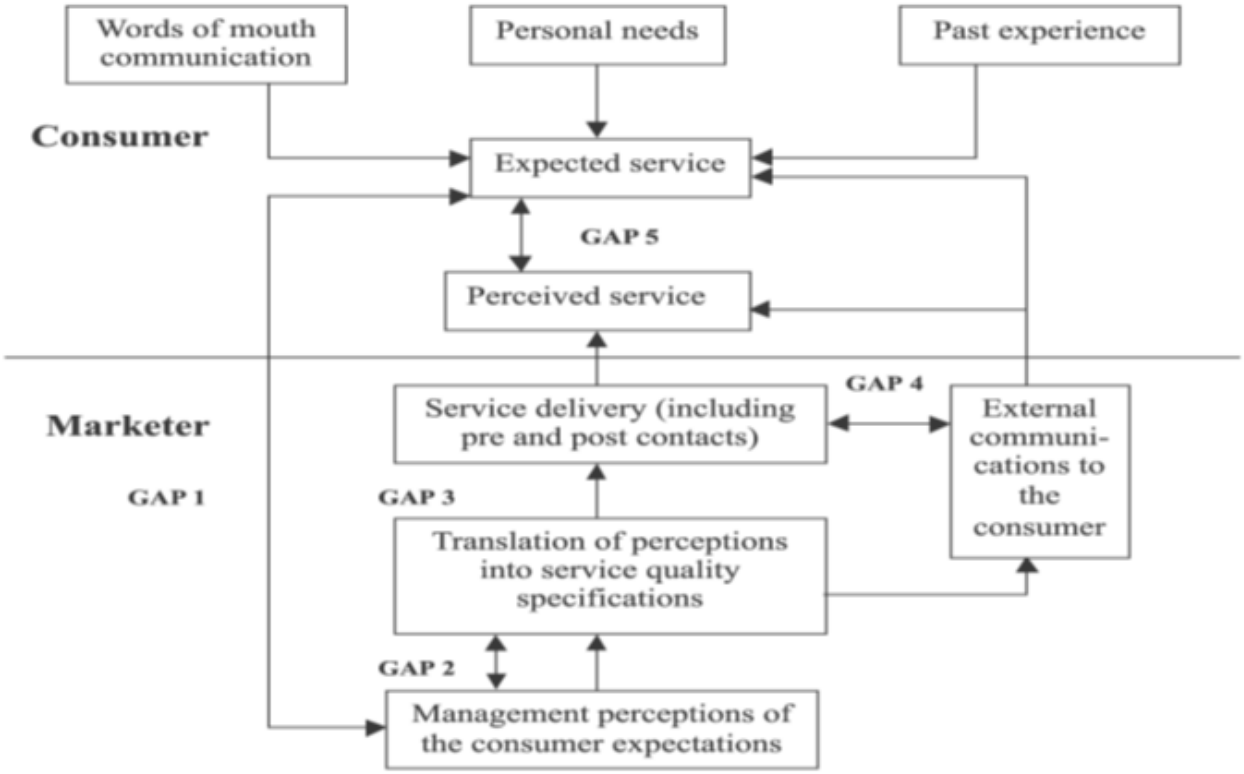
In order to differentiate services from goods, certain characteristics are employed, which are equally applicable in the library contexts. For instance, services are ***intangible;*** they are performances and cannot be distinguished by the same senses like goods can (Ladhari, 2009; Zeithaml et al., 2013). They cannot be seen, touched, held, stored (Schneider and White, 2004) or counted, measured, tested, verified and inventoried in advance of sale (Siddiqi, 2011). Secondly, their production and consumption are ***inseparable*** during delivery (Ladhari, 2009; Zeithaml et al., 2013): customers are often in the factory, observing and evaluating the production process (Schneider and White, 2004.So also, services are generally ***heterogeneous.*** The performance of services often varies from one provider to another, from one customer to another, and from one day to the other (Schneider and White, 2004) and can rarely be standardised to ensure uniformity and consistency (Gheysari et al., 2013). These characteristics are applicable in any people-intensive environment, and a library is no exception.

Conversely, Quality is a perplexing concept to define or to measure (Sallis, 2005; Shahin, 2010). Leaders of thought suggested three approaches to defining quality; the *philosophical* approach holds that quality is synonymous with innate excellence (achieving superiority and desirability) and can't be defined any further; the *technical approach* contends that quality is the extent to which a product conforms to predefined technical standards (Kasper et al., 1999), and can be measured in terms of the number of deviations from pre-set standards, or of the defects observed. The *user-based* approach, however, takes the view that quality is subjective and hinges on the perceptions of an individual customer. Given that one defining characteristic of services is heterogeneity across people and time, an approach that reflects this variability is essential in defining service quality (Schneider and White, 2004). Quality defined in terms of user perceptions is thus attractive to assess quality of library services.

On the basis of the attributes aforementioned, service quality is consequently defined as a global judgement or attitude related to the superiority of a service (Parasuraman, Berry and Zeithmal, 1985, 1988, 1990); the difference between customer expectations of service and perceived service (Shahin and Samea, 2010; Lewis and Mitchell, 1990), or the outcome of an evaluation process, whereby the consumer compares his expectations with the service performance(Gronroos, 1984; Patterson, 1993).

## Theoretical Framework: The Gaps Model of Service Quality

The framework that guided this study is the Gaps Model of Service Quality (GMSQ). This framework simultaneously incorporates internal organisational functioning and the external customer. This theory proposes that positive customer outcomes are achieved through viewing the internal world of a library as not separate or distinct from the external world it serves and that these worlds are conceptually and empirically linked. It further posits that service quality is a function of the discrepancy between a library user's *expectations* and *perceptions*, a situation caused by a series of internal organisational behaviour factors (Parasuraman, Berry and Zeithmal, 1990). The framework also postulates that by paying attention to the proper functioning of internal elements in the service system (Hallowell et al., 1996), customer perceptions of quality can be influenced. Designed to pinpoint the outcome of a customer-service provider interaction and the role of the internal conditions in service delivery, the model proposes that if a library values quality, first it establishes the proper set of internal foundation conditions, whereupon, an environment likely to yield positive customer experiences then emerges (Schneider and White, 2004). The Gaps model is shown in Figure 1:




**Source:** Parasuraman *et al*. (1985)

**Figure 1: The Gaps Model of Service Quality**

The most important gap is Gap 5 (*Customer Gap*/ Service Quality Gap), defined as library users' subjective evaluation of the comparison between their expectations(what should happen) and their perceptions (experiences) of the service delivered (Shahin, 2010; Shahin and Samea, 2010). PZB (1990) suggested that the library's ultimate goal is to close this gap by meeting or exceeding customers' expectations. To close *Gap 5*, the four internal gaps (*service provider gaps)* there is need to attend to those internal issues prevailing in the library's internal environment (Parasuraman, Berry and Zeithaml, 1990; Zeithaml et al, 2013). Each gap, representing a potential cause of quality shortfall is discussed later.

## Measuring the Customer Gap: The SERVQUAL Methodology

Following extensive research based on a set of focus group interviews of consumers and in-depth interviews with executives in four nationally-recognised service firms, Parasuraman, Berry and Zeithaml (1985; 1988; 1990) noted that customers use five dimensions to evaluate the overall quality of the service they have received. Their findings revealed that the *Customer Gap* (Gap 5) is a function of the discrepancy between customer expectations and their perceptions along a set of five criteria namely:

*Tangibles:* Appearance of the library's physical facilities, physical appearance of employees, equipment and communication materials – service physically

*Reliability:* Delivering the promised service dependably and reliably.

*Responsiveness*: Willingness of employees to provide prompt service and help customers.

*Assurance:* The ability of the employees to inspire trust and confidence through their knowledge of the product and courteous behaviour.

*Empathy:* Personalised attention given to individual library users.

On the basis of their findings from the focus group interviews, Parasuraman, Zeithmal and Berry (1985, 1988) developed SERVQUAL, a psychometric instrument that operationalises, across the five aforementioned dimensions, service quality as a function of the difference between *Expectations* and *Perceptions.*

Despite facing intense criticism by researchers and practitioners, SERVQUAL has enjoyed wide research application in a consortium of industries, including retailing (Phiri and Mcwabe, 2013; Al-Alak and El-refae, 2012), banking (Meybodi, 2012; Rahaman et al., 2011), healthcare services (Ramez, 2012),and in libraries (Somaratna and Peiris, 2011; Zakaria et. al., 2010; Hossain and Islam, 2012).

## The Role of Internal Processes and Practices in the Quality of Service Delivery

Literature in service marketing contends that the quality of a service experienced by the external customer is inseparable from the internal functioning of a given library (Schneider and White, 2004; Yagil, 2008). Studies supporting the link between internal functioning and the level of customer perceived quality posit that to deliver excellent quality service, a library must first pay attention to the effectiveness of the internal elements that produce it (Schneider and White, 2004;El-Samen and Al-Shurideh, 2012). Inevitably, what happens inside a library in terms of employee support through tools, policies and procedures and resources to deliver service, has been shown to relate to the quality of the service experienced by customers (Schneider and White, 2004; El-Samen and Al-Shurideh, 2012). From extensive research, PZB (1985, 1987; 1990) determined that certain internal issues were impediments to delivery of service, calling these gaps, according to their Gap Theory. These internal gaps are explained as follows:

Gap 1: The *knowledge gap is* the difference between consumers' expectations and management's perceptions of those expectations, i.e. management assume they know what consumers want. This gap is widened by management's failure to set out on information-gathering initiatives.

Gap 2: The *service specifications gap is* the difference between management's perceptions of consumer expectations and service quality specifications, i.e. setting standards and specifications that do not address customer requirements, i.e. lack of customer-driven standards.

Gap 3: *The service delivery gap is* the difference between available, established service quality specifications and service actually delivered, i.e. the service performance gap, resulting from employee uncertainty about what

supervisors expect from them; mismatch between employees skills and their jobs; inadequacy of tools and technology; inappropriate evaluation and reward systems; and lack of teamwork.

Gap 4: The *communications gap is* the difference between service delivery and communications to consumers about service delivery, i.e. when promises made during advertising do not match delivery. Promises may be done through the appearance of the aesthetics of the buildings or through verbal accounts during publicity campaigns.

The situations represented by the four gaps account for the variations that service delivery experienced by library users during service interactions To close the service quality gap (external customer gap, or Gap 5), human, financial and other resources must be mobilised and appropriately managed to deal with issues pertaining to the four internal gaps first. Further, being a people-intensive undertaking, a library must embrace customer-centric organisational cultures if they are to successfully market their services (Parasuraman, 1987). Such value systems may include a unified focus on customer satisfaction, willingness to be flexible, respect for employees and developing and nurturing a customer-oriented culture.

## Methodology

This study assessed the overall level of library service quality within the Botswana National Library Service (BNLS) branches of Gaborone (city), Lobatse (town) and Ramotswa (major village), and investigated issues responsible for quality shortfalls that may be noted in the system. Informed by the Gaps Model, this study used a mixed method approach to collect data in two phases. In Phase 1, a stratified random sampling technique helped to identify registered library users, from whom quantitative data were collected. The survey instrument was a modified self-completion SERVQUAL instrument, comprising 22 service statements *'Expectations'* and *'Perceptions* 'on a 6-point Likert scale. Results generated in this phase, were carried over to Phase 2 where a census approach was used to collect qualitative data from30 targeted frontline employees (FLEs)working in the three branch libraries. These comprised officers of various designations: senior librarians, principal library officers, library assistants, library attendants and officers on Government Internship programme.

The study used a survey approach to collect data from two sets of respondents. First, a stratified random sampling technique was used, with the help of service employees, 455 registered users were identified from whom quantitative data were collected, using a customised self-completion SERVQUAL instrument. Internal consistency of the SERVQUAL items was determined by computation of Cronbach's Alpha Coefficient at 0.924 for Expectations items and 0.908 for Perceptions items, indicating good reliability of the questionnaire Two hundred and fifty-four (254) respondents returned the questionnaire.

**Table 1: Calculation of Cronbach's Alpha coefficient by dimension**

| Variable | No. of study cases | Items per variable | Cronbach's Alpha | |
|---|---|---|---|---|
| | | | Expectations | Perceptions |
| Tangibles | 254 | 4 | 0.831 | 0.774 |
| Reliability | 254 | 5 | 0.806 | 0.681 |
| Responsiveness | 254 | 4 | 0.735 | 0.837 |
| Assurance | 254 | 4 | 0.721 | 0.728 |
| Empathy | 254 | 5 | 0.793 | 0.757 |
| | | **22** | **0.923** | **0.908** |

**Source: Field data compiled on SPSS**

The aggregate Expectations and Perceptions values are greater than the necessary value of 0.70 proposed by Nunnally and Bernstein (1994) for theory testing. Further, qualitative data were collected from 18 of the targeted 30 FLEs through one-on-one, face-to-face interviews. Observation and document analysis techniques were also used. This phase was necessitated by the need to account for users' perceptions noted earlier. Data gathered from this qualitative phase were subjected to content analysis.

## Findings

The targeted subjects of this investigation comprised 455 registered library customers who responded to the SERVQUAL questionnaire and 30 centre employees interviewed. As shown in Table 2, a return rate of 254 users, representing 55.8% was achieved. Of these, 42.5% (n=108) were female while 57.5% (n=146) were male. The majority of the user community were aged 15-35, representing 84.7% (n=214) while those who aged above 35 years, categorised as elder, accounted for 15.3% (n=40). Of the 30 Centre employees meant to be interviewed, only 18 eventually participated giving a response rate of 60 percent. As shown in Table 2 (Staff), the study subjects included a Senior Librarian, 2 Principal Library Officers, Library Assistants (2), Library Attendants (4), Office Cleaners (3), Gatekeeper (1), Gardner (1) and Internship officers (4). Details are that 2 (11.1%) were male and 16 (88.9%) were female:

**Table 2: Demographics of study respondents**

| | Category | Description | GPL | LPL | RPL | Total | |
|---|---|---|---|---|---|---|---|
| Gender | Library users | Male | 47 | 33 | 28 | 108 (42.5%) | **254** |
| | | Female | 66 | 48 | 32 | 146 (57.5%) | |
| | Staff | Male | 0 | 2 | 0 | 2 (11.1%) | **18** |
| | | Female | 6 | 4 | 6 | 16 (88.9%) | |
| Age (years) | Library users | 15-35 | 85 | 76 | 53 | 214 (84.7%) | **254** |
| | | 36+ | 28 | 5 | 7 | 40 (15.7%) | |
| | Staff | 20-25 | 1 | | 1 | 2 (11.1%) | **18** |
| | | 26-30 | 0 | 3 | 0 | 3 (16.6%) | |
| | | 31-35 | 0 | 1 | 0 | 1 (5.5%) | |
| | | 36+ | 5 | 2 | 5 | 12 (67.7%) | |

Table 3 shows the qualifications of employees tasked with dispensing service at the three branch libraries. Of the 18 employees who were interviewed, 6 (33.3%) had qualification in librarianship comprising 1 (5.6%) professional librarian and 4 (27.7%) paraprofessionals, while the majority (n=12), accounting for 66.7% did not possess any form of training in librarianship.

**Table 3: BNLS Employees' job qualifications**

| | Qualification | GPL | LPL | RPL | TOTAL | % |
|---|---|---|---|---|---|---|
| | Master's/PhD | 0 | 0 | 0 | 0 | **0.0** |
| | Bachelor's Degree | 1 | 0 | 0 | 1 | **5.6** |
| | Diploma | 0 | 1 | 1 | 2 | **11.1** |
| Librarianship | Certificate | 1 | 1 | 1 | 3 | **16.7** |
| | | | | | **6** | **33.3** |
| | Diploma | 1 | 3 | 0 | 4 | **22.2** |
| | Certificate | 0 | 0 | 0 | 0 | **0.0** |
| | BGCSE | 1 | 0 | 1 | 2 | **11.1** |
| Non-library | JCE | 2 | 1 | 1 | 4 | **22.2** |
| qualification | PSLE | 0 | 0 | 2 | 2 | **11.1** |
| | | | | | **12** | **66.7** |

It is also noted that the majority of users134 (52.8%) were those who visited the library twice or more in a week, followed by 62 (24.4%) who visited more than once per month. Table 4 below shows the patterns of the use of the library by the surveyed customers:

**Table 4: Use of the public library**

| | Description | GPL | LPL | RPL | Total | % | % cumulative |
|---|---|---|---|---|---|---|---|
| Frequency of use | Once per week | 8 | 15 | 11 | 34 | 13.4 | 13.4 |
| | Twice or more per week | 66 | 40 | 28 | 134 | 52.8 | 66.2 |
| | Once per month | 14 | 8 | 2 | 24 | 9.4 | 75.6 |
| | More than once per month | 25 | 18 | 19 | 62 | 24.4 | 100.0 |
| Length of use | 1 – 3 months | 14 | 9 | 0 | 23 | 9.1 | 9.1 |
| | More than 3 months – 1 year | 25 | 17 | 13 | 55 | 21.7 | 30.8 |
| | More than 1 year – 3 years | 29 | 22 | 14 | 65 | 25.6 | 56.3 |
| | More than 3 years - 6 years | 30 | 10 | 14 | 54 | 21.3 | 77.6 |
| | More than 6 years – 10 years | 6 | 9 | 5 | 20 | 7.9 | 85.5 |
| | More than 10 years | 9 | 14 | 14 | 37 | 14.6 | 100.0 |

**Source: Field data (2015)**

## The Quantitative Findings

The first objective of this study was to establish the extent to which branch libraries provide quality service, from their customers' perspective. Assessment of customer experiences across the five identified dimensions (tangibles, reliability, responsiveness, assurance and empathy) considered critical in quality evaluations is shown in Table 5. The aggregate service quality gap score of **-1.2** across the five attributes signals general dissatisfaction with overall quality of service in the libraries under study, as calculated in Table 5:

**Table 5: Library customers' overall service quality scores (P-E) for individual libraries**

| Service Dimension under assessment | Service items assessed | GPL | | | LPL | | | RPL | | | Overall Performance | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | P | P-E | E | P | P-E | E | P | P-E | E | P | P-E |
| Tangibles | **4** | 5.2 | 3.4 | **-1.8** | 5.2 | 3.6 | **-1.6** | 5.5 | 4.3 | **-1.2** | 5.3 | 3.8 | **-1.5** |
| Reliability | **5** | 5.2 | 4.2 | **-1** | 5 | 4.1 | **-0.9** | 5.3 | 4.5 | **-0.8** | 5.2 | 4.3 | **-0.9** |
| Responsiveness | **4** | 5.4 | 4.6 | **-0.8** | 5.3 | 4.2 | **-1.1** | 5.6 | 4.6 | **-1** | 5.4 | 4.5 | **-1.0** |
| Assurance | **4** | 5.5 | 4.6 | **-0.9** | 5.3 | 4.3 | **-1** | 5.5 | 4.6 | **-0.9** | 5.4 | 4.5 | **-0.9** |
| Empathy | **5** | 5.2 | 3.8 | **-1.4** | 5.2 | 3.6 | **-1.6** | 5.4 | 3.9 | **-1.5** | 5.3 | 3.8 | **-1.5** |
| Total | **22** | 5.3 | 4.1 | **-1.2** | 5.2 | 4.0 | **-1.2** | 5.5 | 4.4 | **-1.1** | 5.3 | 4.2 | **-1.2** |

*GPL-Gaborone Public Library; LPL=Lobatse Public Library; RPL=Ramotswa Public Library*

E = Expectations and P = Perceptions Source: Field data

For the *tangible features* of service, the findings revealed an overall service quality Gap Score of **-1.5** derived from assessing the four service items making up the *Tangibles* dimension. Customers' expectations with regards this dimension were that each public library i) has modern, up-to-date and visually-appealing physical structure; ii) study desks, chairs and periodical shelves are adequate, comfortable and in good condition; iii) the libraries have modern-looking and dependable equipment – computers, printers, photocopiers, scanners, microreaders, and projectors; and, iv) materials associated with the service (newspapers, pamphlets, periodicals) are visually-appealing and in an excellent condition. Findings indicate that respondents had expected the libraries to have modern-looking and visually appealing physical structures. This score means that the physical features of service: specifically, the building as physical evidence of service, the adequacy and condition of desks, shelves and books, newspapers and magazines were below expectations.

Concerning the *Reliability* dimension (the ability to perform as promised, widespread consistently (Phiri and Mcwabe, 2013; Zeithaml et al. 2013), a set of five (5) questions were designed around the understanding that services that are not dependable or reliable, may lead customers to developing switching behaviours. Customer expectations were assessed on five comprising this dimension, including staff of the library insist on error-free records; ii) when employees of the library promise to do something by a certain time, they do it; iii) when a library user has an information-related problem, the staff shows a sincere interest in solving it; iv) the library staff performs the required service right the first time; and, v) staff provides their service at the time they promised to do so. Users gave this dimension an overall quality score of **-0.9**. The negative rating here is indicative of users'

dissatisfaction at the three public libraries, and this may affect their loyalty and patronage intentions.

With regards to the *Responsiveness* dimension, a set of four (4) questions were raised around the understanding that in order to attract positive word-of-mouth, a service needs to be responsive to users' needs. The service items assessed under this dimension were: i) employees of the library always inform users exactly when a service will be available; ii) employees of the library always give prompt service to users; iii) employees are always willing to help users; and, iv) employees of the library are never too busy to help users. Users rated this responsive service negatively. An average SERVQUAL score of **-1.0** was obtained. Users' expectations were still higher than their perceptions of performance. The ability of the libraries to perform as promised, with speed and, consistently (Zeithaml et al. 2013) was below expectation.

Concerning employees' display of knowledge and courtesy during service encounters and their ability to convey trust and confidence(*Assurance*), an average overall gap score for the three libraries was **-0.9,** a situation still signalling quality shortfall. The service attributes under scrutiny included: i) the behaviour of staff always instils trust and confidence; ii) library users always feel save when dealing with library staff; iii) employees of the library are consistently courteous; and, iv) employees of the library always have the knowledge to answer a variety of information related questions. Calculation of these yielded an average score of -0.9.

Also showing quality shortfall was another dimension, normally considered a pivotal quality attribute in library users' assessment of the quality of a service–*Empathy*. This attribute examined the extent of the caring and individualised attention that library employees' should give to customers. An overall gap score of **-1.5** was recorded, showing that ability to provide a caring and individualised attention service atmosphere, where each user is treated as an individual was perceived low. Users' perceptions were low across the three libraries on the service items comprising this dimension, namely: i) staff gives users individual attention; ii) opening hours are convenient to customers; iii) library hires employees who give users specialised attention; iv) employees have the users' interest at heart and, v) staff makes every effort to understand the specific needs of each individual customer. Calculation of these returned an average gap score of -1.5.

So far, this study has quantitatively measured the Customer Gap presenting a set of universally-recognised criteria that underlie customer perceptions of quality. An overall gap score of **-1.2** for the participating library facilities, derived from calculating overall customers' experiences, showed quality shortfalls across the three libraries as shown in Table 5. The -1.2 figure, calculated through the formula: Perceptions ***minus*** Expectations **(P-E)** for each dimension, is the average of the five overall performance scores on the five service dimensions assessed in each of the three libraries. A more simplified version is shown in Table 6:

**Table 6: Calculation of the overall service quality score for the three public libraries**

| Service dimension under assessment | No. of attributes per dimension | GPL | LPL | RPL | Overall Performance |
|---|---|---|---|---|---|
| **Tangibles** | **4** | -1.8 | -1.6 | -1.2 | -1.5 |
| **Reliability** | **5** | -1 | -0.9 | -0.8 | -0.9 |
| **Responsiveness** | **4** | -0.8 | -1.1 | -1 | -1.0 |
| **Assurance** | **4** | -0.9 | -1 | -0.9 | -0.9 |
| **Empathy** | **5** | -1.4 | -1.6 | -1.5 | -1.5 |
| | | | | | **-1.2** |

GPL – Gaborone Public Library; LPL – Lobatse Public Library; RPL – Ramotswa Public Library

**Source: Field data**

To understand the impediments responsible for these quality experiences, the *Gap Theory* further proposes that reasons for the existence of these quality shortfalls be investigated. Consequently, a qualitative phase was undertaken to investigate the internal issues that may be held responsible for identified quality shortfalls.

**Findings from the Qualitative (Interview) Phase**

**The Role of Work Environment Practices in Customers' Evaluations of Service Quality**

The second objective of this study, necessitated by the findings of the previous phase, was to establish the influence of those factors in the internal environment on external customers' perception of service quality. Ten semi-structured questions were developed, informed by the four gaps of the framework to collect qualitative data through in-depth, one-on-one, face-to-face interviews with service personnel deployed at the three centres.

The findings revealed that library management lacked knowledge of customer expectations and their perceptions. The study findings confirmed the existence information-gathering mechanisms, though these were not well-managed. Staff noted the suggestion box as the most prevalent form of dialogue with the user community, though 33.3% (n=6)of staff reported was very unreliable because: usually no specific time frame was set to refresh the boxes; the boxes were empty for long periods; they were positioned in obscure locations. Other forms of purposeful information-gathering were complaint registers and internal surveys, which regrettably had since been terminated. Frontline employees (FLEs) also reported inadequate upward communication, with 61% revealing that they did not meet top management as regularly as could enable exchange of information about customers' experiences, yet they had abundant information about customers, especially as they came into contact with the customers on daily basis. Some 11 (61%) members of staff said they never met their top management at all, while only 4 (16.6%) indicated seeing senior members just once over the two years of their attachment to the library. Lack of information on customer needs could create Gap 1 as espoused by the Gaps Model of Service Quality (GMSQ).When Gap 1(the Knowledge Gap) exists, it will always reflect in the Customer Gap.

The study further established the presence of instances of the *management perceptions of customer expectations-service quality standards gap*. The result revealed that Management was unable to design service performance standards that translate customer experiences into service quality specifications that employees could execute, due to lack of information on the user community. A total of 9 (50%)employees said they were using their Ministry's generic service standards, cascaded from their Permanent Secretary - a process which centres on the system's internal performance objectives rather than those based on user requirements. Employees revealed the inadequate resources to facilitate service delivery: with 2 (11.1%)specifically lamenting the outdated and inadequate book stock, acute shortage of personnel, shortage of transport to undertake outreach services, the use of the manual circulation system and frequent malfunctioning of the item-detecting machine. Researcher observation further revealed that the Lobatse and Gaborone public libraries had poor partitioning, restrooms outside the library buildings, crowded entrances and lack of office space for staff. These scenarios showed inadequate organisational commitment to service quality, an antecedent to Gap 2 of the framework. When Gap 2 (Service Specifications Gap)exists, it will always reflect in customers' experiences.

The study also established a third gap, the *service performance gap*, emanating from a number of human and other resources management. Employees reported they did not have adequate and relevant training as shown on employees' qualifications in Table 3 above. However, staff conceded to being sent to attend some workshops periodically, although they reported that the content of some of the short courses training is sometimes not relevant to their daily duties. During the interviews, 5 (27.8%)staff members stated they did not know of any document spelling out their job descriptions, but were only informed orally what their job entailed; 18 (16.7%) indicated their job descriptions were spelt out in the Balanced Score Card (BSC) document, while 3 (16.7%) said they just knew what was expected of them as public officers – no job descriptions. Members of staff (n=3

– 16.7%) also reported not being appropriately compensated, rewarded or recognised for outstanding customer service performance. Some employees reported the last time they received a once-off monetary incentive was more than a decade ago, but were unable to tie the incentive to any systematic reward for performance because the gesture was extended to everybody in the workplace.

The investigation also revealed the presence of a fourth gap – *the discrepancy between promises and the service delivered*. It was revealed that after raising customers' expectations through external advertising, the service delivered did not match those promises. The findings revealed that 13 (72.2%) members of staff agreed that their libraries did not fulfil what they promised customers, while 6 (33.3%) singled out provision of inadequate computer and Internet as a major source of user dissatisfaction. A further 6 (33.3%) revealed that the computer training programme was not running as smoothly as publicised due to shortage of computers. It was observed that three user-trainees would share a computer during training sessions. When service promised did not match service delivered - Gap 4 results. The presence of this gap is a sure recipe for the customer gap.

## Discussion

This study assessed the extent to which the three selected BNLS branch libraries provide quality experiences to users and establish issues in their internal functioning that might account for users' service experiences.

Assessment of data from the customer instrument revealed that the *tangibles* (desks, shelves, appearance of personnel and electronic equipment) scored lower expectations than perceptions. A score of **-1.7**, signalled that the physical aspects of the service negatively influence customers in their evaluation of quality. Zeithaml et al., (2013) had noted that library managers must understand that users form impressions of the level of service they receive through contact with the physical manifestations of the service. In order to take care of this, Hooper et al., (2013) suggested that these tangibles should not be neglected as they may diminish users' perceptions and evoke feelings of dissatisfaction.

Assessing the *reliability* aspect of service - ability to perform the service as error-free as promised, 'right the first time' and with care and consistently - the participating libraries accrued an overall score of **-0.9**. Customers' expectations for an excellent library service were not met on the attributes investigated. Bitner's (1990) and Cho et al.'s (2004) investigations concluded that customers who are satisfied complain less; those that are dissatisfied become disloyal to the service provider. The authors agreed on the notion that when a library makes mistakes, or does not do what it said it would do, customers lose confidence in its reliability. Regarding employee ***responsiveness***- the willingness and ability of employees to provide prompt service and help customers, the overall service score was **-0.9**. Once again, customers had higher expectations for employees' *responsiveness* towards their needs. This score suggests that the library system needs to enhance employees' interactive skills as espoused by Zeithaml et al. (2013).Hoffman and Bateson (2001) also revealed that employees' responsiveness levels are usually affected by frustration and dissatisfaction with their job. This seemed to have been endorsed by staff, who lamented lack of promotion, training and remuneration. Issues here are therefore responsible for the size of the customer gap.

With respect to the *assurance* aspects of service -employees' knowledge and courteous behaviour when addressing users' information queries, a score of **-1.0** was realised. Zabava (1995) asserts that assurance may influence users' willingness to recommend the service to friends or to display re-visit behaviours. Customers therefore had higher expectations of employees to show knowledge and courteous behaviour. Such would also influence their trust and confidence in the system. It is important that service providers are knowledgeable, technically and interactively if they are to enhance users' perceptions of quality. Training frontline employees (FLEs) in librarianship issues would be essential in promoting a customer service philosophy.

Given that libraries are high-contact environments, staff needs to give users caring and individualised attention. It is from this, that users formulate evaluations of the quality of the service rendered. Accordingly, each library user is a unique

individual, with unique needs and characteristics and expect to be treated as such. This attribute was referred to as *empathy* by the proponents of the Gap Model. The overall score for this dimension was **-1.5.** The negative report in disparity could be attributed to lack of requisite attitude towards service and orientation to serving customers and fellow employees.

The SERVQUAL dimensions scores accumulated to an overall service Customer Gap score of **-1.2** indicating that library users experienced service encounters that are lower than what they expected. The *Customer*

*Gap* as noted in this study may also be an indicator that the public library system in its present state in the Botswana context may need to do more to contribute effectively to the attainment of the United Nations 2030 Agenda for Sustainable Development or to the envisioned knowledge economy. Consequently, key internal issues contributing this to score warrant an investigation which is the second phase of this study. The qualitative study set off to understand the reasons behind the *Customer Gap* confirmed the internal gaps in the service system identified by Parasuramn, Berry and Zeithmal (1990) are impediments to service excellence during the interviews of the personnel deployed in the three information centres.

The first internal gap contributing to Gap 5 was observed to result from lack of management's knowledge of what users expect ofor think about service. Results revealed: lack of comprehensive user research orientation; rather minimal interaction between top management and FLEs at base; and absence of clearly established complaints-handling systems in some libraries, or its monitoring where necessary. A number of authors have observed that lack of information on what the customer thinks about the service is a major guarantor of service quality shortfall (Parasuraman, Berry and Zeithaml, 1990; Zeithaml et al., 2013; Blešiæ et al., 2011). These findings show that libraries are operations-oriented rather than being customer, confirming earlier findings which concluded services are designed around management thinking (Tekle, 2005) and lack of continuous study of the service communities' changing needs as noted by researchers (Ramachandran, 1995; Mwandoloma, 1993; Nkabinde (1988). These issues constitute Gap 1of the Gaps Model.

The second internal factor responsible for quality shortfall in the library service is lack of strategic management of resources, specifically inability to design customer-oriented service specifications, procedures and standards in the workplace to address quality issues. Conspicuously noted was the use of service standards and procedures which were not congruent with customers' expectations, despite employees possessing a wealth of information about users' needs by virtue of being in constant daily contact with them. Other factors observed include lack of frequent contact between employees and supervisors; inadequate resources committed to ensure service excellence; and the services capes whose designs, maintenance and partitioning do not meet the needs of the internal and the external customers. Results revealed that libraries did not translate employee knowledge of customer experiences into service quality specifications that employees understand and can execute. These deficiencies in strategic management of resources will always guarantee Gap 2. As long as this Gap 2 exists, the Customer Gap will be a certainty.

The third major internal factor noted to contribute to quality shortfall at the BNLS is the inability to deliver to the level of the service designs and standards already in place. Three causes of this as reported in the study include employees not inadequately trained to interact with users or handle situations that require expertise; employees inadequately compensated or rewarded for exceptional customer service performance, diminishing their level of morale. These causes seem to confirm the causes identified by Parasuraman, Berry and Zeithaml (1985; 1990) in their pioneer study.The *fourth* major internal factor contributing to quality shortfall is the system's inability to deliver service as promised, after heightening their expectations through publicity. Promises made during kgotla (gathering of the people of a village or community to discuss important issues) meetings, in publicity campaigns or school visits were not met. Staff acknowledged this deficiency. Performance that does not match promises made constitutes Gap 4 of the Gaps Model of Service Quality (GMSQ). Thus far, it maybe

concluded that the four factors described were responsible for theoverall **-1.2** service quality Customer Gap score generated from the customer survey, indicating shortfalls experienced by library customers.

## Conclusion

Excellent customer service enables libraries to grow, to continue to be relevant to their customers and to meet the demands of the UN 2030 Agenda for Sustainable Development. To attain the requirements of the UN 2030 Agenda, libraries need a greater understanding and responsiveness to users' needs. Assessment of library service quality helps in identifying weak and strong areas. This study evaluated library service quality through the Gaps Model of Service Quality and its derivative SERVQUAL instrument. It could be concluded that public libraries are failing to meet their customers' expectations. The results of this study show that customers experience quality shortfalls in the three selected branch libraries of BNLS. There are gaps that need to be closed if these libraries are to meaningfully assist Botswana attain the UN 2030 Agenda for Sustainable development. When customers' expectations exceed their perceptions of library performance, dissatisfaction results and such customers may be lost.The Public Libraries Division of human resources management strategies need to be re-aligned so as to enable internal processes to support and encourage efforts towards delivering quality service.

## Recommendations

For the public libraries in Botswana to effectively respond to the demands of the UN 2030 Agenda for Sustainable Development, and contribute maximally to a knowledge-based economy, the following recommendations emanating from the findings of this study are proposed:

- The Public Libraries Division must employ evidence-based library management approaches, including establishing: a responsive and efficient complaints-handling system; transaction-based user surveys, customer expectations-perceptions studies and critical incident techniques.
- The system must communicate quality through its physical facilities including the building, shelves and study chairs; they must be attractive aesthetically, be spacious, be appropriately-partitioned and be well-furnished.
- The system must manage its human resources prudently by developing its employees through training in technical and interactive skills; creating a service environment in which employees take pride in their work by providing the tools, demanding, encouraging and measuring internal service and rewarding exceptional performance.

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**Bogale Keorapetse Ditebo** is Head of Department of Library Studies at Tonota College of Education, Botswana. He holds MLIS degree of the University of Botswana.

**Olugbade Oladokun** is Associate Professor in the Department of Library and Information Studies, University of Botswana. He holds MLS, University of Ibadan, MIS (Information Science), University of Pretoria and PhD, University of Botswana. He was previously working at the University of Botswana Library as Senior Librarian, and Manager, Learning Commons. Much earlier, he had worked at Ladoke Akintola University of Technology, Ogbomoso and was Senior Librarian and Principal Librarian.

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# Embedded Librarian Services: An Information Marketing StrategyApplied at the Federal University of Technology, Owerri, Nigeria

**Ifeoma Stella Njoku, Scholastica A. J. Chukwu, Felix Mmanuoma Eke, Faustina C. Haco-Obasi and Emeka Ogueri**
*The Library,*
*Federal University of Technology,*
*Owerri,Nigeria*
*somanjoku@gmail.com,*
*nnechika2005@gmail.com,*
*fellymooreone@yahoo.com,*
*chiomaobasi35@gmail.com,*
*emyoge6@gmail.com*

## Abstract

*This study is necessitated by an increasing number of resources available in the virtual environment which is affecting patron's use of library physically to access information. The purpose of the study was to assess the information marketing strategy that an embedded librarian employed at the Federal University of Technology, Owerri (FUTO). Specifically, the study aimed to identify the role of an embedded librarian at the institution; determine the channels through which embedded librarians reach out to the faculties and establish the challenges hindering embedded librarian services. Structured questionnaire was used to collect data from twenty (20) embedded librarians across ten (10) schools in FUTO. Eighteen (18) copies of the questionnaire designed for this study were duly filled and returned. The study applied inferential statistics using t-test to analyse the data obtained from the survey carried out on embedded library / librarians. Findings show social media, consultation, visits and orientation as some of the channels through which information was disseminated. The findings also showed that inadequate time of operation, lack of cooperation, lack of stated time for consultation, insufficient power supply as some of the challenges. The paper concludes that information marketing and advocacy of library services by librarians is a veritable tool required to deliver information to the domain of those who need it and also bring back library users.*

**Keywords:** Embedded Librarian, Library Services, Information Marketing, Information Literacy, Information Awareness

## Introduction

The rapid evolving technologies, online access to information from remote places and the changing information needs of students and faculty members have transformed library services outlook. Thus, librarians are required to meet the millennial patrons demand by moving the library to users via information marketing. Marketing of information services is not an easy task as marketing of tangible goods or products. Jestin and Parameswari (2002) explain that the idea of modern library services must be based on the modern concept of marketing to achieve library users' satisfaction and to nurture a culture of customer service in order to boost the library's image in the eyes of the users which bring about the term embedded librarianship.

Embedded librarian or embedded librarianship can have multiple meanings for variety of reasons. The term has become prominent in the library profession within the past five years. An embedded librarian service is a marketing strategy necessitated by increasing number of resources available in the virtual environment which is affecting patron's use of the library. It represents a process of service

outreach that provides information benefits through a systematic framework that brings library users and customers back to information business threshold (Njoku and Chukwu, 2019). Riccio (2012) defines embedded librarianship as to move librarians out of the traditional library setting, whether physically or virtually, into a new framework for providing library services. It shifts the emphasis from answering research requests in a vacuum to developing a unique understanding of what customers need and delivering proactive results. Embedded librarianship has emerged as a user-centered approach to academic library facilities that necessitates a thorough understanding of students' and staff's educational and research interests. Embedded librarian services in Federal University of Technology, Owerri (FUTO) began in the year 2014 and have since enhanced information delivery services of the library for the benefit of its users. As the library opens from 8am to 6pm every weekday, so are embedded library services available to students, particularly the full-time category. In FUTO, embedded librarians are liaison officers for departmental and faculty libraries for resources organisation, availability and access during National Universities Commission accreditation and professional bodies resource verification exercises. In spite of numerous services rendered by academic libraries in physical and virtual environments, there exists low patronage on the use of information resources. Faculty members and students resort to finding information virtually undermining the importance of the library in teaching, learning and research. Thus, the need for academic libraries and librarians to meet the information seeking need of patrons/ university community outside the library building through marketing varied innovative information approaches to bring back library users or move the library to meet users in their domain. An embedded librarian service is a product of bridging the gap between the declining numbers of patrons and increasing access to scholarly information. The practice is faced with barriers such as lack of shared understanding of embedded services, inconsistent cooperation from faculty and inconsistent library embedded process.Hence, this study aims to succinctly identify the roles of the embedded librarians, the channels used to discharge their services, challenges and prospects for better library services.

## Objectives

The objectives of the study were to:

i. identify the role of an embedded librarian at the Federal University of Technology, Owerri (FUTO)

ii. determine the channels through which embedded librarians reach out to the faculties

iii. establish the challenges hindering embedded librarian services

## Literature Review

Embedded librarians are integrated information experts that offer more direct research assistance to groups of faculty and students than the typical one-shot instruction session, often over the course of an entire semester. While librarians can embed in face-to-face classes, they are increasingly in demand within virtual environments in order to support online classes, hybrid classes, and face-to-face classes that include an online support component.

Embedded librarianship, according to Dewey (2004), is a term that "implies a more systematic integration of one group with another to the degree that the group attempting to integrate is experiencing and studying, as closely as possible, the primary group's everyday life." When compared to acting in tandem with another individual, party, or behaviour, embedding necessitates more direct and purposeful interaction. Embedded librarianship, according to Dewey, is a way for academic librarians to become more active in strategic campus creation and growth, such as through the faculty, senate, strategic planning committees, space/campus design participation, collaboration with faculty study, and so on. Shumaker (2012) defined embedded librarianship as a distinctive innovation that moves librarians out of libraries and creates a new model of library and information work. Embedded librarians are often compared to embedded journalists; librarians are embedded into an academic course and are in the trenches alongside the content faculty and students. Embedded librarians develop working relationships with content faculty and strive to understand students' needs.

According to Agboola, Mamuna, and Aduku (2018), an embedded librarian plays a critical role in promoting library services by attending to users at

their desired location, especially in academic institutions. Abrizah, Inuwa and Afiqah-Izzati (2016) observed that embedded librarians' roles were established, particularly in the sense of service delivery, and all of them were reported to be applicable to academic libraries. Instruction in information literacy, research and other scholarly activities, distance and online learning, and classroom embedding were all listed as ways to ensure good embedding librarianship.

In order to help with information services, the librarian typically meets with lecturers in their offices and students in lecture halls, or on campus. Users' inquiries are made through access to a Facebook community, WhatsApp group, Email, phone number, as well as a seminar programmes.

These channels enable embedded librarians share information and solve problems of students and researchers on various studies, assignments, and projects. According to Wayne (2017), the embedded librarian tailors their information to users using the above methods, which requires reliable Internet access and a consistent power supply. Matthew and Schroeder (2006) describe several ways that a librarian can provide assistance within the classroom. One common way is to create an "Ask a Librarian" discussion board. This virtual space gives the students a single space in which they can ask research-related questions. In addition, the librarian can use the discussion board to provide instruction by addressing some of the issues students may encounter in their research. The increasingly important role of information has resulted in varieties of services rendered by the library in order to meet the ever-changing need of users.

Time factor is one of the major challenges affecting embedded library services, according to Thomas (2013) and Ralph (2012). For Thomas (2013), some lecturers complained that they did not have time to communicate with embedded librarians (EL), while Ralph (2012) observed that ELs took too long to respond to questions that came at an inconvenient time. At Lupane State University in Zimbabwe, Ndlovu (2017) claims that embedded librarians are suspected by faculty of interfering with their academic activities as academics. Agboola; Mamuna and Aduku, (2018). On the other hand, saw insufficient and qualified staff as likely challenges for embedded librarianship, as well as lack of a stable network and epileptic power supply, among other things.

Thomas, (2013) further listed bureaucratic bottleneck as a factor affecting embedded librarianship. As in an ideal situation, some of the duties of an EL's is to partner with the faculty in teaching and learning but due to these bureaucratic bottlenecks, some institutions do not allow it. He gave an instance with Vaal University of Technology, (VUT) South Africa where librarians were denied access to course management systems by the Information Technology (IT) department of the institution thus preventing them from embedding in some online services.

## Materials and Methods

In this paper, we used structured questionnaire to collect data from respondents across schools in the Federal University of Technology, Owerri (FUTO). FUTO has a total of ten (10) schools to which two librarians are attached for embedded librarians' services. The questionnaire was administered to twenty (20) librarians and the duly completed copies of the questionnaire were collected from the respondents. The librarians were briefed and handed over the questionnaire after their regular daily house-keeping duties before retiring to their offices. Administration and retrieval of the instrument was carried out between October to December, 2021. The questionnaire is made up of four sections and all are measured on 4-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The following weights were assigned to the scales to convert it from ordinal to interval scale: strongly agree was assigned with the weight four (4); agree was assigned with the weight three (3); disagree was assigned with the weight two (2) and strongly disagree was assigned with the weight one (1). Section A contains statements on roles of an embedded librarian; Section B presents the channels used to disseminate information; Section C identifies challenges faced in embedded librarian services while Section D seeks solutions to the challenges. The data collected from the respondents were presented in Tables1, 2, 4, 6 and 8; while the analysis of the respective data was presented in Tables 3, 5, 7 and 9 respectively. The data was analysed using one sample t-test. The reason for the

use of t-test is because we have a small sample size of 18 with 17 degrees of freedom. These sample size come from the number of respondents to the administered questionnaires.

**Test Statistic**

$$t_{cal} = \frac{\bar{x} - \bar{\bar{x}}}{s/\sqrt{n}}$$

where ($\bar{x}$) is the sample mean, (s) is the sample standard deviation, (n) is the sample size and $\bar{\bar{x}} = \frac{1}{N}\sum_{i=1}^{N}\bar{x}_i$ is the population mean and level of significance $\alpha = 0.05$

**Hypothesis**

$H_0$: Accept Ho: and reject $H_1$: if the $t_{cal}$ is less than $t_{tab}$

$H_1$: Reject Ho: and accept $H_1$: if the $t_{cal}$is greater than $t_{tab}$ significant

**Interpretation**

Since $t_{cal}$ is less than $t_{tab}$ (since $t_{cal}$ is greater than $t_{tab}$) we accept $H_0$: (we reject $H_0$) and conclude that the test is significant (the test is not significant).

## Data Presentation and Analysis

**Table 1: Profile and status of respondents**

| Embedded Librarians | Qualification | Status | Experience | Subject Background |
|---|---|---|---|---|
| EL 1 | PhD | Snr Lib. | 20 yrs | LIS |
| EL 2 | PhD | Lib. 1 | 20 yrs | LIS/ English |
| EL 3 | MLS | Lib. 1 | 11 yrs | LIS |
| EL 4 | MLS | Lib. 11 | 10 yrs | LIS |
| EL 5 | MLS | AL | 7 yrs | English/ LIS |
| EL 6 | MLS | Lib. 1 | 20 yrs | LIS |
| EL 7 | MLS | Lib. 1 | 9 yrs | LIS |
| EL 8 | MLS | Lib. 11 | 10 yrs | LIS |
| EL 9 | MLS | Lib. 11 | 10 yrs | English/ LIS |
| EL 10 | MLS | Lib. 11 | 7 yrs | LIS |
| EL 11 | BLS | AL | 1 yr | LIS |
| EL 12 | MLS | Lib. 1 | 27 yrs | Microbiology/ LIS |
| EL 13 | PhD | Snr Lib. | 12 yrs | LIS |
| EL 14 | PhD | Snr Lib. | 20 yrs | LIS |
| EL 15 | PhD | Snr Lib. | 20 yrs | French/ LIS |
| EL 16 | PhD | DUL | 20 yrs | Psychology/ LIS |
| EL 17 | PhD | DUL | 20 yrs | LIS |
| EL 18 | PhD | Snr Lib. | 20 yrs | LIS |
| EL 19 | PhD | Snr Lib. | 20 yrs | LIS |
| EL 20 | PhD | Snr Lib. | 11 yrs | LIS |

**Table 2: Responses on the Role of an embedded librarian**

| S/N | Role of Embedded Librarian | SA | A | D | SD |
|---|---|---|---|---|---|
| A | The embedded librarian climbs the ladder to meet users | 7 | 8 | 2 | 1 |
| B | Plays an advisory role on school library resources and facilities | 10 | 7 | - | - |
| C | Gives assistance to department during accreditation | 13 | 5 | - | - |
| D | Plays as a liaison between the library and the school | 12 | 5 | 1 | - |
| E | Help students narrow topics for research | 3 | 10 | 4 | 1 |
| F | Help students find resources and peer reviewed articles | 4 | 12 | 2 | - |
| G | Provides information about citations and references | 5 | 10 | 2 | 1 |

**Table 3: Analysis of Responses on the Role of an embedded librarian**

| S/N | Role of Embedded Librarian | SA (4) | A (3) | D (2) | SD (1) | Mean ( $\bar{x}$ ) | t-cal | t-tab | Decision |
|---|---|---|---|---|---|---|---|---|---|
| A | The embedded librarian climbs the ladder to meet users | 28 | 24 | 4 | 1 | 14.25 | -0.95 | 1.74 | Significant |
| B | Plays an advisory role on school library resources and facilities | 40 | 21 | - | - | 30.5 | 1.03 | 1.75 | Significant |
| C | Gives assistance to department during accreditation | 52 | 15 | - | - | 33.5 | 0.69 | 1.74 | Significant |
| D | Plays as a liaison between the library and the school | 48 | 15 | 2 | - | 21.67 | 0.07 | 1.74 | Significant |
| E | Help students narrow topics for research | 12 | 30 | 8 | 1 | 12.75 | -1.29 | 1.74 | Significant |
| F | Help students find resources and peer reviewed articles | 16 | 36 | 4 | - | 18.67 | -0.22 | 1.74 | Significant |
| G | Provides information about citations and references | 20 | 30 | 4 | 1 | 13.73 | -1.02 | 1.74 | Significant |
| | | | | | | $\bar{\bar{x}} = 20.75$ | | | |

As presented in Table 3, all the 7 items in the questionnaire of objective 1 on the roles of embedded librarians in the Federal University of Technology Owerri were significant. That means that each of the questions is relevant and defines the role of embedded librarians.

**Table 4: Responses on the Channels through which embedded librarians disseminate information**

| S/N | Channels of Communication | SA | A | D | SD |
|---|---|---|---|---|---|
| A | Social media | 11 | 7 | - | - |
| B | Library website | 9 | 7 | 1 | - |
| C | Databases | 8 | 9 | - | - |
| D | Library instruction | 7 | 9 | 2 | - |
| E | Orientation | 9 | 8 | 1 | - |
| F | Workshops | 6 | 10 | 1 | 1 |
| G | Discussion forum | 7 | 7 | 2 | - |
| H | Visits | 9 | 8 | 1 | - |
| I | Handbooks/handouts | 3 | 10 | 2 | 2 |
| J | Consultation | 5 | 12 | 1 | - |
| K | Notice board | 6 | 10 | 2 | - |
| L | Discussion board | 3 | 8 | 3- | 4 |

**Table 5: Analysis of the Responses on the Channels through which embedded librarians disseminate information**

| S/N | Channels of Communication | SA (4) | A (3) | D (2) | SD (1) | Mean ($\bar{x}$) | t-cal | t-tab | Decision |
|---|---|---|---|---|---|---|---|---|---|
| A | Social media | 44 | 21 | - | - | 32.5 | 1.11 | 1.74 | Significant |
| B | Library website | 36 | 21 | 2 | - | 19.67 | -0.01 | 1.74 | Significant |
| C | Databases | 32 | 27 | - | - | 29.5 | 3.91 | 1.74 | Not significant |
| D | Library instruction | 28 | 27 | 4 | - | 19.67 | -0.01 | 1.74 | Significant |
| E | Orientation | 36 | 24 | 2 | - | 20.67 | 0.09 | 1.74 | Significant |
| F | Workshops | 24 | 30 | 2 | 1 | 14.25 | -0.73 | 1.74 | Significant |
| G | Discussion forum | 28 | 21 | 4 | - | 17.67 | -0.29 | 1.74 | Significant |
| H | Visits | 36 | 24 | 2 | - | 20.67 | 0.09 | 1.74 | Significant |
| I | Handbooks/handouts | 12 | 30 | 4 | 2 | 12 | -1.21 | 1.74 | Significant |
| J | Consultation | 20 | 36 | 2 | - | 19.33 | -0.04 | 1.74 | Significant |
| K | Notice board | 24 | 30 | 4 | - | 19.33 | -0.05 | 1.74 | Significant |
| L | Discussion board | 12 | 24 | 6 | 4 | 11.5 | -1.83 | 1.74 | Significant |
| | | | | | | $\bar{\bar{x}} = 19.73$ | | | |

With the exception of item with serial number C (Databases) which is not significant, the rest are all significant. This means that with the exception of databases, every other channel is relevant sources through which embedded librarians' disseminate information.

**Table 6: Responses on the challenges faced by embedded librarians in the course of their duties**

| S/N | Challenges | SA | A | D | SD |
|---|---|---|---|---|---|
| A | Passive librarians | 4 | 7 | 5 | 1 |
| B | Lack of sustainability | 2 | 10 | 4 | 2 |
| C | Low internet service | 8 | 8 | 2 | - |
| D | System not working due to administrative bottleneck | 7 | 10 | 1 | - |
| E | Inadequate time of operation | 7 | 11 | - | - |
| F | Lack of operational base and facilities in school | 8 | 10 | - | - |
| G | Departments not providing enabling environment/space | 13 | 5 | - | - |
| H | Lack of stated time for consultation | 5 | 10 | 2 | - |
| I | Inadequate cooperation and collaboration from departments | 8 | 10 | - | - |
| J | Difficulty in covering all the departments in physical space. | 4 | 13 | 2 | - |
| K | Inadequate power supply | 10 | 7 | 1 | - |

**Table 7: Responses on the challenges faced by embedded librarians in the course of their duties**

| S/N | Challenges | SA (4) | A (3) | D (2) | SD (1) | Mean ($\bar{x}$) | t-cal | t-tab | Decision |
|---|---|---|---|---|---|---|---|---|---|
| A | Passive librarians | 16 | 21 | 10 | 1 | 12 | -2.47 | 1.74 | Significant |
| B | Lack of sustainability | 8 | 30 | 8 | 2 | 12 | -1.72 | 1.74 | Significant |
| C | Low internet service | 32 | 24 | 4 | - | 20 | -0.31 | 1.74 | Significant |
| D | System not working due to administrative bottleneck | 28 | 30 | 2 | - | 20 | -0.29 | 1.74 | Significant |
| E | Inadequate time of operation | 28 | 33 | - | - | 30.5 | 3.16 | 1.74 | Not Significant |
| F | Lack of operational base and facilities in school | 32 | 30 | - | - | 31 | 8.39 | 1.74 | Not Significant |
| G | Departments not providing enabling environment/space | 52 | 15 | - | - | 33.5 | 0.59 | 1.74 | Significant |
| H | Lack of stated time for consultation | 20 | 30 | 4 | - | 18 | -0.61 | 1.74 | Significant |
| I | Inadequate cooperation and collaboration from departments | 32 | 30 | - | - | 31 | 8.39 | 1.74 | Not Significant |
| J | Difficulty in covering all the departments in physical space | 16 | 39 | 4 | - | 19.7 | -0.29 | 1.74 | Significant |
| K | Inadequate power supply | 40 | 21 | 2 | - | 21 | -0.15 | 1.74 | Significant |
| | | | | | | $\bar{\bar{x}} = 22.61$ | | | |

In the analysis of data in Table 7 on the challenges faced by embedded librarians in the course of their duties, we observed that with the exception of serial number E, F and I that were not significant, the rest are significant. This means that the questions with serial numbers E, F and I do not pose challenges to embedded librarians in performing their duties while the rest pose challenges to the embedded librarians in the performance of their duties.

**Table 8: Responses on the Suggestions for Improving embedded librarian services**

| S/N | Suggestions for Improving Services | SA | A | D | SD |
|---|---|---|---|---|---|
| A | Librarians need orientation and reorientation on public interpersonal/customer relations skills and competency | 9 | 8 | 1 | - |
| B | Improve work ethics | 11 | 6 | 1 | - |
| C | Rebrand administrative procedures | 5 | 11 | 1 | - |
| D | Develop new service and approach | 7 | 12 | - | - |
| E | Discovering new source of information | 5 | 13 | - | - |
| F | Widening opportunities for new market | 5 | 12 | - | - |
| G | Repackaging information products to suit savvy students | 7 | 11 | - | - |
| H | Finding new ways to make library accessible | 12 | 6 | - | - |
| I | Rebranding of old products/creating new products | 6 | 11 | - | - |
| J | Transforming old process | 5 | 12 | - | - |
| K | Incorporate new sources that promote patronage. | 9 | 9 | - | - |

**Table 9: Analysis of responses on the Suggestions for Improving embedded librarian services**

| S/N | Suggestions for Improving Services | SA (4) | A (3) | D (2) | SD (1) | Mean (x) | t-cal | t-tab | Decision |
|---|---|---|---|---|---|---|---|---|---|
| A | Librarians need orientation and reorientation on public interpersonal/customer relations skills and competency | 36 | 24 | 2 | - | 20.67 | -0.68 | 1.74 | Significant |
| B | Improve work ethics | 44 | 18 | 2 | - | 21.33 | -0.49 | 1.74 | Significant |
| C | Rebrand administrative procedures | 20 | 33 | 2 | - | 18.33 | -1.01 | 1.74 | Significant |
| D | Develop new service and approach | 28 | 36 | - | - | 32 | 1.15 | 1.74 | Significant |
| E | Discovering new source of information | 20 | 39 | - | - | 29.5 | 0.22 | 1.74 | Significant |
| F | Widening opportunities for new market | 20 | 36 | - | - | 28 | 0.08 | 1.74 | Significant |
| G | Repackaging information products to suit savvy students | 28 | 33 | - | - | 30.5 | 1.24 | 1.74 | Significant |
| H | Finding new ways to make library accessible | 48 | 18 | - | - | 33 | 0.37 | 1.74 | Significant |
| I | Rebranding of old products/creating new products | 24 | 33 | - | - | 28.5 | 0.25 | 1.74 | Significant |
| J | Transforming old process | 20 | 36 | - | - | 28 | 0.08 | 1.74 | Significant |
| K | Incorporate new sources that promote patronage. | 36 | 27 | - | - | 31.5 | 0.91 | 1.74 | Significant |
| | | | | | | 27.39 | | | |

From the analysis in Table 9, all the suggestions on improving embedded librarian services are relevant and should be adopted.

## Discussion

The study shows that the embedded librarians play critical roles in the academic activities of both students and faculty members of the Federal University of Technology Owerri. This study applied inferential statistics using t-test; stated hypothesis and tested them. From the results, majority of the questions were significant to the effective functioning of embedded librarians, while very few were not significant to the effective functioning of embedded librarians (see Tables 3, 5, 7 and 9 respectively). This is in line with the views of Agboola, Mamuna, and Aduku (2018) that embedded librarian plays a critical role in promoting library services by attending to users at their desired location, especially in academic institutions.

The study discovered various channels through which embedded librarians disseminate information and communicate with the students and faculty members. Social media, orientation, visits and consultation were discovered to be some of the channels through which they disseminate information. This is in tandem with the opinion of Wayne (2017), that to help with information services, the librarian typically meets with lecturers and students in their offices, lecture halls, or on campus.

The study also discovered various challenges faced by embedded librarians in the course of discharging their duties. The study revealed that system not working due to administrative bottleneck, inadequate time of operation, lack of operational base and facilities in school, departments not providing enabling environment/space, lack of stated time for consultation, inadequate cooperation and collaboration from departments and inadequate power supply as some of the challenges faced by embedded librarians. This corroborates the views of Ndlovu (2017) who claims that embedded librarians are suspected by faculty of interfering with their academic activities as academics while Agboola et al. (2018) saw insufficient and qualified staff as likely challenges for embedded librarianship, as well as a lack of a stable network and epileptic power supply, among other things.

## Conclusion and Recommendations

Embedded librarianship is a way for academic librarians to become more active in strategic campus creation and growth, such as through the faculty, senate, strategic planning committees, space/campus design participation, collaboration with faculty study, and so on. Embedded librarians' roles were established, particularly in the sense of service delivery and these services were provided: discovering user's areas of need, building on community capacity, fostering interaction, partnership, cooperation and collaboration. In the face of all these they are faced with some challenges which hinders their progress and for them to achieve maximally, there should be librarians' orientation and reorientation on public interpersonal/customer relations skills and competency, provision of steady power supply, functional internet services and so on.

Suggestions on the way forward in combating these challenges are: Librarians need orientation and reorientation on public interpersonal/customer relations skills, competency in discovering new sources of information, widening opportunities for new market, repackaging information products to suit savvy students and finding new ways to make library accessible. Therefore it behooves on the management of the library to find ways to implement these suggestions as it will bring users back to library information services.

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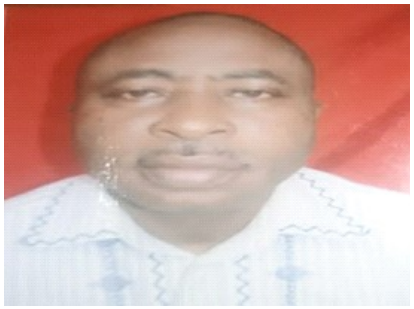
**Ifeoma S. Njoku** is a senior librarian and the Coordinator, Research Training and Statistics Unit of the Library, Federal University of Technology Owerri, Imo State, Nigeria. She is a Certified Librarian of Nigeria and obtained her PhD in Library and Information Science from Abia State University Uturu.

**Scholastica A.J. Chukwu** is a Senior Librarian and a staff of the Federal University of Technology Owerri, Imo State, Nigeria. A Certified Librarian of Nigeria She obtained her Ph.D. in Library and Information Science from Abia State University Uturu.

**Felix Mmanuoma Eke** is the Coordinator, Innovative Library Services Unit, Federal University of Technology Owerri, Imo State, Nigeria. He holds Ph.D. in Library and Information Science from University of Uyo, Akwa Ibom State.



**Faustina Chioma Haco-Obasi** is a librarian 11 in the University Library of Federal University of Technology, Owerri. She is currently the Reference Librarian. She is undergoing her doctoral programme at Abia State University, Uturu.

**Emeka Ogueri** is a librarian 1 with the Federal University of Technology, Owerri. A Certified Librarian.