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## USE OF ONLINE DATABASES BY NUCLEAR SCIENTISTS OF GHANA ATOMIC ENERGY COMMISSION, GHANA: A REVIEW

Albert Paa Kojo Ebi Bilson Mr.

*Ghana Atomic Energy Commission*, a.bilson@gaecgh.org

Andy Tandoh Mr.

*Ghana Atomic Energy Commission*, andy.tandoh@gaecgh.org

Christabel Torshie Torto Ms.

*Ghana Atomic Energy Commission*, c.torto@gaecgh.org

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# **USE OF ONLINE DATABASES BY NUCLEAR SCIENTISTS OF GHANA ATOMIC ENERGY COMMISSION, GHANA: A REVIEW**

**BY**

**Mr. Albert Paa Kojo Ebi Bilson**

Librarian/ International Nuclear Information System Liaison Officer for (Ghana),

Ghana Atomic Energy Commission (Library).

Email: [a.bilson@gaecgh.org](mailto:a.bilson@gaecgh.org)

**Mr. Andy Duah Tandoh**

Management Information Systems Specialist/ Alternate International Nuclear Information

System Liaison Officer for (Ghana), Ghana Atomic Energy Commission

Email: [andy.tandoh@gaecgh.org](mailto:andy.tandoh@gaecgh.org)

**Ms. Christabel Torshie Torto**

Administrative Assistant

Ghana Atomic Energy Commission

Email: [c.torto@gaecgh.org](mailto:c.torto@gaecgh.org)

## **Abstract**

ICT has greatly changed how research, teaching and learning is done. In the past, these activities were aided mainly by manual databases consisting of paper or print material records. However, over the period of time this has dramatically changed to digital electronic formats such as portable document format (PDF). The goal of this paper was to examine the use of online databases by Nuclear Scientists of Ghana Atomic Energy Commission and review the literature available. A systematic review of 20 articles from 1970 to 2021 was conducted. The review covered studies on both quantitative and qualitative research approaches both locally and abroad. The findings revealed that from the older literature, awareness of the existence of online databases by patrons in their institutions was low. However from the current literature the trend has changed with patrons now been much aware of these online databases. Some problems identified as hindering the access to online databases included low bandwidth speed, and cost of infrastructure which are stumbling blocks especially in developing countries of which Ghana is a part. Recommendations included the provision and expansion of infrastructure, training programmes, information literacy, subscription to current and relevant online databases, conducting regular surveys and funding and financing of electronic resources. It is essential libraries are supported to improve access and usage whiles creating awareness of the numerous benefits that can be gained by research and academic institutions in channelling their energies into having current, available electronic resources for their patrons for teaching, learning and research.

**Keywords:** Academic Libraries, Research Libraries, Special Libraries, Electronic Resources, Databases, Nuclear Scientists, Developing Countries, Internet, Bandwidth, Awareness

# INTRODUCTION

## 1.0 Background to the study

The emergence of Information and Communication Technology (ICT) has impacted greatly on research, teaching and learning from the days of manual databases which consisted mainly of paper or print material records to online databases which have digital electronic formats such as portable document format (PDF).

One key objective of The Ghana ICT for Accelerated Development (ICT4DAD) policy for Research and Development (R&D), Scientific and Industrial Capacity development is to “support and strengthen scientific research and R&D within the nations Universities and Research Institutions as a basis for promoting the development of a globally competitive ICT sector and industry”.

The role of libraries have changed with the advent of the internet and ICT and it plays a key role in providing timely and accurate information to patrons using librarians as intermediaries.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) ICT refers to “forms of technology that are used to transmit, process, store, create, display, share or exchange information by electronic means. This broad definition of ICT includes such technologies as radio, television, video, DVD, telephone (both fixed line and mobile phones), satellite systems, and computer and network hardware and software, as well as the equipment and services associated with these technologies, such as videoconferencing, e-mail and blogs”.

Yourdictionary.com (2015) also defines an online database as “a computer application that is delivered from the Internet that stores and organizes data to make it accessible to the user”.

Examples of such databases include an online catalogue of a library, online booking/registration and reservation systems of airlines and the online tracking system provided by the United Postal Services (UPS) one of the largest courier service companies.

Agyeman (2003), confirming the usefulness of information in a nuclear research and development environment stated that “among the short benefits of information use to nuclear scientists are timeliness in the execution of work, effective implementation of work, avoidance of unnecessary duplication of research and savings in time and resources”.

Information is therefore essential in today’s global environment and as such timely, accurate and relevant information is needed by nuclear scientists to conduct meaningful and quality research for national development. Online databases are therefore very important sources of such information. In spite of the numerous challenges faced by developing countries in their use, it is essential that librarians in most academic and research institutions of which Ghana Atomic Energy Commission (GAEC) is no exception play a pivotal role in the selection of databases for its user community, increasing awareness and patronage as well as training to ensure their utmost utilization.

## **1.2 Overview of the study setting**

GAEC is located North-West of the University of Ghana campus. It is 24 kilometres from the central business district of Accra and 6 kilometres from the Legon-Madina road towards kwabenya through Haatso township.

### **1.2.1 Brief history, Mission and Vision of the Ghana Atomic Energy Commission**

GAEC was established in 1963 by an act of parliament (Act 204 of 1963). It was later superseded by the Atomic Energy Act 2000 (Act 588) which has expanded its scope and functions. The Commission draws its inspiration from this current Act since it addresses the numerous challenges faced by the country in terms of energy in particular, the application of nuclear technology in sectors such as health, agriculture and human health for economic development. (GAEC - The Nuclear Agenda, 2013:7).

Its mission is to “become the leading organization contributing to sustainable national prosperity through the effective utilization of nuclear, biotechnology and other related technologies”.

(<http://gaecgh.org/about-us/mission/>)

Its vision is to develop and promote the utilization of nuclear techniques and biotechnology for economic development through advising government on policy matters related to the field, applied research and development, commercial applications of research, fulfilling national obligations in the field, contributing to building a sustainable future for the country by facilitating the introduction of nuclear power into Ghana’s energy mix; developing the human resource in the field, the satisfying of stakeholder’s expectations and the building of strategic partnership and alliances with national, regional and international bodies to enhance utilization of nuclear and related technologies for sustainable development. (<http://gaecgh.org/vision/>)

### **1.2.2 The GAEC Library**

The main function of the GAEC library is to “serve as a resource base for information in nuclear science and technology in Ghana. It aims at acquiring scientific literature relevant to the interest of the user population, organizing and displaying these materials, and making them available to

the research scientists, engineers and technicians of the commission. The GAEC Library also extends its services to other institutions in the country”. (<http://library.gaecgh.org/our-library/>)

### **1.2.3 Online databases at the GAEC Library**

The GAEC library is a member of the Consortium of Academic and Research Libraries in Ghana (CARLIGH). It provides access to several online databases in the area of nuclear and allied sciences on its digital library website (**library.gaecgh.org**). A majority of these online database are however subscription based.

Its main users are Nuclear scientists including Lecturers and Professors, Research Scientists, Technologists and Postgraduates students of the Graduate School of Nuclear and Allied Sciences who are able to access these databases after agreeing to the terms and conditions associated with these online databases. Table 1 lists some of the databases subscribed to by the GAEC library.

**Table. 1:** Some online databases available on the Ghana Atomic Energy Commission (GAEC) electronic Library

NO.	NAME OF ONLINE DATABASE	SUBJECT SCOPE	WEB ACCESS
1	Access to Global Online Research in Agriculture (AGORA)	Agriculture based and other disciplines	<a href="http://www.agoralogin.research4life.org">www.agoralogin.research4life.org</a>
2.	Access to Research for Development and Innovation (ARDI)	Development and Innovation	<a href="http://www.ardilogin.research4life.org">www.ardilogin.research4life.org</a>
3.	African Journals Online (AJOL)	Multidisciplinary	<a href="http://www.ajol.info/index.php">www.ajol.info/index.php</a>
4.	Health InterNetwork Access to Research Initiative (HINARI)	Health and biomedical	<a href="http://www.hinarilogin.research4life.org">www.hinarilogin.research4life.org</a>
5.	INASP	Multidisciplinary	<a href="http://www.Inasp.info">www.Inasp.info</a>
6.	International Atomic Energy Agency (IAEA) Publications	Nuclear sciences and applications	<a href="http://www.iaea.org/publications">www.iaea.org/publications</a>
7.	International Centre for Theoretical Physics (ICTP) ejournal delivery service	Physics and Mathematics	<a href="http://www.ejds.ictp.it/ejds">www.ejds.ictp.it/ejds</a>
8.	International Nuclear Information System (INIS)	Nuclear sciences and applications	<a href="http://www.Inis.iaea.org">www.Inis.iaea.org</a>
9.	International Nuclear Library Network (INLN)	Nuclear sciences and applications	<a href="http://www.iaea.org/nuclearenergy/library-inln">www.iaea.org/nuclearenergy/library-inln</a>
10.	Online Access to Research in Environment (OARE)	Environment based plus other disciplines	<a href="http://www.oarelogin.research4life.org">www.oarelogin.research4life.org</a>
11.	Springer Open	Multidisciplinary	<a href="http://www.Springer.com/gp">www.Springer.com/gp</a>



## **LITERATURE REVIEW**

### **2.1 Introduction**

The study and learning centre RMIT University (2022) is of the view that a literature review focuses on three key points namely:

- Looking at what the research talks about (theory).
- Looking at how the research was carried out (methodology) and
- Finding out the gaps in literature that your research intends to fill.

Relevant literature are discussed under the major headings such as: how databases emerged, types of online databases (reference and source), previous studies on online databases under the following themes: Reasons for using online databases, awareness of online databases, frequency in accessing online databases, benefits of online databases, problems with using online databases and conclusion of the literature review.

### **2.2 How online databases emerged**

Chowdury (2010) identified five generations of database systems which followed the five decades of the computing era from the 1950s with the first two concerned with the predecessors of database systems.

He revealed that the first generation was concerned with the 1950s in which the computer systems major task was to process data with the control of a program involving calculating, counting etc. He further opines that the program was directly provided with data-set to operate on or it had to read data from a secondary memory into the computers main memory, process and write the

modified data set back to the secondary memory which was known as punch cards or to magnetic tapes which only allowed sequential processing.

Elaborating on the second generation, Chowdury (2010) revealed that it started in the early 1960s. He was of the view that it differed from the first generation in many ways and indicated that computers could now be used in online and batch modes. He stressed that the evolution of the magnetic disk as a secondary storage paved the way for multiple access to be possible.

The second generation gave birth to two popular models namely a network model called Conference/Committee on Data Systems Languages (CODASYL) and a hierarchical model called the Information Management System (IMS) by International Business Machines (IBM). (<http://quickbase.intuit.com/articles/timeline-of-database-history>)

The third generation according to Chowdury (2010) started in the late sixties and coincided with the 1970s. He saw a distinction between logical and physical information which came about due to the greater need to manage large file sets of data. He further indicated that data models were used for the first time to describe physical structures from a logical point of view.

Codd (1970) was not satisfied with the CODASYL. Since it had some lapses. He addressed these lapses in his paper titled “A relational model of data for large shared data banks”.

Chowdury (2010) revealed that the fourth generation which arrived in the 1980s brought about systems such as the Database Management System’s (DBMSs). He stated that the relational model made a distinction between a physical and logical data model which is true for relational databases. He was of the view that these systems had data independence and availability of powerful language with data independence referring to transparent storing of data to users and the powerful language freeing users to a large extent from questions of how to manage data.

Structured Query Language (SQL) became the standard query language with database two (DB2) becoming the flagship product for IBM and the advent of IBM brought about the establishment of many database companies and the development of products such as PARADOX, DBASE, RBASE500, RIM DBASE III and IV, OS/2 Database Manager and Watcom SQL. (<http://quickbase.intuit.com/articles/timeline-of-database-history>)

The fifth generation according to Chowdury (2010) emerged in the 1990s. He stressed that its most significant achievements are the object-oriented database systems, multimedia and knowledge-based systems. He further argued that the significant feature of modern day databases is that they are web-based and users can search, retrieve records, add or even edit the records remotely without having any knowledge of the software and hardware feature of the database system. Examples of which include shopping, booking flights and shopping etc. (Chowdury, 2010).

## **2.3 Types of online databases**

Chowdury (2010), discussed two types of databases namely reference databases and the source databases.

### **2.3.1 Reference databases**

They direct users to the source of information such as a document, person or organization (Chowdury, 2010). They have three subdivision namely bibliographic, catalogue and referral databases.

Bibliographic databases contain citations or bibliographic references of materials and abstracts of literature. (Chowdury, 2010).

Feather and Sturges (2003) on the other hand share a different view. They consider these databases as containing references to published literature, including journal and newspaper articles, conference proceedings and papers, reports, government and legal publications.

Examples of bibliographic databases are the International Nuclear Information System (INIS), Library and Information Science and Technology Abstracts (LISTA), Sociological abstracts and Education Resources Information Center (ERIC).

Catalogue databases provide access to the collection of one or more libraries or internet resources. (Chowdury, 2010).

They tend to be digital in nature containing images, documents, audio, manuscripts etc. They can sometimes be subscription based. Examples of such databases include the Center for suicide prevention database catalogue, Düben collection database catalogue of the University of Uppsala Universitet, Sweden and the Library of Congress catalogue.

Referral databases provide reference to information on the name, address, specialization of persons, institutions, information systems etc. (Chowdury, 2010).

Examples of referral databases include foundation directory, fine chemicals directory and Ulrichs's Periodical Directory.

### **2.3.2 Source databases**

They provide direct answers for users thereby requiring no need to refer elsewhere. They contain information in machine readable format and regarded as a form of electronic document. (Chowdury, 2010). They include the numeric, full-text, text-numeric and multimedia databases.

Numeric databases contain numerical data of varied forms such as statistics and survey data. (Chowdury, 2010).

Full-text databases contain the full text of documents. (Chowdury, 2010). Examples of full-text databases are ProQuest nursing journals, JSTOR, EBSCO, LexisNexis etc.

Feather and Sturges (2003) on the hand view full-text databases as not only containing bibliographic description but also the entire text of documents.

Text-numeric databases contain a mixture of both textual and numerical data such as company annual reports or handbook data. (Chowdury, 2010).

Multimedia databases contain text, image, audio and video information. (Chowdury, 2010).

Feather and Sturges (2003), describe them as containing a mix of different media formats such as text, audio, video and still graphics (photographs, diagrams and illustrations, graphs, charts, maps and even representations of works of art). They observe that due to limitations of current telecommunications networks in transmitting huge files they are usually in CD-ROM format than online.

They can be found in the music industry, telemedicine, digital libraries, video on demand, news on demand, geographic information systems etc.

#### **2.4 Previous studies on online databases**

Several literature exist on the use of online databases outside and within Ghana. Examples outside Ghana include Khan and Haridasan (2015), Kandasamy and Vinitha (2014), Farid, Abiodullah and Ramzan (2013), Tlakula and Fombad (2017) and Naqvi (2012). In the case of Ghana

examples of such studies include Amakwah (2014), Atiso and Atkins (2014), Kwafoa et.al. (2014), Kwadzo (2015), Acheampong et.al. (2019) and Bentil et.al. (2021).

Some of the similarities among these literature was that most of these investigations were carried out in academic and research institutions using the sampling technique.

#### **2.4.1 Reasons for using online databases**

Several reasons have been identified in the literature which explains why people use online databases in academic and research institutions. Khan and Haridasan (2015) conducted a study to investigate the use of online databases in the faculty of arts at two universities in India. The findings of their study revealed that a majority of users accessed online databases for teaching and research. The finding by Kandasamy and Vinitha (2014) that (91.11%) respondents used online databases for research supports the claim by Khan and Haridason (2015).

In Ghana, an investigation by Amankwah (2014) on the use of electronic resources by undergraduate students of the Ghana Institute of Management and Public Administration (GIMPA) revealed a different trend. 63 (79.7%) of respondents searched online databases to complete assignments as against 24 (30.3%) for research. This could be attributed to the fact that respondents were students who accessed these online databases to retrieve useful material for completing their assignments.

#### **2.4.2 Awareness of online databases**

In a study by Okello-Obura and Magara (2008) to analyse electronic information access and utilization by Library and Information Science (LIS) students in Makerere University, Uganda, it was reported that a majority of the students were not even aware of the available full-text databases such as Emerald and EBSCO. This was a surprising revelation since respondents were

LIS students who should rather have had a better understanding of these databases but that was not the case.

Another finding by Sulemani and Katsepor (2007) which revealed that faculty members lacked awareness and use of two of the most popular full text databases at the Library namely HINARI and PERI concurred with the results by Okello-Obura and Magara (2008).

In a different dimension in Ghana as posited by Amankwah (2014), awareness of academic databases among students was high with 73 (94.4%). The study by Kwafoa et.al. (2014) also had 92% of respondents been aware of the existence of academic databases which confirmed the findings by Amankwah (2014).

### **2.4.3 Frequency in accessing online databases**

Habiba and Chowdhury (2012) surveyed academics, researchers and students at Dhaka University Library, Bangladesh. The study revealed that (44%) of users accessed electronic resources including online full text databases daily, (27%) accessed a few times a week, (3%) accessed at least once a fortnight and (9%) accessed once a month which was encouraging. The finding by Habiba and Chowdhury (2012) concurs with Kwafoa et. al. (2014) who had (52%) respondents using online databases always.

In Ghana however, Dadzie (2005) and Amankwah (2014) shared similar contrasting results. In the case of Dadzie (2005) despite the high information technology environment at Ashesi University, only (5%) of respondents always used these online databases as against (58%) who rarely or never used them. In the case of Amankwah (2014) who surveyed undergraduate students of GIMPA he indicated that for EBSCOHOST, an academic database there was only 7 (8.8%) of students using it once a week as against 35 (44.3%) who said they used it once a month and 43 (54.4%) who indicated that they did not use it at all.

#### **2.4.4 Benefits of online databases**

The change from manual to electronic content can be said to be one of the major changes made by academic and research libraries. These have impacted greatly on how patrons use and access materials. In the past one had to be physically present in a library to access information. Nowadays it is possible to be in a remote location to access information from an online database any time one wants to. Using basic and advanced searching capabilities provided by most databases one can easily search for any issue pertaining to their area of study or interest. Most of these online databases also indicate the relevancy of the retrieved information which helps one to make informed judgement about the retrieved material. Another issue is that a lot of these online databases contain peer reviewed journals which have been reviewed by editors of the various journals thereby making the information they provide credible in nature, authentic, current and objective in nature. The content of some of these online databases are full-text and the content can be retrieved and downloaded onto a computer or an electronic device thereby saving printing cost.

Negahban and Talawar (2009) are of the view that Electronic information resources expands access, increases usability, effectiveness and establish new ways in which individuals can use information and be more productive in their endeavours. Other advantages according to them include providing better, faster and easy access to information than information accessed through print media. They conclude that electronic information resources can be relied upon for timely information.

Commenting on the benefits of electronic resources, Dadzie (2005) is of the view that Electronic resources are invaluable research tools which complement print-based resources in all traditional library. According to her some of the added benefits provided by electronic resources include provide access to information that might be restricted to the user because of geographical location



or finances, access to current information as these are often updated frequently, access to a variety of search techniques, provision of extensive links and convenience for users to access information from the library, internet cafe', offices or at times from the comfort of their homes at any time of the day.

Another finding by Kwafoa et. al. (2014) in their study revealed that (87%) of respondents found electronic resources to be highly beneficial or beneficial and indicated that it saved them time as well as it's relatively ease of use.

#### **2.4.5 Problems with using online databases**

Several issues have been identified in the literature with using online databases in academic and research institutions.

One problem identified by Habiba and Chowdhury (2012), in their investigation was that (43%) of academics, researchers and students at Dhaka University, Bangladesh indicated a low availability of computers. They also indicated that (43%) of users of the library were of the view that adequate bandwidth to access the resources was below average. This finding concurred with the results by Okello-Obura, C. and Magara, E. (2008) who had 170 (90%) of respondents confirming that limited access to a computer terminal was a problem with accessing electronic resources. The results also was confirmed by in another study by Kwadzo (2015), where (70%) of respondents mentioned online access problems and (56.3%) stated slow downloading process.

Another problem is the amount of subscribed databases by research and academic institutions which might not be relevant to it users. In one such study by Kandasamy, S. and Vinitha, K. (2014) their findings revealed that (45.44%) of respondents indicated that not many online databases were subscribed to by their university on their subject/research. This finding concurred with findings by Amankwah (2014).

Other problems such as power outages, lack of information on how to use electronic resources was indicated by Amakwah (2014).

## **2.5 Conclusion of Literature review**

The purpose of this review was to analyse evolving trends in the use of online databases in academic and research institutions of which GAEC is a part. It is clear from the older literature reviewed that awareness of the existence of online databases by patrons in their institutions was low. However from the current literature the trend has changed with patrons now been much aware of these online databases. Also it is important worth noting that a lot still needs to be done in increasing usage of these online databases as it is still on the average.

Electronic resources of which includes online databases are not been exploited to their full potential thereby hindering the quality of research outputs in these institutions. Problems with bandwidth speed, cost of infrastructure are also stumbling blocks especially in developing countries of which Ghana is a part. It is essential to conduct more research to find out how best to improve access and usage and create awareness of the numerous benefits that can be gained by research and academic institutions in channelling their energies into having current, available electronic resources for their patrons for teaching, learning and research.

## **CONCLUSION AND RECOMMENDATIONS**

### **3.1 Introduction**

The study was conducted to look at the usage of online databases at GAEC by reviewing current and old literature on the subject matter. This chapter provides a brief recapitulation of the findings in the study. It also includes conclusions as well as recommendations for policy makers especially management, Practitioners especially Librarians, researchers, Lecturers and Professors and scholars especially at the Ghana Atomic Energy Commission.

### **3.2 Conclusions**

ICT has dramatically changed the way in which patrons of a library can access materials. This has made electronic resources especially online databases more popular and convenient to use than their print counterpart's. Several studies have revealed that online databases are current, mobile and available to users at anytime of the day that they wish to. Most Libraries in academic and research institutions strive to provide their patrons with electronic resources to support teaching, learning and scholarly academic research and development activities of user community. This study illustrates that there are several benefits to be derived by research and academic institutions in subscribing to relevant online databases for its users. There are several bottlenecks faced by librarians in provision, awareness, and access of these online databases. Despite numerous challenges in the acquisition and usage of these databases, librarians have a pivotal role to play in ensuring that the benefits that come with these online databases are explored by its users to enable them to produce rich and quality research material thereby improving their research output.

### **3.3 Recommendations**

Based on the findings of the study it is recommended that most academic and research institutions including the Ghana Atomic Energy Commission study and apply the following recommendations.

#### **3.3.1 Provision and expansion of infrastructure**

Infrastructure in every organisation should be one of its utmost focus. Since without infrastructure its main objectives cannot be achieved. It is like a farmer without tools to farm. It is suggested that government supports the commission financially by providing funding for items such as desktop computers for the library, training laboratories, expanding ICT infrastructure through the provision of fast and reliable internet bandwidth, wireless internet connectivity and maintaining and improving power supply. Infrastructure happens to be a problem in Africa and the government needs to prioritize infrastructure in its budget. The availability of infrastructure will enable research not to be hindered and promote quality and relevant research outputs for national development.

#### **3.3.2 Training Programmes**

Frequency in accessing electronic resources including online databases was found to be low from the available literature. It is recommended that librarians improve awareness and usage among patrons by organising regular training workshops, seminars and open days and using the services of qualified and certified information technology professionals to train and improve the ICT skills of patrons in the searching and retrieval of relevant information on these online databases using Boolean logic skills. This will go a long way to improve the frequency of access as well as the other useful benefits that come with using online databases. Secondly it will provide an avenue

for patrons to put across any challenges or issues that they face when accessing these online database.

### **3.3.3 Information literacy**

Information literacy was almost non-existent in the literature. According to the Chartered Institute of Library and Information Professionals (2013), information literacy is “knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner.”

According to the Wesleyan University Library (2015) Information Literacy is a decisive skill required in the pursuit of knowledge which encompasses the need to recognize when information is needed and the ability to efficiently locate, accurately evaluate, effectively use, and clearly communicate information in different formats.

Skills required to be information literate include a need for information, understanding availability understanding how to find information, understand the need to evaluate results understand how to work with or exploit results, understand ethics and responsibility of use, understand how to communicate or share your findings and understand how to manage your findings (CILIP, 2012).

It is recommended that librarians are sponsored to attend training workshops, seminars and conferences to improve their information literacy skills at the work place. This will significantly improve the librarians training delivery approach method when for instance they organise tours and orientation programmes and assist users in database search skills organised for first time users at the library. This will greatly help to make users of the library whether remote or in person information literate.

### **3.3.4 Subscription to current and relevant online databases**

It was observed from the literature that there was the problem of the unavailability of subscribed databases on the subject/research area of users. It is recommended that the librarians provide relevant, current and subject specific databases for users to aid them in their research, learning and teaching endeavours.

### **3.3.5 Conducting regular surveys**

It is also recommended that librarians conduct surveys from time to time to gauge awareness and usage of electronic resources especially online databases as well as suggestions and recommendations relating to its use.

### **3.3.6 Funding and Financing of electronic resources**

Management of academic and research Libraries must adequately provide for the needs of their libraries by investing in the subscription of electronic resources. This is necessitated by the fact that the level of funding or supporting the provision of these resources greatly influences the quality of services a library is able to offer to its patrons. Likewise at the governmental level, there should be a sizeable amount of budget allocated specifically to the improvement of library services.

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