

# THE ROLE OF DIGITAL LIBRARIES IN BRIDGING THE KNOWLEDGE GAP IN AFRICA

**IDDI W. JUMA**

Senior Librarian  
Masinde Muliro University of Science and Technology  
iddijuma@yahoo.com

**JUSTUS WAMUKOYA**

Professor, School of Information Sciences  
Moi University  
jwamukoya1@yahoo.com

**CAROLINE WEKULLO**

Administrator  
Masinde Muliro University of Science and Technology  
cwekullo@gmail.com

## **ABSTRACT**

Digital libraries have a huge potential towards offsetting the knowledge deficit in many parts of the world and Africa in particular. This article reports on a study aimed at exploring the status of digital libraries and the contributions they have made towards bridging the knowledge gap in Africa. The study examined the origin, growth and current status of digital libraries; identified critical issues surrounding their existence; and investigated the level to which they had helped to reduce disparities in access to knowledge and promote the quality of education and research in Africa. It also explored the challenges met in the development, management and use of these libraries with a view to improving them. Data collection and analysis was largely based on a review of the extant literature as well as an analysis of the statistical data collected from a number of organisations and websites. The key finding was that although there had been some efforts in Africa to harness opportunities created by the Internet and digital libraries through research initiatives, the continent still trailed the rest of the world in the actual use of these resources. It was recommended that African governments and higher education institutions (HEIs) create an environment that is conducive for further development of these libraries and facilitate them to contribute more effectively to information and cultural content. There was also a need to increase investments in the digital technologies to reduce the existing disparities and barriers to universal access to the knowledge resources.

## KEYWORDS

virtual libraries, electronic libraries, local content, Internet

## 1 INTRODUCTION

Knowledge is considered the key to human development. For some time now, knowledge has widely been recognised as the most important factor of production in an economy. Its production and utilisation is, therefore, essential for development. In its 1999 Human Development Report, the United Nations Development Programme states that ‘knowledge is the new asset . . . and globalisation’s rules have set off a race to lay claim to knowledge’.

According to Evers (2002:1), nations and organisations that have been able to leverage their knowledge more effectively and efficiently through the use of new information and communications technologies (ICTs) are poised to continue to dominate the world trade and to derive massive benefits in human development. In fact, some countries, especially those in South East Asia, have embarked on an ambitious plan to use knowledge as a base for economic development which has enabled them to by-pass earlier stages of industrialisation.

African countries are poorer than their western counterparts and even among themselves, they are not on a par in terms of their capacity to generate and utilise the knowledge resources at their disposal. This is evident from poverty headcount statistics by the World Bank Group (2013:22). These disparities are generally blamed on political, social and economic differences. Lack of adequate financial resources, therefore, means that African countries cannot afford to buy all the required knowledge materials to support quality education and research programmes. Ineptitude in research activities and outputs has also affected the quantity and quality of knowledge resources available for sharing. In fact, Diagne (2000:2) asserts that many African higher education institutions (HEIs) are faced with tight budgets, obsolete libraries and dysfunctional equipment which are a recipe for poor education.

However, the new ICTs now driving globalisation and digital libraries in particular are widely expected to depolarise the world from the connected knowledge rich and the isolated knowledge poor. Digital technology has fostered unforeseen possibilities for creativity, innovation and sharing of knowledge.

Digital libraries have a huge potential towards offsetting the knowledge deficit in many parts of the world and Africa in particular. However, few studies have focused on generating new knowledge that could help to realise this potential. This is evident from the scarcity of empirical literature that relates to the subject of the current study.

This observation is supported by Harle (2009:5) who argues that the majority of information particularly in electronic form is currently published and hosted outside

Africa. The extent to which African universities are able to develop their digital libraries is, therefore, largely dependent on the will of external forces including speed and reliability of access to international broadband networks.

To fill this gap, the study aimed to investigate the current status of digital libraries and the contributions they have made towards more effective knowledge creation, access and dissemination in Africa. In an attempt to achieve this, the study examined the origin, growth and current status of digital libraries; identified critical issues surrounding their existence; and investigated the level to which they had helped to reduce disparities in access to knowledge and promote the quality of education and research in Africa. It also explored the challenges met in the development, management and use of these libraries with a view to improving them.

The data collection and analysis was largely based on a review of the extant literature as well as analysis of statistical data collected from a number of organisations and websites. The findings are expected to help information professionals and particularly digital librarians to understand what is taking place and enable them to play a more substantive role in spearheading and promoting the growth of digital libraries in Africa.

To standardise interpretation of findings, the study attached specific meanings to a number of operational terms. One such term is knowledge gap, which as defined by Evers (2002:2) refers to the unequal distribution of knowledge across and within countries. The manifestation of the gaps can be seen in two perspectives, namely: the number of knowledge resources available in African libraries; and the education opportunities and research products emanating from them.

Despite their different connotations, data, information and knowledge are terms often used interchangeably. According to Dodig-Crnkovic (2013:para. 23), data is a series of disconnected facts and observations. These may be converted to information by analysing, cross-referring, selecting, sorting, summarising, or in some way organising the data. Patterns of information, in turn, can be worked up into a coherent body of knowledge. Knowledge consists of an organised body of information; such information patterns form the basis of the kinds of insights and judgments which are called wisdom.

According to Reitz (2013:para. 157), a library is a collection or group of collections of books and/or other print or non-print materials organised and maintained for use. On the one hand, an electronic library consists of services and materials that are both in digital as well as a variety of analogue formats that require electricity and specialised equipment to use. On the other hand, a digital library consists of services and materials that are stored, processed and transferred via digital (binary) devices and networks. Digital services are services (eg, reference assistance) that are delivered digitally over computer networks.

Marchionini (2002:3) adds that digital libraries are the 'logical extensions and augmentations of physical libraries in the electronic information society'. By extension,

digital libraries do not break away, but rather amplify existing resources and services of traditional libraries; and by augmentations, they offer new services and new opportunities for human information seeking and problem solving.

Both digital and electronic libraries can be virtual libraries if they exist only virtually, that is, they do not exist 'in real life'. For example, a virtual library can consist of material from a variety of separate libraries that are organised in a virtual space using computers and computer networks. One of the best examples of a virtual library is the Networked Computer Science Technical Reports Library (Sridhar 2007:2).

According to the Global Knowledge Partnership (2005:44), local content refers to the locally owned and adapted knowledge of a community – where the community is defined by its location, culture, language, or area of interest.

## 2 THEORETICAL FRAMEWORK

The study was based on the Medium Theory of two Canadians, Harold Adams Innis and Herbert Marshall McLuhan, who adapted the principles of economic monopolies to the study of information monopolies. The theory argues that one way in which social and political power is wielded is through control over communication media (such as a complex writing system controlled by a special class of priests). However, according to Agrawal (2010:48), information monopolies can be broken, by new media. He points out that the medieval monopoly over religious information was broken by the printing press. Just like the printing press, which bypassed the scribes and allowed for the wider availability of the scriptures and other religious texts, mobile phone technology has gained wider access thereby bridging the information gaps that previously existed between the rich and the poor.

The Medium Theory contrasts the Knowledge-gap Hypothesis Theory later proposed by Phillip J. Tichenor, George A. Donohue and Clarice N. Olien in 1970 in the article 'Mass media flow and differential growth in knowledge'. The hypothesis suggests that each new medium increases the gap between the information rich and information poor, because of differences in access to the medium, and control over its use, among other factors. It is believed that the increase of information in society is not evenly acquired by every member of society: people with higher socio-economic status tend to have a better ability to acquire information. This leads to a division of two groups, namely: a group of better-educated people who know more about most things; and those with low education who know less (Weng 2000:para. 1).

However, the Knowledge-gap Hypothesis fails to consider the dynamics of the medium itself and how it responds differently to various approaches of its management. If poorly managed, the Internet and all its feeder digital libraries, for instance, are no different from any other media. They could accelerate and widen the gap between the knowledge

rich and the knowledge poor because of the high speed with which information is generated and shared across the globe.

Nevertheless, because anyone who has the necessary infrastructure can have universal and simultaneous access to much of the Internet content at all times, the Internet can be seen as one of the few media that could bridge the knowledge gap rather than widen it. Such media as the telephone, television and radio have many intermediaries who control the communication process and even when a person has access to the universe of information they air, the user has very little say over the content.

Furthermore, they act as ephemeral transmitters of information while the Internet is not only a transmitter, but also a library as well as an archival system, and any information accessed today will possibly still be available tomorrow and the day thereafter. Even where the content of digital libraries is controlled through subscriptions, as is the case in most parts of Africa, these subscriptions are much cheaper and quicker to acquire and avail than their printed surrogates. These features are very important in bridging the knowledge gap which often thrives on the lack of standard procedures and privileges and to a large extent varied content in knowledge acquisition and delivery processes.

### **3 METHODOLOGY**

The study was based on a review of the extant literature and findings of previous studies on digital libraries in Africa. A review of the historical perspective of the development of digital libraries in the world and Africa in particular has provided a panorama of important issues and trends necessary in understanding the point the continent has reached in the growth of her virtual library systems. The study also attempted to identify and analyse critical issues surrounding the existence of digital libraries in Africa. The analysis of the extant literature was used to investigate the level to which digital libraries had helped to reduce disparities in access to knowledge and information and promote the quality of education and research in Africa.

A number of resources both in digital and print formats were used, including internetworldstats.com, theworldbank.org and speedtest.net websites in order to get comparative statistics and interpretations of internet penetration in various parts of the world as a measure of growth and development of digital libraries. The sites were also useful in showing global trends in generation and consumption of digital resources in different parts of the world particularly Africa. An analysis of these statistics and associated interpretations was done using descriptive approaches.

### **4 FINDINGS**

The findings were in four thematic areas, namely: the development of digital libraries; trends and issues in digital libraries; the status of African scholarly information on the Internet; and an analysis of the standing of Africa's digital libraries.

## 4.1 THE DEVELOPMENT OF DIGITAL LIBRARIES

With the exponential expansion of the Internet and World Wide Web (Web), digital libraries are significant to the operations of modern libraries. However, the topic on the history and development of digital libraries is increasingly becoming more and more complex as it cuts across a large number of areas in library, information technology and computer sciences. These areas include: information indexing and retrieval; collection development; database management; reference and referral services; human-computer interaction; interface design; digitalisation and preservation; intellectual property; and library cooperation and interoperability, among many others.

Historical facts are not clear as to when the first digital library came into existence, but the common ground is that the concept did not appear until the late 1980s. The idea was born out of two circumstantial needs, namely: the need to integrate various technological solutions especially in the area of multimedia services in order to provide an all in one package; as well as the need to ameliorate information sharing provisions and make them more efficient and user friendly.

However, the development of digital libraries has faced several challenges. One of the several scholars who have attempted to put these challenges into perspective summarises them as follows:

Digital libraries have faced a series of difficulties: first technical, then economic, currently legal, and next, we will face social problems. How do we avoid a world in which junk information is taking over, because the new world has much less effective refereeing and reviewing? My particular worry is that as we rely increasingly on PageRank and social filtering, even without deliberate abuse by spammers or ‘gamers’, we suffer two consequences . . . (1) The number of works read shrinks . . . (2) Effective filtering means that people read only what they agree with already (Lesk 2012:592).

These problems have continued to manifest themselves since 1989, when the Web project was first proposed and since mid-1993, when it grew at an exponential rate. Users could browse and set up a node on the network to put information on it. It is popularly believed that this was the beginning of a true digital library. However, without a catalogue, these digital library services and search tools were rudimentary and relatively more technical to use.

In the early and mid-1990s, higher levels of funding were given to digital libraries which led to a booming era with a large number of visionary projects. Scholars in the field wanted to find ways to apply or create technologies in order to better use and share information on the network systems, which themselves were developing at an amazing speed. This shared vision is best illustrated by the Digital Library Initiative which is one of the largest digital library projects established by Harvard University in the United States (US) in 1998 to help in advancing the means to collect, store, and

organise information in digital forms, and make it available for searching, retrieval, and processing via communication networks.

The US dominates the world of digital libraries with some of the biggest projects concentrated in its university libraries, including the: University of Michigan Digital Library Research Project; University of Illinois at Urbana-Champaign Digital Library Research Project; and University of California at Berkeley Digital Library Research Project, among many others.

The technical and engineering basis for digital libraries also reaches back several decades, to the 1960s, and includes on-line research and commercial information services, library automation systems, document structuring and manipulation systems, human computer interface work and a wealth of other efforts. According to Lynch (2005:para. 4), technologies like distributed search (eg, Z39.50) were well established by the late 1980s; it is easy today to forget that Kahn and Cerf's seminal integrative paper 'The Digital Library Project Volume 1: the World of Knowbots' was written in 1987–1988. Indeed, by the mid-1980s, there were systems both in the commercial sector and the research world that might reasonably be considered digital libraries at least by some definitions. Very substantial digital library systems were developed prior to the Web.

In Africa, libraries were not as quick to embrace digital technologies as in the developed parts of the world. This could be attributed partly to the perennial problems of technological infrastructure and requisite ICT knowledge and skills. Furthermore, digital library initiatives in Africa largely revolved around university libraries whose efforts in this area were made possible by the need to transform and beef up their print collections which were highly inadequate. According to Rosenberg (2006:2), the transformation included more investment in terms of electronic infrastructure and connectivity as well as attention to e-learning and related approaches as key tools to enhance the quality of higher education and make it more accessible.

Rosenberg (2006) asserts that in order for this transformation to succeed, several logical stages must be followed, namely: listing the contents; developing an electronic catalogue; networking the catalogue; offering full electronic text of journals and books offline or online; digitising locally produced information; and establishing institutional repositories, to provide access to the scholarly material produced by members of the university.

Ultimately, value addition to optimise the usage of the digital materials is required. This entails: training staff and students in information literacy; developing 'middleware' to enable seamless searching and access to information; forming partnerships with academic departments in delivering e-content in flexible learning environments; and developing e-services that meet user needs. Beyond this, many libraries would also like to see their academic staff and students interact electronically with the library's, and ultimately the world's, scholarly content without actually visiting the library. In real

practice, few African libraries have reached this status and most are at some intermediate stage (Rosenberg 2006:2).

Over the past few years, considerable efforts have been made to ensure that university communities in Africa are able access the growing quantities of information resources now in digital format. Support has been provided in creating awareness; setting up the required networked infrastructure; and providing the necessary hardware and software. Negotiations have resulted in journals and databases being made available free or at heavily discounted prices through programmes like AGORA, HINARI, OARE, The World Bank, eIFL, PERI, as well as United Nations Educational, Scientific and Cultural Organisation (UNESCO 2005) digital repositories initiatives and much training is still ongoing.

From 30 November to 1 December 2005, UNESCO and the Coalition of South African Library Consortia (COSALC) held a workshop known as *Building digital library collections using the Greenstone* at the University of Cape Town. Delegates from Ethiopia, Lesotho, Namibia, New Zealand, Swaziland, Sudan and host country South Africa participated. It was the third in a series of activities organised by COSALC and Sivulile<sup>1</sup> aimed at raising awareness on open access models for information exchange, and ICT capacity building of information professionals in African institutions. The efforts aimed at supporting the creation of digital libraries and providing archivists and librarians in Africa with the skills to utilise electronic information tools and resources in their work and enhance access to online resources.

On the basis of these activities, the participants made recommendations for promoting awareness, and providing training and technical support to enable digital libraries to play a larger role in addressing development challenges on the continent. Particular attention was given in the study to localisation and support for African languages. Greenstone and other similar open source packages were developed so that users could organise, create and publish digital collections of electronic files on the Web or on CD-ROM. It is currently being used by a number of academics, civil society organisations, governments and public institutions around the world to disseminate information on a variety of topics ranging from e-books to innovative agricultural practices. Jointly, these initiatives marked a major turning point on the African continent and the beginning of an era when digital libraries would move from obscurity to the open scene (UNESCO 2005:para. 6).

According to Rosenberg (2006:2), libraries which became automated several years ago have been unable to migrate or upgrade to new systems, and so they offer only limited services. Those libraries that have advanced down the digital road do not yet appear to have explored user needs in the digital world and the possibilities of a more dynamic interaction with ICTs. The philosophy of the academic library as a passive repository remains real. The necessary changes in service provision and staffing structures have not taken place. Librarians themselves have not had the opportunities to critically reflect



on what has already been developed and express their priorities for the future with regard to digital libraries.

This historical perspective offers some insights into the status of digital libraries in Africa. First, the socio-economic disadvantage that Africa has suffered for a very long time has had tremendous effect on the uptake of digital library concept. In addition, Africa has lacked a coordinated approach to the development of the digital libraries leaving much of the achievements so far recorded to be highly subjective and disjointed. In equal measure, the contribution of Africa has been dismal in terms of generating the content that makes up the digital collection as compounded by Teferra (2004:159) who asserts that ‘Africa produces less than 1 per cent of global knowledge’.

The following snapshot of some of the most recent activities in digital libraries on the African continent can give a glimpse of the direction the continent has taken in the development of digital libraries.

The First International Conference on African Digital Libraries and Archives (ICADLA-1), was held from 1–3 July 2009 at the United Nations Conference Centre (UNCC), Addis Ababa, Ethiopia. On 8 June 2010, the Civilian Research and Development Foundation (CRDF) launched the new Middle East and North Africa Science and Technology Initiative. The initiative aimed to build and sustain excellence in science and technology; help young scientists to develop skills relevant to sustained employment; and promote science and technology based innovation and economic development in the Middle East, North Africa and Asia.

## **4.2 TRENDS AND ISSUES IN DIGITAL LIBRARIES**

The concept of digital libraries has continued to attract many professionals from different backgrounds, including: engineers, philosophers, entrepreneurs, a diversity of social scientists, lawyers, scientists and technicians. Librarians have been at the core of it all though some would argue, as Lynch (2005:para. 1) puts it, that digital libraries have very little to do with libraries as institutions or the practice of librarianship. Others argue that the issue of the future of libraries as social, cultural and community institutions, along with related questions about the character and treatment of what has come to be called ‘intellectual property’ in modern society, form perhaps the most central of the core questions within the discipline of digital libraries – and that these questions are too important to be left to librarians, who should be seen as nothing more than one group among a broad array of stakeholders.

Beyond the e-research and cyber infrastructure programmes, another trend is the great deal of investment across the higher education, cultural memory, and government and commercial sectors in systems and services like digital asset management, digital collection creation and management, local content and institutional repositories. All of these use the technological tools of digital libraries, and many of them draw upon the social tools and insights as well. Search technologies of various kinds, both at the

enterprise and internet-wide levels, also draw heavily on digital library technologies (Lynch 2005:para. 12).

According to Chisenga (1999:para. 2), the growth of the Internet has presented a rare opportunity for the people and institutions in Africa to contribute to the development of the content of the global information infrastructure. The benefits of contributing to global information are many and include the following which were identified by the United Nations Economic Commission for Africa (UNECA 1996): make African people producers of indigenous information and knowledge and not simply passive consumers of imported information; enable Africa to export information and knowledge and to participate pro-actively in the development of the global information infrastructure; provide African researchers and scientists with access to information on Africa generated from within the continent; enable African researchers and scientists to collaborate on equal footing with their peers around the world irrespective of distance; and promote African cultural heritage, including the modern cultural sector of its rich and growing film and music industries.

Contributing to the information and cultural content of global information can be done in many ways, including: posting local information content on Web sites; creating Subject Based Information Gateways; creating electronic databases, digitalisation of documents and artefacts as well as indigenous language orientation.

Finally, there are numerous areas of research related to the historic interests of the digital library community that are at the crossroads of technology and social science and which will demand investment and attention in the coming years. Many of these are natural extensions of the collaborations initiated by the past decade of digital library research programs. Some of the most compelling research areas include personal information management. As more and more of the activities in people's lives are captured, represented and stored in digital form, the questions of how to organise, manage, share, and preserve these digital representations has become increasingly crucial. According to Lynch (2005:para. 17), some of the trends lending urgency to this research area include: the development of digital medical records; the overall shift of communications to email and mobile phone messaging; and the amassing of very large personal collections of digital content such as text, images, video and sound recordings.

The other area of great interest is the role of digital libraries, digital collections and other information services in supporting teaching, learning, and human development. The analysis here needs to be done not on a relatively transactional basis but how information resources and services can be part of long term development and learning that spans an entire human lifetime, from early childhood to old age.

Perhaps the most important theme here, and one that may point to a major direction for research that follows on the last decade of progress in digital libraries, is connecting and integrating digital libraries with broader individual, group and societal activities, and doing this across meaningful time horizons that recognise digital libraries and related

constructs as an integral and permanent part of the evolving information environment. The next decade for digital libraries may well be characterised most profoundly by the transition from technologies and prototypes to the ever-present, immersive, and pervasive deployment of digital library technologies and services in the broader information and information technology landscape (Lynch 2005:para. 21).

A summary of the ongoing trends in the development is well captured by Kavulya (2007:312) who argues that digital libraries are becoming more and more prevalent worldwide and there is no doubt that the future of knowledge creation and information sharing lies in electronic networks. To reap the most out of this scenario the sub-Saharan countries need to position themselves in the current society by putting in place the infrastructure to facilitate better knowledge gathering, processing, distribution, access and application. Digital libraries will continue to enable libraries in the region to reform their knowledge management approaches and services and hence, boost their capacity to enhance modernisation of the communities they serve.

However, despite the numerous actions and projects in place including the African Virtual Library and the African Virtual University, it is still difficult to obtain a good overview of the current status of electronic and digital initiatives in Africa. Information is scanty but the available evidence suggests that progress made by libraries is very uneven, both between and within countries. According to Rosenberg (2006:2), some university libraries have embraced the new media and made them available to users, while others do not have the necessary infrastructure to access those e-resources now available on countrywide subscriptions. While some libraries are fully automated, others remain manually organised.

Another challenge is the difficulty of measuring the extent of being digital. To this end Igun (2013:14) provides a criterion developed by the Digital Library Federation which requires that for a library to be 'predominantly digital', 99 per cent of its interlibrary loan request must be submitted electronically; 95 per cent of all use of library-provided indices is digital (with 75 per cent being used remotely); and 65 per cent of reference desk questions be answered with digital resources. Furthermore, 50 per cent of journals must have some digital components; 31 per cent of interlibrary loan photocopies should be transmitted electronically; 10 per cent of the materials budget be expended on digital resources; and 5 per cent of all resources must be digital full text. Applying these criteria, it can only be generalised that African digital libraries have not reached the highest level of development and most are at some intermediate stage.

### **4.3 STATUS OF AFRICAN SCHOLARLY INFORMATION ON THE INTERNET**

A number of scholars have written articles highlighting efforts that have been made to help Africa improve her rating in terms of scholarly content including journals and research content on the internet. According to Hussein and Priestly (2002), as quoted

by Chiware (2007:1), the opportunities and obstacles for producing scholarly journals vary considerably in Africa due to the diverse and geopolitical and economic conditions within different African countries.

Chiware (2007:4), on the other hand, asserts that a growing number of African journals, including scientific and technological ones, are now available online through a number of collaborative international as well as national projects. Scientists and publishers in many countries face problems in accessing research information and gaining visibility for their own publications. Many still use the print technology to publish their works – a process that is both expensive and economically disparaging. The transfer of e-publishing technology and online distribution of such journals can greatly increase visibility and enrich the global knowledge base. A number of collaborative efforts in electronic publishing and dissemination have been put in place to overcome these problems.

Some of these collaborative efforts include the Electronic Publishing Trust, which pioneered access to full-text articles in African journals in 1996 for development in collaboration with Bioline. This was done to enable open access to the world's scholarly publications and to support the electronic publication of reviewed bioscience journals from countries experiencing difficulties with traditional publication. On the other hand, the Programme for the Enhancement of Research Information (PERI), coordinated by the International Network for the Availability of Scientific Publications (INASP), has been strengthening research capacities by reinforcing local efforts to produce, disseminate and access to scholarly information and knowledge especially among African countries. According to Ballantyne (2004 a) as quoted by Chiware (2007:2), INASP has successfully achieved these objectives by bringing affordable global information to researchers in developing countries; by stimulating and supporting the publication and dissemination of in country research findings; and by providing information and communication skills training for researchers, practitioners, librarians and publishers.

The PERI programme incorporates several aspects, including delivery of research and scholarly information where participating libraries access a large volume of full-text journals and bibliographic databases from over 30 publishers. Participants from the developing countries pay highly subsidised subscription rates which help researchers, university libraries and information managers in research institutes and universities access the journals cheaply and make up for the acute shortage of print resources in their libraries. Access is also available to government and other non-profit organisations because of the countrywide nature of the licences that INASP pays for.

INASP is also instrumental in disseminating national research with the aim to increase the visibility and accessibility of research carried out in developing countries, its main output being African Journals Online that provides a web platform of tables of contents and abstracts from several African published peer-reviewed journals with links to the full text, if available.

Since onset, INASP has been instrumental in enhancing ICT skills to enhance the proficiency of information professionals, researchers and academics in developing countries to make effective use of electronic information resources and tool. Ballantyne (2004b) as quoted by Chiware (2007:2) notes that the main challenge is the possibility of extending from being an African journals indexing tool to becoming an African journals publishing platform. African universities and research institutions host a number of scholarly journals and could play a leading role towards this direction.

The Database of African Theses and Dissertations (DATAD) is an initiative that was born out of a 2000 feasibility study carried out for a pilot project to index, abstract and distribute theses and dissertations completed in African universities. The programme aims to improve management and access to African scholarly work. Theses and dissertations represent a significant proportion of Africa's research activity. However, access to this research output is not easy, even within the host institutions. Theses in African HEIs are usually produced in very limited quantities and almost entirely in print format and can only be consulted physically in a university library.

The programme's long-term objectives include: working with participating institutions to build a regional database of theses and dissertations, creation of conducive environment for research and publication in the African region and creating capacity in African universities for the electronic collection. Other objectives are management and dissemination of theses and dissertations, providing visibility and accessibility to the work of African scholars as well as facilitating the protection of the intellectual property rights of African university communities. The programme also aims at providing support for the Association of African Universities (AAU) programmes which aim at capacity building in research; promotion of cooperation among member universities; and the networking of HEIs.

#### **4.4 A COMPARATIVE ANALYSIS OF AFRICA'S DIGITAL LIBRARIES STANDING**

Digital libraries depend heavily on the digital media particularly the Internet. For the African continent to make a meaningful impact on the generation and dissemination of the digital content and reduction of the knowledge gap between citizens and libraries and the rest of the world, their Internet connectivity must be up to the mark. To understand this reality, an analysis of how Africa compares with the rest of the world in terms of generation, access and uptake of Internet resources is necessary. This has been achieved by examining a number of statistical data from several research reports and websites. To put the current statistics into perspective, reference is made to a presentation made during the First Meeting of the Committee on Development Information (CODI) from 28 June – 2 July 1999 in Addis Ababa, Ethiopia, where it was reported that:

A recent survey shows that Africa generates only around 0.4 per cent (1:250) of global content. What is more is that when South Africa is excluded, the rest of Africa generates

a mere 0.02 per cent (1:5000)! More frustrating is that Africa's share of Internet hosts has been declining ever since 1995 despite a brief rise in 1997, according to a survey conducted by Network Wizards. This could be regarded as a warning for the paucity of African capacity for generating content! That said, the picture is slowly but steadily improving. Nearly all African countries online have some form of locally or internationally hosted web server, unofficially or officially representing the country with varying degree of comprehensiveness (UNECA 1999:para. 4).

More than seven years down the line, not much had been achieved in terms of ameliorating the situation. This reality was perhaps captured best in the following excerpt:

Despite the tremendous surge in ethnic portals, there is only a few Internet-content generated by ethnic communities themselves or organized around their unique cultural interests and practices . . . very little of the information on the Internet presently is directly suitable for dissemination to poor communities as it is. It needs to be repackaged to ensure local suitability and relevance; also very little information proceeds from these African communities to the outside world, hence, the need for digitizing Africa's local content for an increased access (Akinde 2007:47).

However, with the recent connection of several African countries on the fibre optic network, some slight improvements have been realised even though a lot more still needs to be done. The growth can also be attributed to the growing number of mobile phones, and increasing access to affordable Internet on the African continent. The African 'blogosphere' is perhaps the best example of these changes. According to Wikipedia (2013:para. 21), Internet usage in Africa is now growing even faster than mobile telephony. Between 2000 and 2008, Internet subscriptions grew by 1 030.2 per cent, versus the world average of 290.6 per cent. Sanneh (2013:para. 7) seconds this observation by saying that use of the Internet, mobile phones and social networks, is now making it possible for anyone with a connection to tell their own story. Every day the continent is becoming increasingly connected.

Initially, an Internet search resulted in only a handful of postings from across the continent. Now there are thousands of African blogs and the numbers continue to grow exponentially. Afrigator (South Africa), Afrinnovator (Kenya), Akouaba (Congo), Naijapulse (Nigeria) and BlogSpirit (Uganda) have emerged as Internet platforms that aggregate, organise and distribute the ever-increasing amount of digital information. Besides, Africa is also starting to produce talented programmers developing ingenious projects. In 2006, Nathan Eagle of MIT launched an innovative curriculum needed to train local programmers in Nairobi. The program has now expanded to universities in ten sub-Saharan countries and reflects the growing demand for and interest in the subject.

A look at the world Internet usage statistics may also reveal the extent to which the African continent is faring in terms of the generation and consumption of global Internet content as shown in Table 1:

**Table 1:** World Internet users and population stats

World Regions	Population (2012 Est.)	Internet Users Dec. 31, 2000	Internet Users Latest Data	Growth 2000-2012	Users % of Table	Penetration (% Population)
North America	348,280,154	108,096,800	273,785,413	153.3 %	11.4 %	78.6 %
Oceania / Australia	35,903,569	7,620,480	24,287,919	218.7 %	1.0 %	67.6 %
Europe	820,918,446	105,096,093	518,512,109	393.4 %	21.5 %	63.2 %
Latin America / Caribbean	593,688,638	18,068,919	254,915,745	1,310.8 %	10.6 %	42.9 %
Middle East	223,608,203	3,284,800	90,000,455	2,639.9 %	3.7 %	40.2 %
Asia	3,922,066,987	114,304,000	1,076,681,059	841.9 %	44.8 %	27.5 %
Africa	1,073,380,925	4,514,400	167,335,676	3,606.7 %	7.0 %	15.6 %

Source: <http://www.internetworldstats.com/> (17 November 2013)

According to these statistics, only 15.6 per cent of the African population used the Internet. However, this number represented only 7 per cent of the global Internet usage in spite of the fact that Africa represented about 15 per cent of the world population. Besides, in spite of registering the fastest growth in the number of Internet users (167 335 676 from 2000 – 2013), the continent’s penetration rate still trailed the rest of the world at 15.6 per cent.

Featuring poorly both in terms of Internet usage and penetration rate implied that the continent’s participation both in the generation and use of the digital content on the Web was not quite significant. With the bleak reality that much of the knowledge content on the African continent in both print and digital forms is foreign and given that a large portion of the Internet content and traffic constitutes emails and junk materials, Africa’s meaningful share of the global internet was far much less than the 7 per cent indicated. In essence, these statistics were a fair measure of the knowledge gap between Africa and the rest of the world which needs to be bridged.

Another measure of how Africa was performing in terms of using and contributing to the internet content follows in Table 2:

The table shows that Africa compared poorly with other regions of the world in terms of Internet usage. Being relatively cheaper, easier and faster to access than the print media, the Web contains millions of scholarly resources in the form of electronic books, journals and research papers which substantially help to reduce huge gaps in library collections. The low Internet download and upload data rates of 100 KB/sec (4.1%) and 31 KB/sec (6.2%), therefore, means that Africa was still highly underutilising this resource. Given that the highest percentage of Internet traffic constituted mails and other

**Table 2:** Ranking of world regions by average Internet upload and download speeds and rates

Rank	Continent	Download		Upload	
		Speed	Rate	Speed	Rate
1	North America	7315 kbps	914 KB/sec	1498 kbps	187 KB/sec
2	Europe	5013 kbps	627 KB/sec	1010 kbps	126 KB/sec
3	Oceania	3122 kbps	390 KB/sec	466 kbps	58 KB/sec
4	South America	2154 kbps	269 KB/sec	419 kbps	52 KB/sec
5	Asia	1070 kbps	134 KB/sec	323 kbps	40 KB/sec
6	Africa	801 kbps (4.1%)	100 KB/sec (4.1%)	245 kbps (6.1%)	31 KB/sec (6.2%)
7	World	4188 kbps	524 KB/sec	889 kbps	111 KB/sec

Source: Internet Speed Test – SpeedTests net, <http://www.speedtests.net/world/> (12 April 2012)

unscholarly content, the low upload ratio means that indeed, Africa still contributed only a dismal amount of content to the Internet thus perpetuating the picture and culture of mega consumer and mini producer.

## 5 CHALLENGES AND RECOMMENDATIONS

The uniqueness of the African scene has resulted in unique problems in the promotion of digital libraries. One of the main challenges in this area is the fact that historically, digital libraries on the African continent were spearheaded by and largely confined to university libraries. This means that any problem affecting African universities and their libraries in particular will automatically affect them.

Undoubtedly, there are several challenges facing African universities and research institutions in their quest to facelift their digital content, including problems of access, policy, limited research capacities as well as resources.

According to Chiware (2007:5), most ICT projects in African universities have been achieved through donor funding; thus, when such funding dwindles, the possibility of the projects going under is very high. Unless funding problems are seriously addressed, the capacity of African universities and research institutions to publish both in print and electronic media will remain quite limited.

Universities in other regions like southern Africa are building IT infrastructure from their own funding which largely comes from the government. Universities in countries like South Africa, Botswana, Namibia, Zimbabwe, Lesotho and Swaziland have achieved a certain level of IT development that compares well with HEIs outside the continent.



Chiwere (2007:8) also asserts that bandwidth is one of the scarcest resources in African ICT development. Most universities still connect to the Internet through a system of lease payments which are very costly to maintain. Furthermore, the leases do not deliver reliable services because they are always shared yet disguised as dedicated connections.

The recent hook-up to the terrestrial fibre optic infrastructure by several African countries was widely expected to lower Internet charges; yet, this has not happened on the expected scale so access to digital libraries remains difficult.

Another challenge facing the African scientific and technological community in electronic publishing is the crisis in their research capacities to create and sustain the quality of educational research that is essential to national development and self-determination. This problem is quite common in scenarios where universities for instance lack sufficient funds to support aspiring research interests or participation in regional and international professional forums such as conferences and seminars. In fact, due to the continuing deterioration of the economic status of the African continent, it is estimated that the 'research capacities of African universities have declined by as much as 50 per cent in the past decade'. Chiwere (2007:6) argues that the emergence of a more active community of African scholars is required for the African universities' enhanced capacity to create, develop and disseminate scientific and technological information through the Internet.

Most African countries are also still reeling from the aftermath of colonial rule and their laws relating to intellectual property rights focus more on punishment than facilitation. In this scenario, African countries generally lack appropriate laws for local innovation and cultural development. There are also inadequate policies to create a balance between public and private ownership, local resources and foreign direct investment, monopoly and competition in communication and value added services (UNECA 1999:25).

To overcome these challenges, the following needs to be done:

- African governments and HEIs should create a conducive environment with appropriate incentives to foster the growth of digital libraries and facilitate them to contribute more effectively to information and cultural development.
- African governments must facilitate further lowering of bandwidth cost for HEIs and other research institutions in order to realise long-term development of digital libraries and allow the creation of sustainable local content.
- Africa should manage her ICT resources well by paying due attention to the vulnerability to vandalism of the modern media such as the fibre optic cables and infrastructure in order to safeguard and maximise the limited bandwidth.
- African governments and HEIs must put in place all-encompassing ICT policy frameworks to guide how their ICT resources can be maximised for effective generation and dissemination of digital information content.

- African governments should work closely with stakeholders, form networks to share experiences and resources as well as develop appropriate models that suit each country.
- African universities should embrace appropriate digital technology to enhance efforts in reducing printing costs and in disseminating knowledge.
- Continuous efforts should be made by HEIs to improve the quality of electronic journals, research reports and related information that is of academic value.
- African governments should increase investment in the development of digital libraries and content to reduce the existing disparities and barriers to universal access to knowledge resources.
- More studies should be conducted to determine the current technical, economic, legal, and social constraints that affect the development of digital libraries and come up with suitable solutions that fit within what is currently practical in Africa.

## 6 CONCLUSION

Despite the huge potential that digital libraries have towards bridging the knowledge gap in Africa, the article has shown that their growth and development are still rudimentary, with a low contribution to the growth and development of scholarship. This has been caused by a number of problems, including: poverty; lack of enabling policy environment; limited Internet bandwidth; poor infrastructure; and dependence on dwindling donor funding. It is also evident that few scholars are showing an interest in studies that could provide new knowledge to foster their growth.

However, there is evidence, especially from the global Internet penetration levels, that the development of digital libraries on the continent is continuing to improve and governments and HEIs in Africa need to create a conducive environment for this growth to continue. There is also a need to: facilitate lower Internet bandwidth cost; manage ICT resources properly in order to minimise wastage; as well as put in place appropriate ICT policy frameworks.

African governments and HEIs in particular must show commitment to their development agenda and create networks to share their experiences and resources. They must also increase their general investment in the development of digital libraries and spearhead the use of appropriate digital technologies to reduce printing costs and improve the quality of scholarly publications.

On the other hand, Africa's research communities should conduct more studies to generate new knowledge and come up with more relevant and practical solutions to problems affecting the development of digital libraries on the continent.

## NOTE

1. Sivulile in isiXhosa means 'We are open' and expresses South African support for the global open access movement.

## REFERENCES

- Agrawal, N. 2010. *Theories of communication and mass media*. Jaipur: Global Media.
- Akinde, TA. 2007. Digitizing African local content: the way forward. *Information Technology* 1:44–50.
- Ballantyne, DR. 2004a. Enhancing access to information in higher education and research, *New Review of Information Networking* 10(1):107–114.
- Ballantyne, DR. 2004b. *Scientific content creation and dissemination: opportunities for African universities in electronic publishing*. Windhoek: University of Namibia.
- Chisenga, J. 1999. *Global information infrastructure and the question of African content. Paper presented at the 65th IFLA Council and General Conference, 20–28 August, Bangkok, Thailand*. <http://www.glib.hcmuns.edu.vn/elib/iflanet/IV/IFLA65/PAPERS/118-116E.HTM> (Accessed 16 November 2013).
- Chiware, ER. 2007. Scientific content creation and dissemination: opportunities for African universities. *Africa Media Review* 15(1&2):58–67.
- Diagne, M. 2000. The African virtual university: bridging the knowledge gap for development. *TechKnowLogia* 2(1):21–22.
- Dodig-Crnkovic, G. 2005. *Knowledge map of information sciences: data, information and knowledge*. <http://www.success.co.il/is/dik.html> (Accessed 13 November 2013).
- Evers, H. 2002. Knowledge society and the knowledge gap. Paper read at an International Conference, 'Globalisation, Culture and Inequalities', in honour of the work of the late Professor Ishak Shari, 19–21 August, University Kebangsaan, Malaysia.
- Harle, J. 2009. *Digital resources for research: a review of access and use in African universities: an issues paper prepared as part of an ACU study for Arcadia*. London: Arcadia. <https://www.acu.ac.uk/focus-areas/digital-resources-for-research> (Accessed 13 November 2013).
- Hussein J. & Priestley, C. 2002. Current status and challenges ahead for scholarly journal publishing in Africa. Seminar on Strengthening Scholarly Publishing in Africa, 1–4 July, Zanzibar, Tanzania.
- Igun, SE. 2013. Digital libraries in Africa: evolution, status, and challenges. *International Journal of Digital Library Systems* 3(2):13–17.
- Kavulya, JM. 2007. Digital libraries and development in sub-Saharan Africa: a review of challenges and strategies. *The Electronic Library* 25(3):299–315.
- Lesk, M. 2012. A personal history of digital libraries. *Library Hi Tech* 30(4):592–603. <http://www.emeraldinsight.com/journals.htm?articleid=17065298> (Accessed 13 November 2013).
- Lynch, C. 2005. Where do we go from here?: the next decade for digital libraries. *D-Lib Magazine* 11(7/8). [http://www.godaisies.com/notes/LIS\\_688\\_DigiLib\\_Notes\\_2010-09-01.pdf](http://www.godaisies.com/notes/LIS_688_DigiLib_Notes_2010-09-01.pdf)

- Marchionini G. 2002. *Introduction to digital libraries*. Pisa, NC: University of North Carolina at Chapel Hill. <http://www.is.informatik.uni-duisburg.de> (Accessed 25 April 2011).
- Reitz, JM. 2013. *Online dictionary for Library and Information Science*. [http://www.abc-clio.com/ODLIS/odlis\\_1.aspx](http://www.abc-clio.com/ODLIS/odlis_1.aspx) (Accessed 13 November 2013).
- Rosenberg D. 2006. Towards the digital library in Africa. *Electronic Library* 24(3):289–293.
- Sanneh, A. 2013. Where is Africa on the Internet? *WIPO Magazine* April.
- Sridhar, MS. 2007. *Digital information management. Lecture delivered at Academic Staff College, University of Mysore in the refresher course on Library and Information Science, 30 November, ISRO Satellite Centre, Bangalore, India*. [http://eprints.rclis.org/10853/1/b1-24\\_digital\\_inf\\_mangt\\_ac\\_staff\\_col\\_nov\\_07.pdf](http://eprints.rclis.org/10853/1/b1-24_digital_inf_mangt_ac_staff_col_nov_07.pdf)
- Teferra, D. 2004. Striving at the periphery, craving for the centre: the realm of African scholarly communication in the digital age. *Journal of Scholarly Publishing* 35(3):159–171. <http://ahero.uwc.ac.za/index.php?module=cshe&action=downloadfile&fileid=18409092513330050259730> (Accessed 25 April 2011).
- UNECA *see* United Nations Economic Commission for Africa.
- UNESCO *see* United Nations Economic, Scientific and Cultural Organization.
- United Nations Economic, Scientific and Cultural Organization. 2005. *UNESCO supports training for building digital libraries in Africa*. [http://portal.unesco.org/ci/en/ev.php-URL\\_ID=20808 &URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201.html](http://portal.unesco.org/ci/en/ev.php-URL_ID=20808 &URL_DO=DO_TOPIC&URL_SECTION=201.html) (Accessed 13 November 2013).
- United Nations Economic Commission for Africa. 1999. Content creation and dissemination. Paper presented during the First Meeting of the Committee on Development Information (CODI), 28 June – 2 July, Addis Ababa, Ethiopia.
- Weng, S. 2000. *Mass communication theory and practice*. Taipei: San-ming.
- Wikipedia. 2013. *Internet in Africa*. [http://en.wikipedia.org/wiki/Internet\\_in\\_Africa](http://en.wikipedia.org/wiki/Internet_in_Africa) (Accessed 17 November 2013).
- World Bank Group. 2013. *Poverty headcount ratio at \$1.25 a day (PPP)*. Washington: World Bank Group. <http://www.worldbank.org/en/about/contacts> (Accessed 14 November 2013).