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# Managing digital information resources in Africa: Preserving the integrity of scholarship<sup>☆</sup>

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## KEYWORDS

Scholarship;  
Africa;  
Knowledge preservation;  
Digital knowledge  
resources;  
Libraries;  
Access to knowledge

**Summary** Permanent access and storage of recorded knowledge resources have been the cornerstone of libraries for centuries. Preserving the integrity of scholarship is one of the greatest challenges facing librarians and information professionals the world over today. In Africa the issue comes very much to the fore because of the prevailing conditions and the state of the continent's knowledge resources. This paper explores and reviews issues of permanency, accuracy, and integrity of stored digital knowledge resources in sub-Saharan Africa.  
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## Introduction

Today scholarly information is increasingly being produced in digital formats. It entails that the knowledge production process is conducted in the electronic environment. According to Subotzky and Cele (2004), worldwide, knowledge production and acquisition have changed to the extent that providers of higher education institutions are being challenged to produce “both relevant knowledge for the new informational economy, and graduates with the appropriate mix of disciplinary knowledge and generic competencies for the rapidly changing workplace”. The actors in this knowledge environment whether they be the creators of knowledge, the publishers of knowledge and the people that are finally responsible for permanently storing the resultant knowledge will need to possess the

necessary competency and knowledge skills to be able to participate fully in the digital environment. In many respects the electronic form is attractive to the author, publisher, vendor and libraries for the simple reason that the electronic form has revolutionized the way knowledge is produced and disseminated to the end user, usually in a fast, timely and efficient way. Although creators of knowledge, publishers and librarians alike, are all motivated by various factors, they are agreed on the potential the electronic medium brings to the knowledge production and management process. For libraries, the electronic environment has and is changing the way the librarian acquires, processes, stores and delivers information to users.

Several factors motivate interest in the electronic form of knowledge amongst Knowledge Creators, Publishers and Librarians. Knowledge creators are the “creators of intellectual property and original holders of copyright”; Librarians are the ones charged with “assisting the users of the intellectual property to access the property and that of acting as a custodian of the intellectual property on behalf of the author whilst Publishers are the managers and custodians thereof in the process of disseminating the intellectual property”, Fassen (2005). The common thread that runs through them is that they are all involved in one

<sup>☆</sup> A version of this paper was previously presented at the Bridging the North-South Divide in Scholarly Communications on Africa. Threats and Opportunities in the Digital Era Conference in Leiden, the Netherlands, 6–8 September 2006: <http://www.ascleiden.nl/GetPage.aspx?url=/events/event1142937906>.

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way or another in facilitating access to knowledge. Fassen (2005) further contends that in the final analysis “librarians, publishers and authors have a common interest in the long-term preservation of cultural heritage and languages”. It can therefore be argued that creator, publishers and librarians all want a situation where there is access to knowledge for all, regardless of the format in which the knowledge is packaged in.

Permanent access and storage of recorded knowledge resources has been the cornerstone of libraries for centuries. Libraries have prided themselves with having the privilege of being entrusted with the permanent storage of the results of scholarship. Preserving the integrity of scholarship is one of the greatest challenges facing librarians and information professionals the world over today. In Africa the issue comes very much to the fore because of the prevailing conditions and the state of the continents’ knowledge resources. The questions being posed are: What should libraries and interested institutions in Africa be doing to ensure not only the permanent storage and management of effective sustainable digital collections but most importantly on preserving Africa’s knowledge base? How do we ensure that digitally available knowledge resources will not be altered? How will integrity be maintained? Who and how do we archive these knowledge resources? This paper seeks to understand the effects of the increasing production of digital information resources on the tasks that libraries are faced within preserving the integrity of scholarship in Africa. These are tasks that libraries are faced within the digital environment on a daily basis. The paper will tackle the issues of permanency, accuracy, and integrity of stored digital knowledge resources.

### Five rules of librarianship

Librarians have been adapting to the digital environment to make meaning of Ranganathan’s five rules of librarianship (Ranganathan, 1963). These five rules are as relevant today as when he wrote them years ago:

Books are for use.  
Every reader has his or her book.

Every book has its reader.  
Save the time of the reader.  
The library is a growing organism.

Noruzi (2004) revised these laws in the context of what they would mean for information provision in today’s digital environment:

Web resources are for use.  
Every user his or her web resource.  
Every web resource [has] its user.  
Save the time of the user.  
The web resource is a growing organism.

In an article arguing the relevance of these laws in today’s digital age, Cloonan and Dove (2005), also came up with a comparison of Ranganathan’s five laws of librarianship and what they would mean in today’s environment. Their comparisons are summarized in Table 1

The American Librarian Association (1996) Library Bill of Rights goes further to assert that:

Books and other library resources should be provided for the interest, information, and enlightenment of all people of the community the library serves. Materials should not be excluded because of the origin, background, or views of those contributing to their creation. Libraries should provide materials and information presenting all points of view on current and historical issues. Materials should not be proscribed or removed because of partisan or doctrinal disapproval. Libraries should challenge censorship in the fulfillment of their responsibility to provide information and enlightenment. Libraries should cooperate with all persons and groups concerned with resisting abridgment of free expression and free access to ideas. A person’s right to use a library should not be denied or abridged because of origin, age, background, or views. Libraries which make exhibit spaces and meeting rooms available to the public they serve should make such facilities available on an equitable basis, regardless of

**Table 1** Imperatives motivated by the 5 laws: then and now (Cloonan & Dove, 2005).

The Law	In Ranganathan’s day	In today’s world
Books are for use	Put books in circulation - not just on the shelf	Make sure online resources are available where and when they’re needed
Every reader, his book	Break down barriers to the principle of education (and books) for all	Eliminate the obstacles that prevent users from making effective use of electronic resources
Every book, its reader	Open the stacks; provide a well-cross-referenced catalog	Integrate electronic resources into virtual learning environments and other web pages of the institution
Save the time of the reader	Create effective catalogs for speeding the readers’ search for particular books	Provide metasearching capabilities so that users can search entire sets of electronic resources. And link resolvers so that readers get access to the best source
A library is a growing organism	See libraries as part of the larger community	Offer 24/7 anytime, anywhere, access to libraries; the Information Commons; the Invisible Web

the beliefs or affiliations of individuals or groups requesting their use.

If the mainstay of Ranganathan's five laws of librarianship and the America Library Association Bill of Rights is the issue of "making information accessible to everyone", then the duties and responsibilities of libraries should be focused on meeting this challenge regardless of the era and the format in which the scholarly information is packaged.

Today, it is not unreasonable to envisage a situation where in the future all scholarly communication will be entirely in electronic format. [Fenton and Schonfeld \(2005\)](#), argue that "for most scholarly journals, the transition away from the print format and to an exclusive reliance on the electronic version seems all but inevitable, driven by user preferences for electronic journals and concerns about collecting the same information in two formats. But this shift away from print, in the absence of strategic planning by a higher proportion of libraries and publishers, may endanger the viability of certain journals and even the journal literature more broadly—while not even reducing costs in the ways that have long been assumed".

However, African countries are clearly not preparing for such eventualities. Whilst the whole world is striving to stay and keep ahead of the digital environment, the continent has still not moved any further in preparing for Africa's knowledge resources in the digital era. Higher institutions libraries in Africa are still largely dependent on print in accessing knowledge resources. Even the acquisition of print for the libraries has been a constant struggle. As a consequence university libraries' book and journal print purchases are almost non-existent. According to [Sawyer \(2004\)](#) the decline in the quality of education at higher institutions of learning is a result of the decline in financial resources in the 1970s and 1980s. For instance, from 1993, the Addis Ababa University in Ethiopia, University of Yaounde Medical School and the University of Nigeria cancelled journal subscriptions totaling 1200, 107 and 824, respectively, over the years ([Levey, 1993](#)). The University of Zambia Library has not purchased any journals since the 1980s without support from various funding agencies such as the American Association for the Advancement of Science and the Swedish International Development Authority ([Kanyengo, 2007](#)). At the University of Natal in South Africa, the main library there was forced to cut more than 250 journal subscriptions over a five year period ([Abdool Karim, 2003](#)). Generally, university libraries in Africa are under funded and poorly organised to respond to the current and emerging needs of supporting critical scholarship on the continent ([Olukoju, 2004](#); [Onari-Okemwa, 2007](#); [Sawyer, 2004](#); [Wirsiy, 2007](#)). The situation is similar to other libraries such as public libraries that have also seen a decline in funding levels. Several studies indicate that public libraries in Africa have suffered from inadequate funding thereby affecting their effectiveness in library service provision ([Akpohonor, 2005](#); [Chisenga, 2004](#); [Issak, 2000](#)).

Libraries are still trying to find themselves, but are slowly showing efforts of trying to move to the digital environment. They are hampered by the complexity of the numerous problems they are confronted with, such as low funding levels, staff shortages and infrastructure. At the

University of Zambia, there are yet no strategic plans on how to interact with digital information resources. The situation is similar in other African countries. As this trend is likely to continue, there is a fear that countries and institutions like the University of Zambia that are not taking preparatory measures in ensuring permanent access to electronic knowledge resources, will be left out, whenever the print form is no longer available to them.

### State of the Africa's knowledge resources

Africa's knowledge resources can be characterized into three broad categories: knowledge printed and published on the African continent, and knowledge printed and published in northern countries, and knowledge resources produced in Africa and not printed, commonly referred to as 'grey literature'. This knowledge resource (grey literature) is not only huge but not well organized and not easily accessible. As it is often unorganized, it is usually found scattered in people's homes and offices, and more recently on the Internet through self-publishing. The huge number of papers presented at conferences and workshops, if they were to go through a peer review process and then strengthened so that they find their way in different publication outputs, could be an enormous contribution to Africa's knowledge scholarship. If this knowledge resource were to be well organized and made accessible it could become a potential source of knowledge upon which to base future generations of knowledge production.

Studies done on publishing in Africa show a steady increase in research output in the continent's own periodicals and books published on the African continent. However, what is lacking is the diversity and plurality of the periodicals in many of the countries. In some of the African countries, for instance, there might be one journal for medicine, history, literature etc. Yet in some of the countries, the journals simply do not exist. Diversity and plurality will encourage and strengthen the research output so that knowledge resources are professionally produced in journals that are indexed worldwide in order to allow for wider access to the knowledge. According to [Olukoju \(2004: 363\)](#), academic publishing in Nigeria has declined since the 1970s in terms of "output, quality and regularity of publications". He argues that this is a result of the general funding decline towards education by the federal government as well as prolonged military rule, in this Western African State.

In a study by [Hofman, Kanyengo, and Kotzin \(2005\)](#), it was observed that sub-Saharan Africa Medical and Health researchers were publishing more of their research output in northern countries as compared to their own countries. They also concluded that when publishing in the sub-Saharan African region, researchers tended to publish predominantly in their own country's journals (see [Table 2](#)). [Teferra \(2004\)](#) contends that "Africa has the smallest scientific community in the world and consequently contributes a tiny amount of recorded and 'mainstream knowledge'". He further postulates that, "when such a scientific community is within the jurisdiction of a country that is economically poor, politically unstable, and infra-structurally precarious, these activities become more constrained and undermined." As a result Africa's total

**Table 2** Where are sub-Saharan African authors publishing? 1995–2004 (Hofman et al., 2005).

Country	SSA	Europe	USA	Canada	Other	Total
South Africa	2469	5638	3549	67	470	12,193
Nigeria	1981	2120	402	9	215	4727
Kenya	570	852	431	1	73	1927
Zimbabwe	409	406	155	1	20	991
Senegal	366	498	107	2	8	981
Ethiopia	406	350	107	2	20	885
Tanzania	138	462	105	2	12	719
Uganda	162	352	120	3	33	670
Cameroon	37	445	153	8	21	664
Ghana	149	361	111	5	34	660
<b>Total</b>	<b>6687</b>	<b>11,484</b>	<b>5085</b>	<b>100</b>	<b>1061</b>	<b>24,417</b>

scientific research output is estimated to be 4% of the world total.

Other authors point to the fact that indeed Africa's publishing efforts have been steadily increasing (Hassan, 2001; Ondari-Okemwa, 2007). Ondari-Okemwa (2007) in a study on publishing in sub-Saharan Africa using the Social Science Citation Index, results clearly indicates that South Africa research output increased from 4568 in 1997 to 6305 in 2006; Zambia from 99 in 1997 to 152 in 2007; Senegal from 168 in 1997 to 224 in 2006; Kenya from 582 in 1997 to 843 in 2006 and Uganda from 136 in 1997 to 382 in 2006. However, these statistics are not impressive enough when compared to other continents especially when one considers that Africa is the second most populated continent after Asia.

With such a small research output, the arrival of electronic publishing is posing several challenges to African institutions' access to knowledge resources. Electronic publishing encourages policies where access will be allowed to electronic information only for instance but not that institutions in Africa or anywhere in the world should electronically archive this information within these institutions once access has been granted (Warner, 2002). One would argue that such a process would guarantee African Institutions' permanent access to those resources that they subscribe to via online. However, the issue of permanence in electronic journals is currently under debate and commercial publishers are generally not willing to let go of the control of the information that will enable them to earn massive profits for years to come. According to Adebowale (2001), a group of Ohio University and college libraries struck a deal with Elsevier for \$6.3 million for 1000 electronic journals. It is difficult to imagine that there are universities in sub-Saharan Africa that can afford \$6.3 million for 1000 journals. And yet in the print era, universities were subscribing to well over 1000 journals for less money.

The issue for African libraries is whether electronic journals will be less expensive as compared to print subscriptions in the long-term. However, the trends show that publishers are hoping to reap massive profits and there is no sign yet that electronic subscriptions are going to be cheaper. The choices might not be so simple for African libraries, however, because if the market trend is that electronic journals are the way forward for commercial publishers in terms of profits and user base, then there might be no print journals to talk about in the future.

## Specificity of preservation issues in Africa

Preservation of information resources in general follows the various agreed standardized formats; these are highly impacted upon by the local realities of the implementing organizations. In addition to the typical problems of digital environments, in which libraries cannot copy and store information for preservation, libraries have to contend with the situational context in which they are located.

## Information policies

African countries are still struggling to come to terms with the digital environment and are therefore still struggling with the enactment of policies on handling information, be they print or electronic format. According to United Nations Economic Commission for Africa (2005), "national information policies in most African countries are not holistic in design and not strategically linked to development needs of the various sectors of the populations and economic sectors". They further argue that if information policies are comprehensively formulated and implemented, they would create an enabling environment in which knowledge resources are collected, stored, and preserved to foster access to it by the majority of the citizens. Evidence on the use of Information and Communication Technology (ICT) in African university libraries, themselves supposed to be the main repositories of knowledge on the continent is an indictment on the inadequate lack of preparations for the digital environment in which the institutions find themselves. A study done by Rosenberg (2005) of 62 libraries in sub-Saharan Africa found not only a heavy dependence on outside assistance for the support of the library and the information services provided by the libraries, but also found the state of Internet connectivity very minimal (see Table 3).

In Zambia, years after independence, they are still struggling to enact a library act and as a result, most institutions operate within a no policy framework. An enabling policy framework would allow institutions to implement various preservation strategies that are in line with their own parent institutions, but also operate within the overall country policy framework. These policy frameworks are essential, especially if they can feed into broader continental policies such as the New Partnership for Africa's Development (NEPAD) which is a VISION and STRATEGIC Framework for Africa's renewal initiative (NEPAD, 2001). The NEPAD initiative is very silent on the preservation of Africa's knowledge resources although it places prominence on the improvement of information and communication technology (ICT) infrastructure. The improvement of ICT infrastructure will do well if there are policy frameworks at the country level that support the preservation and permanent storage of African knowledge resources wherever they might be found and in whatever format they might be.

## Infrastructure

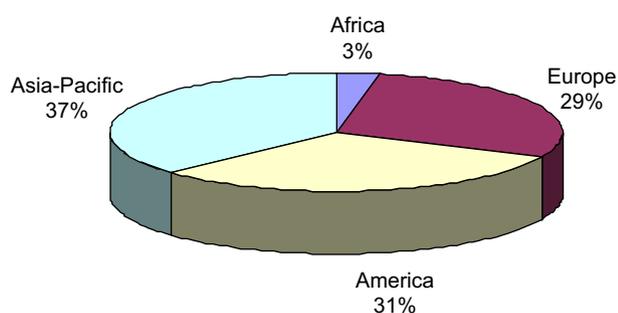
Africa's infrastructure is still lacking the ability to handle large preservation of knowledge resources, especially resources in electronic form. Access to ICT facilities is a daily struggle for institutions that are just barely

**Table 3** Status of Internet connectivity in university libraries in sub-Saharan Africa (Rosenberg, 2005).

	Total % (no.)	Excellent % (no.)	Good % (no.)	Adequate % (no.)	Poor % (no.)	Very poor % (no.)
Vsat	35% (22)	3% (2)	9% (6)	11% (7)	9% (6)	2% (1)
Leased line	29% (18)	0% (0)	2% (1)	13% (8)	11% (7)	3% (2)
Wireless/radio	11% (7)	0% (0)	2% (1)	3% (2)	3% (2)	3% (2)
Dial-up	9% (6)	0% (0)	0% (0)	3% (2)	6% (4)	0% (0)
None	14% (9)	—	—	—	—	—
No data	2% (1)	—	—	—	—	—
Totals		3% (2)	12% (8)	30% (19)	30% (19)	8% (5)
% (no.) libraries with computers						
Computers	In working order			Internet-connected		
100%	40% (25)			19% (12)		
75–99%	34% (21)			16% (10)		
50–74%	8% (5)			15% (9)		
1–49%	5% (3)			23% (14)		
0%	0% (0)			15% (9)		
No data provided	13% (8)			13% (8)		

managing to maintain access to print resources in order to meet the daily requirements for academic learning in higher educational institutions. According to [International Telecommunication Union \(2005\)](#), Internet usage in Africa is only 3%, making it the lowest in the world, and yet Africa has the largest population after Asia. (see [Fig. 1](#)).

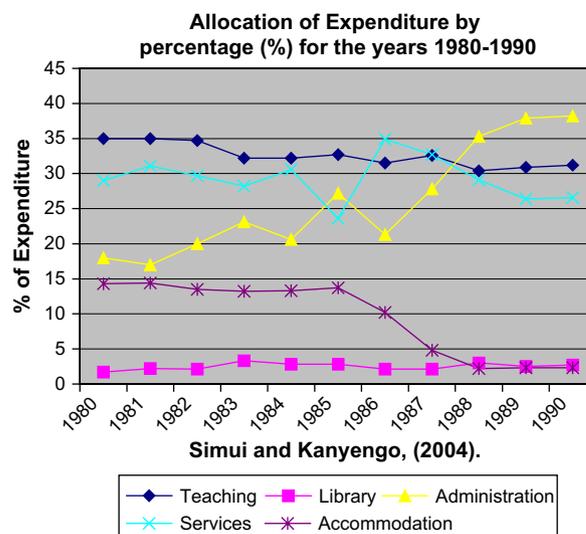
In sub-Saharan Africa, government agencies are still operating in a paper based environment. Most countries are still struggling to make the policy decision to move to an electronic environment in daily government operations. In a study by [Kaaya \(2004\)](#), “conducted to determine the pattern of e-government adoption from 1998 to 2003 using the three East African countries of Kenya, Tanzania and Uganda”, it was determined that there was slow adoption of e-government services. This slow pace was attributable to “resource constraints, lack of pressure from governments, and lack of demand from potential users” ([Kaaya, 2004](#)). Unreliable facilities such as electricity and telephones compounded this problem. However, the real issue is that the citizenry has not yet realized the power of the digital media and therefore has not demanded that most government services and policies be made available to them via the Internet for faster and broader dissemination. Government officials do not appear to be worried about this state of affairs because it is a convenient excuse, as an uninformed populace is easier to manipulate and govern.

**Fig. 1** Distribution of Internet users by region in 2004, [International Telecommunications Union \(2005\)](#).

## Financial constraints

Preservation of knowledge resources is a continuous process, not just a one off issue. To implement an effective and efficient preservation policy, commitment is needed at both the institutional and national levels. This will be an incremental process that will be carried on from one generation to another. This effort entails a commitment of financial resources to the venture over long periods of time.

As alluded to earlier, higher education libraries in Africa have been cutting down on book and periodical subscriptions. In a study on funding for university libraries in Zambia, [Simui and Kanyengo \(2004\)](#) concluded that the funding to the University of Zambia libraries and Copperbelt University Libraries from the University central administration had been dwindling over the years (see [Fig. 2](#)). This trend in funding has also affected all areas of library operations including money that could be allocated for preservation of scholarly information materials. It would therefore require

**Fig. 2** Allocations of Expenditure by percentage (%) for the Years 1980–1990, [Simui and Kanyengo \(2004\)](#).

commitments of substantial financial resources to train personnel to keep abreast of the technological developments in the information technology industry. Financial commitments would also be needed to purchase and preserve the digital knowledge resources to permanently make them accessible to users, now and in the future.

## Technical knowledge

Technical knowledge on the digital elements of electronic documents is largely lacking among staff that are in preservation departments. The presence of preservation departments in most of the higher educational institutions is really in name only as most of them concentrate on book and journal binding. This is coupled with the lack of preservation training. This lack of knowledge extends to deficient know-how on the equipment and software required for the preservation of digital information resources. The library and information science schools that do offer training in preservation only do so at a theoretical level. The joint IFLA/ICA Committee on Preservation and Conservation in Africa (JICPA) survey on Conservation facilities and experts in Africa established that as of 2000, "no formal training in Conservation is offered in Africa, although numerous short courses are provided, or are merely introductory modules offered as part of archival or library training" (Coates, 2000). According to Chisenga (1999), the skills that would enable Africa to operate effectively in an electronic environment are: "lack of adequate skills that would enable them work in electronic information environments; skills in the following subject areas are required; web page design, hypertext markup language (HTML) and the emerging extensible markup language (XML); use of electronic networks; use of metadata; evaluation of Web-based information sources setting up and maintaining subject-based information gateways; management of electronic documents and collections and digitalization of documents".

With the frequent changes in digital electronic resources, the need for these skills becomes more and more urgent. This is unlike the paper format which has been relatively unchanged since it was discovered as papyrus in Egypt 3000 BC. The electronic document on the other hand is fairly new and continues to change forms. If it is not the document changing from MS Word, PDF, html, XML etc.; it is the software requirements to be able to open and read the document. For example, if the document is in PDF you will need a PDF reader; JPEG would require a JPEG; just as a TIFF formatted document would require a TIFF reader. This means that institutions are always forced to change the facilities in order to meet various software and hardware requirements. Digital preservation presumes that there should be constant and continuous learning on the part of preservation staff both in software knowledge as well as hardware. This is because digital preservation methods are always changing depending on the nature of the hardware and software applied.

## Legal barriers

Digitization of information requires obtaining copyright permission from various publishers to be able to duplicate

anything in large quantities. However, most licensing agreements for journals or books produced by major publishers prohibit duplication of electronic documents or local storage of the document. What is usually allowed when one has a subscription is online access to the particular journal, without the subscribing institution having permanent access to content of the journal. Once subscription ends, access to the electronic content of journal is impossible. It is unlike the print subscription model where once one has subscribed to the journal, the institution has permanent access to the journal because of the journal's physical presence in the library's own space.

Copyright is another complex process that libraries should study and teach to their particular constituencies so that it could be used to their own benefit. In the book form it was always clear how the library would use the material through photocopying. In the electronic form, the copyright law is interpreted on various agreed terms with the publisher or vendor, depending on the licensing agreement that the library has entered into.

Typically licensing agreements would include: "a normative structure which includes 1) what is being licensed, 2) to whom, 3) for what purpose, 4) for how long, 5) under what conditions, and 6) at what price" (Anderson & Duranceau, 1999). The International Federation of Library Association's (IFLA) Licensing Principles emphasizes (among other things) that licenses strive to provide perpetual access in the form of "affordable, perpetual access to the licensed information by some appropriate and workable means; address provisions for long-term access and archiving of the electronic information resource(s) under consideration and should identify responsibilities for these" (IFLA, 2001). Jewell (2001) argues that "licenses may also interfere with a library's archival roles and responsibilities if ongoing access rights are excluded or if there are severe restrictions on photocopying".

These licensing agreements are not standardized and may vary from negotiating library to another depending on who has the best legal knowledge of copyright laws and licensing agreements. There are daily disputes in settling the issues of creator, ownership and user of the knowledge and people that would like to reap benefits from that knowledge resource. Therein lies the dilemma – how to balance the rights of the creator of knowledge and also be able to apply the principle of 'fair use' of knowledge resources for all people. Therefore, protection is needed to ensure that everyone benefits from the knowledge resources. However, what has fundamentally changed from the print era is that the "library will not own electronic information outright, but instead will lease this information pursuant to the terms of the license agreement. As information is shifted from the print to the electronic form, the outright sale of information is becoming less common and the leasing of information is becoming more common" (Alford, 2002: 622).

The digital environment envisages an environment of self-publishing where anyone with access can publish anything on the Internet without having to subject the work to a peer review process. Peer review process is important, especially in scholarly publishing, so that knowledge produced and presented to the outside world is based on sound empirical evidence. Self-publishing poses several

dilemmas for libraries and librarians in evaluating and choosing what to collect and preserve for their user base. Self-publishing would mean that libraries will have to get permission from individual authors if they are interested in the document. This increases the work load as opposed to dealing with a single publisher who publishes several works in different fields. Because libraries have to maintain high standards in collecting works that should be used for future scholarship, even if a knowledge resource might appear to be of interest, one cannot always be sure that it can stand up to peer review scrutiny. Also, there is no guarantee on the permanent availability of anything found on the Internet. The fact that a library has made a link to that particular resource and that it is a popular link amongst students and faculty of an institution does not guarantee access to it in perpetuity. If libraries do not have the electronic document in their institution, then they do not own it and therefore, the digital resource might be inaccessible the next time you access the Internet.

### Digital technology challenges

Digital technology poses several challenges in the preservation of digital information resources. These are among others; technology comes in different formats, the cost of maintaining international standards of digital formats is expensive as it is often based on paying for upgrades to match the technology, both the hardware and software. These come with subscriptions costs; so in essence a library would have to subscribe to hardware; software and then to the electronic journal. This is as opposed to print-based journals where once a journal is bought there are no other costs to be incurred from the publisher. Wu (2005) says that there are other invisible costs that may be disguised as "enhanced quality product". Webb (2003), argues that these challenges are "intrinsic to the problem, such as the rate of technological change, the widespread use of proprietary software, and the rapid increase in the quantity and complexity of digital objects; including poor access to existing technical knowledge which may only be available on the Internet; the high cost of obtaining international standards".

### Strategies for permanent access to digital scholarly resources

The electronic environment is complex. Information is constantly changing. At the moment it should be imperative that institutions, especially universities and research institutions, in Africa provide the leadership in seeking solutions that will ensure preservation and permanent access to Africa's digital information resources. This leadership should of course be operating within the framework of an enabling governance policy framework. These solutions need to encompass technological, scientific, research as well as documentation and archival skills.

These solutions require an enabling policy framework both at institutional level, governmental level, as well as at the continental level. The solutions should be spearheaded by research and higher educational institutions at a national level. At the continental level, regional organizations such as the Council for Social Science Research in

Africa (CODESRIA), Association of African Universities (AAU), African Capacity Foundation and others must lead the process of encouraging universities and research institutions to come up with policies of ensuring permanent preservation and access to Africa's knowledge resources. As the popular native American saying goes "we do not own this world, we have only borrowed it from our children". Today's knowledge resources should therefore be preserved for future generations. It will be tragic if today's African knowledge resources are not preserved because the current generation fails to do so. There are several strategies that could help libraries in making permanent preservation of digital information scholarly resources. However, focus will be on the following: enabling policy environment, standardized archiving policies, training in modern methods of preservation, and funding. These strategies are discussed in detail.

### Policy framework

The digital environment has brought about "interdependence between the stages of creation, use and preservation of digital resources and the legal and economic environments in which they operate (Beagrie, 1998). An enabling policy framework provides guidance on where the continent is coming from and where it is headed to. This policy framework should begin at the institutional level before it is incorporated at the national level and then this would lead to the regional level. Lastly, all these efforts feed into the continental preservation policy framework. Such a policy framework should consist of components that would ensure that there will be permanency in Africa's knowledge resources whether they are in print or in digital form. These components should include among others: what kind of collections, what subjects should libraries collect information resources on, who is collecting what information, and it should follow the collection development policies of their parent institutions. There are also questions of which digital information resources to collect and what formats these digital resources will take. This is of extreme importance as the issues of sharing of information resources, especially in resource-scarce environments, will become more imperative.

### Standardized archiving policies

Standardized digital archiving policies are crucial towards achieving the goals of having permanent access to Africa's knowledge resources for universities and research institutions. Although it is too early to talk of standardization because the digital technology itself is just evolving, prudence calls for institutions to start thinking and strategizing about standards. A uniform standardized preservation policy that can be initially done through consortia via universities and research institutions will reduce costs on several levels; one, on the costs of each archived document as one institution will work on it but eventually make it available to all members of the consortia or network as opposed to each member of the network working on the same document. This also means that the institutions can coordinate their collection development policies so that in a networked electronic environment they allocate to

themselves subject areas in which to collect and archive information which will be eventually shared by everyone. Of course there are those institutions whose mandate is to preserve national resources such as national libraries and they should be allowed and encouraged to continue with their mission which is really to preserve the memory of their own countries.

Deliberate efforts should also be made towards the sustainability of the digital collections. There is no point in coming up with a digital collection that will have a limited life span. It is important that whatever digital collections are acquired, they should be in line with the overall collection development policy of that particular institution. The collection development policy should therefore fit within the overall objectives of the mission of the parent organization, otherwise it will be rendered irrelevant. Digital collections that are made with the use of outside funding should also fall within the mandate of the implementing organization and plans should be worked out so that the digital collection project does not die after the outside funding organization has stopped. A digital collection is like any other collection of information resources that needs to be periodically monitored and evaluated for consistency and relevance to the mission of the organization.

### Training in modern preservation methods

Introduction of preservation courses in various training programmes that deal with digital archiving should be encouraged. These should cut across all disciplines so that institutional repositories of members of staff of particular universities and research institutions do their own archiving within the laid down procedure and standards of their institutions. If the training is coordinated amongst the African institutions, it would ensure that repositories that each institution is building follow similar procedures and guidelines that ideally should be agreed upon by various institutions across the continent. This will make it easier for the institutions to share the information resources contained in these repositories should the need arise in future.

Mainstreaming the curricula in library and information sciences is especially important because digitization is a specialised discipline in itself. Efforts should be made within the library schools of working together to be able to integrate this increasingly important element across all school curricula even though some school can specialize in certain aspects of preservation. Recognising the importance of having a robust curriculum in preservation and conservation, the joint International Federation of Library Associations (IFLA)/International Council on Archive (ICA) Committee on Preservation and Conservation in Africa (JICPA) brought together a group of professionals from Library and Information Schools in Africa to develop a "Model Curriculum on Preservation and Conservation of Library and Archival Materials in Africa" (IFLA, 2002). This meeting took place in Nairobi in 1998 and what remains to be seen is how many institutions have implemented that curriculum.

### Legal knowledge

Libraries require the services of people that understand legal language. Ideally people that have been trained in

both law and library science would understand the legal environment in which libraries need to operate in the electronic age. According to Wiley (2004) "licenses take considerably longer to finalize and require expertise, a careful eye, and often staff skilled in negotiating terms that cover much more than just the cost."

### Funding

Digital Preservation is a costly process especially for African countries that are coping with various problems of: disease, poverty and general low levels of economic development. However, it is essential that funding be made available at all levels: institutional, country, regional and continental, for any continental preservation strategy to be effective. This funding should be all encompassing, i.e., it should be for training, infrastructure and software needed for the preservation process.

### Conclusion

There are several policy implications that need to be addressed in order to facilitate the promotion of permanent access to digital scholarly resources in the sub-Saharan Africa. Institutions should be thinking of strengthening the local publishing environment so that the African continent has access to its own knowledge resources. There is need to develop local capacity in digital preservation methods in all fields and at all levels. Regional collaboration needs to take place between African universities and other institutions to ensure systematic development in digital preservation and to encourage the leadership of regional research institutions by trusting them with taking the process forward. This calls for the development and fostering of partnerships between developed countries and African countries in preservation activities. Most importantly, there is need for the development and improvement of a policy framework that will deal with permanent access and availability of digital information resources at institutional, country, regional and continental levels. Any strategies adopted should take cognisance of Africa's knowledge resources held in publishing houses both within and outside the continent, and should commit to future generations in Africa having guaranteed permanent access to that digital content.

### References

- Abdool Karim, Salim S. (2003). Creating equal access to scientific information. *Science and Development Network*, 28 March. Available from: <http://www.scidev.net/Opinions/index.cfm?fuseaction=readOpinions&itemid=122&language=1>. Accessed 21.09.07.
- Adebowale, Sulaiman A. (2001). The scholarly journal in the production and dissemination of knowledge on Africa: exploring some issues for the future. *African Sociological Review*, 5(1), 1–17.
- Akporhonor, Blessings Amina (2005). Library funding in Nigeria: past, present and future. *The Bottom Line: Managing Library Finances*, 18(2), 63–70.
- Alford, Duncan E. (2002). Negotiating and analyzing electronic license agreements. *Law Library Journal*, 94(4), 621–644,

- Available from: [http://www.aallnet.org/products/pub\\_llj\\_v94n04/2002-38.pdf](http://www.aallnet.org/products/pub_llj_v94n04/2002-38.pdf). Accessed 14.09.06.
- American Librarian Association. (1996). *Library bill of rights*. Available from: <http://www.ala.org/ala/oif/statementspols/statementsif/librarybillrights.htm>. Accessed 12.09.06.
- Anderson, Ivy., Duranceau Ellen Finnie., 1999. Riding the Tsunami: managing the licensing of electronic resources. Presented by the New England Technical Services Librarians (NETSL) at the New England Library Association's Annual Conference. Manchester, New Hampshire, 27 september, 1999. Available from: <http://www.nelib.org/netsl/pastprograms/tsunami.htm> Accessed 17.09.07.
- Beagrie, Neil 1998. Developing a policy for digital preservation. Presented at Proceedings of the Sixth DELOS Workshop on Preservation of Digital Information. Tomar, Portugal, 17–19 June 1998. Available from: <http://www.ercim.org/publication/ws-proceedings/DELOS6/neil.pdf> Accessed 12.09.07.
- Chisenga, Justin 1999. Global information infrastructure and the question of African content. Presented at 65th IFLA Council and General Conference. Bangkok, Thailand, 20–28 August 1999. Available from: <http://www.ifla.org/IV/ifla65/papers/118-116e.htm> Accessed 21.09.07.
- Chisenga, Justin (2004). *The use of ICTs in African public library services*. Oxford: INASP.
- Cloonan, Michèle V., & Dove, G. (2005). *Ranganathan online*. Available from: <http://www.libraryjournal.com/article/CA512179.html#1>. Accessed 14.09.2006.
- Coates, Peter Ralph (2000). *JICPA survey of conservation facilities and experts in Africa*. Available from: <http://www.epa-prema.net/jicpa/survey.htm>. Accessed 21.09.07.
- Fassen, Nicol (2005). *The effect of copyright on library services*. LIASA Western Cape Higher Education Libraries Interest Group, 17 November 2005. Available from: [http://liasa.org.za/interest\\_groups/wc/copyright/WCHELIG\\_Copyright\\_Faasen\\_Nov2005.pdf](http://liasa.org.za/interest_groups/wc/copyright/WCHELIG_Copyright_Faasen_Nov2005.pdf). Accessed 14.09.07.
- Fenton, Eileen Gifford, & Schonfeld, Roger C. (2005). The shift away from print. *Inside Higher Ed*. December 8. Available from: [insidehighered.com/views/2005/12/08/schonfeld](http://insidehighered.com/views/2005/12/08/schonfeld). Accessed 14.09.06.
- Hassan, Mohamed (2001). Can science save Africa? *Science*, 292(5522), 1609.
- Hofman, Karen, Kanyengo, Wamunyima Christine, Kotzin, Sheldon 2005. Patterns of publishing by researchers and clinicians from sub-Saharan Africa. Bethesda: National Library of Medicine, Unpublished.
- IFLA (2001). *Licensing Principles (2001)*. Prepared by IFLA's Committee on Copyright and other Legal Matters (CLM). Available from: <http://www.ifla.org/V/ebpb/copy.htm> Accessed 23.10.08.
- International Federation of Library Associations. (2002). *The Joint IFLA/ICA Committee on Preservation and Conservation in Africa (JICPA) report 2002*. Available from: <http://www.ifla.org/VII/s25/p1/jicpa02.htm>. Accessed 17.09.07.
- International Telecommunication Union. (2005). *ITU corporate strategy newslog – Asia-Pacific region takes over lead in internet usage news related to CSD research and analysis*. Available from: <http://www.itu.int/osg/spu/newslog/AsiaPacific+Region+Takes+Over+Lead+In+Internet+Usage.aspx>. Accessed 30.09.07.
- Issak, Aissa (2000). *Public libraries in Africa: a report and annotated bibliography*. Oxford: INASP.
- Jewell, Timothy D. (2001). *Selection and presentation of commercially available electronic resources: Issues and practices*. The Council on Library and Information Resources. Available from: <http://www.clir.org/pubs/reports/pub99/contents.html>. Accessed 17.09.07.
- Kaaya, Janet (2004). The emergence of e-government services in East Africa: tracking adoption patterns and associated factors. In *ACM international conference proceeding series. Proceedings of the 6th international conference on Electronic commerce*, Vol. 60. New York, NY: ACM Press.
- Kanyengo, Wamunyima Christine (2007). Serials management in Africa: a review of survival strategies at the university of Zambia. *Serials Review*, 33(1), 33–39.
- Levey, Lisbeth A. (Ed.). (1993). *A profile of libraries in sub-Saharan Africa: Acquisitions, outreach, and infrastructure*. Washington, DC: American Association for the Advancement of Science.
- NEPAD. (2001). *What is NEPAD?*. Available from: <http://www.nepad.org/2005/files/home.php>. Accessed 01.09.06.
- Noruzi, Alireza (2004). Application of Ranganathan's laws to the web. *Webology*, 1(2). Article 8. Available from: <http://www.webology.ir/2004/v1n2/a8.html>. Accessed 05.09.07.
- Olukoju, Ayodeji (2004). The crisis of research and academic publishing in Nigerian universities. In P. T. Zeleza, & A. Olukoshi (Eds.), *African universities in the twenty-first century: Knowledge and society, Vol. II* (pp. 363–375). Dakar: Council for the Development of Social Science Research in Africa.
- Ondari-Okemwa, Ezra (2007). *Scholarly publishing in sub-Saharan Africa in the twenty-first century: Challenges and opportunities*. Available from: [http://pkp.sfu.ca/files/Scholarly\\_publishing\\_in\\_sub.pdf](http://pkp.sfu.ca/files/Scholarly_publishing_in_sub.pdf). Accessed 01.9.07.
- Ranganathan, Shiyali Ramamrita (1963). *The five laws of library science*. Bombay: Asia Pub. House.
- Rosenberg, Diana (2005). *Towards a digital library: Findings of an investigation to establish the current status of university libraries in Africa*. Oxford: INASP.
- Sawyer, Akilagpa (2004). African universities and the challenge of capacity development. *Journal of Higher Education in Africa*, 2(1), 213–242.
- Simui, Harriet Muyoyeta, & Kanyengo, Wamunyima Christine (2004). *An investigation into the funding of University Libraries in Zambia*. Oxford: INASP.
- Subotzky, George, & Cele, Gabriel (2004). New modes of knowledge production and acquisition: peril or Promise for developing countries. In P. T. Zeleza, & A. Olukoshi (Eds.), *African universities in the twenty-first century: Knowledge and society, Vol. II*. Dakar: Council for the Development of Social Science Research in Africa.
- Teferra, Damtew (2004). Knowledge creation and dissemination in African universities with special reference to ICT. In P. T. Zeleza, & A. Olukoshi (Eds.), *African universities in the twenty-first century: Knowledge and society, Vol. II* (pp. 376–399). Dakar: Council for the Development of Social Science Research in Africa.
- United Nations Economic Commission for Africa, 2005. National knowledge systems and the status of information access policies in Africa. Paper originally presented at the Fourth Meeting of the Committee on Development Information (CODI IV). Addis Ababa, Ethiopia, 23–28 April 2005. Available from: <http://www.uneca.org/disd/events/2006/wsis-library/resources/National%20Knowledge%20Systems%20-%20EN.pdf>. Accessed 12.09.07.
- Warner, Dorothy (2002). Why do we need to keep this in print? It's on the web: a review of electronic archiving issues and problems. *Progressive Librarian, Spring 2002*(19–20). Available from: [http://www.lib.org/PL/19-20\\_Warner.html](http://www.lib.org/PL/19-20_Warner.html). Accessed 01.09.07.
- Webb, Colin (2003). UNESCO campaign to preserve the 'digital heritage' – and consultations in Asia and the Pacific. In *International Preservation News (IPN) – a Newsletter of the IFLA Core Activity on Preservation and Conservation, Number 30 September 2003* Available from: <http://www.nla.gov.au/nla/staffpaper/2003/webb1.html>. Accessed 01.09.07.
- Wiley, Lynn N. (2004). License to Deny? Publisher restrictions on document delivery from e-licensed journals. *Interlending & Document Supply*, 32(2), 94–102, Available from: <http://www>.

- [library.ucla.edu/libraries/eastasian/ccmweb/License%20to%20deny.pdf](http://library.ucla.edu/libraries/eastasian/ccmweb/License%20to%20deny.pdf). Accessed 01.09.07.
- Wirsiy, Charles Kiven 2007. The state of acquisition, organization and use of open access information resources in Cameroon University libraries: the case of the University of Buea and University of Yaounde I libraries. Presented at PKP Scholarly Publishing Conference held at Simon Fraser University. Harbour Centre, 11–13 July 2007, Available from: <http://pkp.sfu.ca/ocs/pkp2007/index.php/pkp/1/paper/viewFile/30/63> Accessed 21.09.07.
- Wu, Michelle M. (2005). *Why print and electronic resources are essential to the academic law library*. Available from: [www.aallnet.org/products/pub\\_llj\\_v97n02/2005-14.pdf](http://www.aallnet.org/products/pub_llj_v97n02/2005-14.pdf). Accessed 01.09.07.