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The development and use of digital libraries, institutional digital repositories and open access archives for research and national development in Africa: opportunities and challenges

Dr. Justin Chisenga, FAO Regional Office, Ghana

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DEVELOPMENT AND USE OF INSTITUTIONAL REPOSITORIES AND OPEN ACCESS ARCHIVES FOR RESEARCH AND NATIONAL DEVELOPMENT IN AFRICA: OPPORTUNITIES AND CHALLENGES¹ - 2 -

Justin Chisenga²
Information Management Specialist
FAO Regional Office for Africa
Accra, Ghana
justin.chisenga@fao.org

ABSTRACT

Scientific and technological information and knowledge is critical to the development of Africa. However, very little research output from Africa finds its way into the international journals. Much of it is in form of grey literature i.e. unpublished information and knowledge resources such as research reports, theses and dissertations, seminar and conference papers, and due to several factors, the literature is not visible and easily accessible to potential users (scientific and technological communities and policy makers) both in and outside Africa. Use of information and communication technologies (ICTs) for the management and distribution of digital-based scientific information and knowledge will enhance access and sharing of these vital resources on the continent and contribute to the development of Africa. In particular, institutional repositories and Open Access archives have the potential to improve access to scientific and technological data, information, and knowledge being generated in Africa.

INTRODUCTION

Access to appropriate scientific and technological information and knowledge at the right time could play a critical role in the development of the countries in Africa. It could assist in finding solutions to most of the problems, such as inadequate food supply, poverty, water pollution, diseases, environmental degradation, deforestation, and many others besieging the continent today. The importance of scientific and technological information to national development is supported by UNESCO when it indicates that the possession and use of knowledge are essential factors for progress, and information, the communicable form of knowledge, has therefore come to be recognized as one of the main prerequisites for economic and social development. It is an indispensable factor in the rational use of natural resources, scientific and technological advancement, progress in agriculture, industry and services, and consequently, assimilation of scientific and technological information is an essential precondition for progress in developing countries (UNESCO 1982).

In 1961, Jawaharlal Nehru, India's first Prime Minister said that - *"It is science alone that can solve the problems of hunger and poverty, insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people...Who indeed could afford to ignore science today? At every turn*

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² The views expressed in this paper are those of the author and do not reflect the views of FAO.



*we have to seek its aid...the future belongs to science and to those who make friends with science*³. Unfortunately, the most valuable products (information and knowledge) of scientific and technological research from continents such as Africa are largely ignored by the international community, and even within the African continent itself, largely because of several factors among them the fact these by-products are not visible and easily accessible.

The research generated in developing and emerging countries is “missing” from the international knowledge bases because of financial restrictions affecting its publication and distribution (Gibbs, 1995; Arunachalam, 1994), and Africa is the most affected continent. Much of the scientific research output from Africa is in form of grey literature, i.e. unpublished information and knowledge resources such as research reports, theses and dissertations, seminar and conference papers. Very little research output finds its way into the world’s well-established international scientific journals, due to various problems and among them because publication in mainstream journals faces the problems of over-subscription and recorded prejudice against submissions from developing country scientists; and in addition to this, very few local journals are published and these journals have in general poor distribution and visibility (Cetto 2002). Therefore, research from developing countries is not being indexed in major international databases such as Science Citation Index (<http://scientific.thomson.com/products/sci/>), which increases the visibility of research outputs.

The grey literature documents in Africa are mostly produced in limited numbers, and have limited circulation even within the institutions where they are produced. The situation is made worse by the fact that grey literature on the continent is inadequately documented and there is a general absence of national or regional bibliographic databases that can be accessed to find out the grey literature that exists on the continent and where to access it. Where the databases exist, it is usually very difficult to get access to the actual documents unless one visits the institutions where the documents were produced. There is also lack of capacity, both human and institutional, for managing grey literature which increasingly is being generated in digital format. The result is that much of the grey literature being generated in research institutes is not being shared and in most cases the results of scientific and technological research are not being developed further beyond field and laboratory research. Very useful and valuable technological and scientific information and knowledge remains unexploited and in some cases is lost.

Use of information and communication technologies (ICTs) for the management and distribution of digital-based scientific information and knowledge resources will enhance access and sharing of these resources scientists and research institutes on the continent and contribute to the development of Africa. It will also open up Africa’s scientific and technological knowledge which currently is not easily accessible both to the local and international scientific communities. In this light, coordinated development and use of digital information repositories, such as institutional repositories (IRs) that are open access archives, accessed via the Internet and intranets, could go a long way in increasing accessibility and usability of scientific research outputs from Africa, and could provide raw materials needed for research and development of most countries. At the same time it will assist in contributing to the development of Africa’s content on the global information infrastructure.

³ Quoted from Dr. Manmohan Singh, India’s Prime Minister’s speech at the Shanti Swarup Bhatnagar Awards ceremony, September 13, 2004, New Delhi. URL: <http://pmindia.nic.in/lspeech.asp?id=21>



The paper highlights the opportunities presented by institutional repositories and Open Access archives to Africa and examines some of the challenges hindering the development of digital information repositories on the continent. - 4 -

INSTITUTIONAL REPOSITORIES

Institutional repositories (IRs) are closely linked to scholarly communication, universities and research institutes, and most definitions of IRs reflect this link. *Wikipedia, the Free Encyclopaedia*⁴, defines an institutional repository (IR) as “an online locus for collecting and preserving -- in digital form -- the intellectual output of an institution, particularly a research institution”. Lynch (2003) defines a university-based institutional repository as “a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of these digital materials, including long-term preservation where appropriate, as well as organization and access or distribution”. The Canadian Association of Research Libraries (2004) indicates that an institutional repository is a digital collection of part of a university's intellectual output, and IRs centralize, preserve, and make accessible the knowledge generated by academic institutions. They also form part of a larger global system of repositories, which are indexed in a standardized way and searchable using one interface, and they offer great promise for the development of new patterns of scholarly communication.

It is worth noting that although institutional repositories are associated with university and research institutes, any organization generating documents in digital format, including governments, corporate organisations, and non-governmental organisations (NGOs) can develop and make use of institutional repositories. Each organisation can define its own policies dealing with access to and use of materials in its repositories. For example, university and research institutions are more likely to provide free access to their materials, while in a corporate organisation or government ministry, not all materials can be made available freely. Access restrictions may be placed on some documents.

University institutional repositories would largely include materials such as research reports, data sets, examination papers, conference papers, newsletters and seminar papers, course notes, journals articles undergoing peer review, and digital versions of theses and dissertations. Government institutional repositories would include policy and strategy documents, speeches, technical papers, reports, consultancy and feasibility study reports, and administrative documents. According to Drake (2004), “corporations and not-for-profits organisations may establish repositories to archive and preserve their institutional histories and administrative documents. Materials in corporate repositories would most likely remain *proprietary* and unavailable to people outside the company. Not-for-profit organizations may find repositories useful for relating the histories of the organizations, raising funds, and creating interest in the projects and activities of the organizations”.

Institutional repositories have a positive impact on the visibility accessibility of information resources, and there are several examples to show this. One example is that of the School of Business of the University of Otago in New Zealand whose institutional repository (New Zealand's first publicly available institutional repository) went live on 17 November 2005. By 31 January 2006, the repository had experienced 9,000 downloads from over sixty countries, and just over two months later, the number of downloads doubled and included visits from eighty countries (Stanger and McGregor 2006). Further, as of 7 March 2006;

⁴ http://en.wikipedia.org/wiki/Institutional_repository



The statistics showed a total of 18,744 downloads from 80 distinct countries since the repository went live. Growth had been consistent over the entire period. The most popular paper (an Information Science discussion paper) had 451 downloads from 23 countries after twelve weeks in the repository. The top ten downloaded papers included two discussion papers, two working papers, two technical reports and four Honours dissertations (one of which was manually scanned from the original hard copy). Of these, only the discussion papers were previously available online, so the advent of the repository has had a clear impact on the availability of research within the School of Business (Stanger and McGregor 2006).

OPEN ACCESS ARCHIVES

Open Access Archives (OAAs) are part of the world-wide initiative, facilitated by common technical standards and open source software, to publish scholarly literature, composed of peer-reviewed journal articles and conference papers as well as technical reports, theses and working papers, on the internet and make it available to readers free of charge and free of unnecessary licensing restrictions. To achieve this initiative, the Budapest Open Access Initiative⁵ has recommended two complementary strategies, and these are:

- *Self-Archiving*: Which allow authors to deposit their refereed journal articles in open electronic archives, and thus disseminate their research articles for free over the Internet.
- *Open Access Journals*: Journals committed to open access, and do not charge readers or their institutions subscription fees to access the articles.

Under the above strategies, authors can either place copies of their articles in an Open Access archive or publish the articles in Open Access journals, and either way, users will have free and unrestricted access to the works. Opening up access to primary literature published within scholarly journals *"will accelerate research, enrich education, share learning among rich and poor nations, and, ultimately, enhance return on investment in research (much of which come from the world's taxpayers). From being in a position where institutions cannot supply all the information need of researcher, researchers will be able to access all of the relevant information they need to be effective"* (SPARC Europe n.d.)

There number of OAAs and OAJs is slowly growing and there are several online services assisting Internet users to locate these resources, among them the following two services:

- *Directory of Open Access Repositories (OpenDOAR)*⁶ - The aim of OpenDOAR is to support the rapidly emerging movement towards Open Access to research information, and it is classifying/listing archives holding research papers, conference papers, theses and other academic materials that are available as open access. Users of OpenDOAR can also suggest a new repository to be included in the directory. As at 17 March 2006, OpenDOAR listed 355 open access repositories from 25 countries in various fields including, 63 in Agriculture and Food Sciences, 219 in Technology and Engineerings, 134 in Health Sciences and 140 in Earth and Environmental Sciences. The United States

⁵ <http://www.soros.org/openaccess/>

⁶ <http://www.opendoar.org>



and the United Kingdom with 33 and 20 entries respectively, followed by - 6 - Germany with 18 entries.

- *Directory of Open Access Journals (DOAJ)*⁷ - The aim of DOAJ is to increase the visibility and ease of use of Open Access (OA) scientific and scholarly journals thereby promoting their increased usage and impact and it indexes OA journals from around the world. As at 17 March 2006, DOAJ contained 2124 journals, giving access to 90741 articles. Admittedly this is a very small number compared to the thousands of print-based, peer-reviewed scientific journal titles in existence. However, it is work in progress and more and more journals are going Open Access. This fact has already been recognised by Ulrich's Periodicals Directory, a bibliographic database providing detailed, comprehensive, and authoritative information on serials published throughout the world, which now includes information and links to Open Access (OA) journals from the Scholarly Publishing and Academic Resources Coalition (SPARC), Public Library of Science (PLOS), Biomed Central, the Directory of Open Access Journals, and other providers⁸.

What then are Open Access archives? These are "electronic repositories of submitted material that may include already-published articles (post-prints), pre-published articles (pre-prints), theses, manuals, teaching material or any other material that the authors or their institutes wish to make publicly available without financial or technical barrier. Such archives may be based on an institute's output, or may be discipline-based or regionally-based (Chan, Kirsop, Costa & Arunachalam 2005).

Based on the above definition, it can be seen that institutional repositories that are accessible without financial or other access barriers are therefore Open Access archives.

OPPORTUNITIES FOR AFRICA

Institutional repositories have relevance to the African environment. They are valuable for research and development because they can offer instant access to information and knowledge resources being generated on the continent. The universities and research institutes in Africa are the major centres of research and consequently the major generators of research based data, information and knowledge. The scientific and technological information and knowledge which they are generating should be easily accessible, and the creation and use of institutional repositories could be the first step in this process. Institutional repositories have the potential to:

- Increase the visibility and provide a better picture of Africa's scientific and technological research outputs and specialisation
- Increase the accessibility and impact of research both in Africa and at the global level
- Preserve and maintain the research outputs of Africa's universities and research institutes.

In spite of the above benefits that could be derived from institutional repositories, there are not that many major institutional repositories or projects being undertaken on the continent. Current efforts in this, especially in universities, are concentrating on digitising and providing access to full-text copies of electronic theses and dissertations (ETDs), rather than setting up

⁷ <http://www.doaj.org>

⁸ <http://www.ulrichsweb.com/ulrichsweb/>



full-scale institutional repositories, although institutional repositories may be the end result (Rosenberg 2005). Some efforts are also being made in the area of Open Access journals. - 7 -

Electronic Theses and Dissertations (ETDs)

Considering that doctoral theses contain some of the most current and valuable research produced within universities, but are underused as research resources, where electronic theses and dissertations (ETDs) are open access, they are used many times more often than paper theses that are available only via inter-library loan (Jacobs 2006), the need and importance of providing access to digital theses and dissertations in Africa cannot be over-emphasized. These valuable knowledge resources are not easily accessible on the continent. For example, in some university libraries on the continent, they are kept as closed access collections, and their content is somehow lost. However, a few universities are already taking advantage of the opportunities presented by ICTs and are developing institutional repositories, some of which are Open Access archives, of electronic theses and dissertations. In some universities cases access to full-text EDTs is limited to members of the communities which they serve. The initiatives include:

- Rhodes University (<http://www.ru.ac.za/library/theses/collection.html>)
- University of Johannesburg (<http://0-etd.uj.ac.za.raulib.rau.ac.za>⁹)
- University of Pretoria (<http://upetd.up.ac.za/ETD-db/>¹⁰)
- University of the Witwatersrand (<http://146.141.35.251/ETD-db/>)
- University of the Western Cape (<http://ww3.uwc.ac.za/index.asp>¹¹)

The Université Cheikh Anta Diop, Dakar, Sénégal, is participating and contributing to **Cyberthèses**¹², a cooperative project that started at first between l'Université de Montréal¹³ and l'Université Lumière - Lyon 2¹⁴, supported by the Fonds Francophone des Inforoutes¹⁵ to archive and distribute theses and dissertations electronically via the Internet.

An opportunity to provide access to ETDs by a large number of universities in Africa exists under the Association of African Universities (AAU)'s Database of African Theses and Dissertations (DATAD)¹⁶ project whose main purpose is to make dissertations and theses (DTs) produced at African universities widely available throughout Africa and the larger world. Currently, DATAD provides access to bibliographic records of theses and dissertations from Addis Ababa University, Ethiopia; Eduardo Mondlane University, Mozambique; Kenyatta University, Kenya; Makerere University, Uganda; Université Cheik Anta Diop, Sénégal; University of Dar es Salaam, Tanzania; University of Ghana, University of Zimbabwe, and Université de Yaounde 1, Cameroon. The second phase of the project is expected to concentrate on creating institutional repositories providing access to both the metadata and to full-text ETDs. If the second phase of the DATAD project takes off, it will increase the number of institutional repositories providing access to these and dissertations in Africa.

⁹ Access to full-text is available via the Internet

¹⁰ Access to full-text is available via the Internet

¹¹ Access to full-text is available via the Internet

¹² <http://www.cybertheses.org/cybertheses/cybertheses.html>

¹³ <http://www.theses.umontreal.ca>

¹⁴ <http://www.univ-lyon2.fr>

¹⁵ <http://www.francophonie.org/fonds/>

¹⁶ <http://www.aau.org/datad/>



Noticeably, there some disconnected and uncoordinated small-scale digital collections - 8 - initiatives in university libraries largely involving the digitization of examination papers, library newsletters, and sometimes academic staff publications.

Open Access archives and Africa

Open Access archives provide Africa with an opportunity to make an immediate impact on the sharing of scientific outputs within the continent. Research scientists generating the documents also stand to benefit from the Open Access archives, in that instead of their research outputs being seen and accessed by users in their institutes and in other institutes at institutions lucky enough to have a access to the document, the digital document placed in an open archive has the potential of being accessed and used by all interested users that have access to the Internet. This increases the profile of the researchers, their institutions, and their countries (APARC Europe n.d.).

Open Access archives are not yet a common feature of the African digital information environment. The Directory of Open Access Repositories - OpenDOAR (<http://www.opendoar.org>), accessed on 17 March 2006, listed only two countries, Namibia and South Africa, as the only countries with Open Access archives. In addition to the electronic theses and dissertation collections at the University of Pretoria and the University of Johannesburg, which have already been mentioned above, the other Open Archives listed in OpenDOAR are:

- DSpace at the University of Namibia Library - accessed at <https://dspace.unam.na:8443/dspace/>, the archive contains a couple of documents.
- Rhodes eResearch Repository (ReRR) - launched on 2 February 2006, is an online self-archiving system holding the academic and research output of the Rhodes University community. The Repository currently contains open-access theses, journal articles and some conference papers. ReRR can be accessed at <http://eprints.ru.ac.za/>.
- University of Cape Town Computer Science Research Document Archive - which archives and makes accessible documents that are products and by-products of research by the Department of Computer Science of the University of Cape Town. The Archive can be accessed at <http://pubs.cs.uct.ac.za/>.

The implication of the above situation is that digital content in most of the digital libraries and institutional repository initiatives being undertaken on the continent is still not yet open for access via the Internet. Africa needs more Open Archives in several subject areas, including in agriculture, social sciences, economics, health, education, environment, and many others. There are several public, private and non-governmental research institutes and organisations whose resources can be made available via institutional repositories and Open Access archives. These include:

- Scientific and technological research institutes, i.e. Council for Scientific and Industrial Research Institute (CSIR), Ghana; National Council for Scientific Research, Zambia, etc.
- Agricultural research systems, i.e. Ethiopian Agricultural Research Institute (EARI), National Agricultural Research Organisation (NARO), Uganda; Institut Sénégalais de Recherches Agricoles, Senegal; Centre National de Recherche Agronomique (CNRA), Côte d'Ivoire; Kenya Agricultural Research Institute (KARI); Plant Protection Research Institute, Zimbabwe, etc.



- Medical and health research systems, i.e. Kenya Medical Research Institute (KEMRI), Kenya; Tropical Diseases Research Centre (TDR), Zambia; Institut Pasteur de Dakar, Senegal; National Institute for Medical Research, Tanzania; Ethiopian Health and Nutrition Research Institute, Ethiopia, etc.
- Social, economic and policy research systems: Namibian Economic Policy Research Unit (NEPRU), Namibia; Council for the Development of Social Science Research in Africa (CODESRAI), Senegal; Institute of Statistical, Social and Economic Research (ISSER), Ghana; Nigerian Institute of Social and Economic Research (NISER), Nigeria; Centre Ivoirien de Recherche Economique et Sociale (CIRES), Côte d'Ivoire; Botswana Institute for Development Policy Analysis (BIDPA), Botswana, etc.

Open Access Journals

There are not that many Open Access journals coming from Africa and a few that are available are hosted from outside the continent. The following OAJs were retrieved from DOAJ:

- *Annals of African Medicine* published by Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. URL: <http://www.bioline.org.br/am>
- *Indo-Pacific Journal of Phenomenology* published by Rhodes University, South Africa. URL: <http://www.ipjp.org/>
- *Journal of Applied Sciences and Environmental Management*, which part of the World Bank assisted National Agricultural Research Project (NARP) - University of Port Harcourt. URL: <http://www.bioline.org.br/ja>

The African Journals Online (AJOL)¹⁷ - an online database of African-published journals has the potential to increase the visibility of research from Africa even though its business model is not in line with the principles of Open Access. The objective of AJOL is to give greater visibility to the participating journals, and to the research they convey, and as a result one of the criteria for inclusion in AJOL's database is that a journal must be published within the African continent. Articles can be ordered and are charged at £7.50 per article. However, most articles are not currently available electronically, and can only be sent by fax or post.

The AJOL database has 230 journals¹⁸ from Algeria (2 journals), Botswana (2), Burkina Faso (2), Cameroon (3), Congo DR (1), Cote D'Ivoire (3), Egypt (5), Ethiopia (7), Ghana (9), Kenya (17), Lesotho (1), Malawi (3), Nigeria (95), Senegal (6), South Africa (48), Sudan (1), Swaziland (3), Tanzania (6), Togo (1) Uganda (5), Zambia (1) and Zimbabwe (9) covering agricultural sciences and resource management; arts, culture, language and literature; health; science and technology, social sciences, and multidisciplinary. The following are some of the journals indexed in AJOL:

- African Crop Science Journal (Uganda)
- African Journal of AIDS Research (South Africa)
- African Journal of Biotechnology (Kenya)
- African Journal of Science and Technology (Kenya)
- African Journal of Urology (Egypt)
- African Plant Protection South (Africa)
- East African Medical Journal (Kenya)

¹⁷ <http://www.ajol.info>

¹⁸ As at 17 March 2006



- International Journal of Agriculture and Rural Development (Nigeria)
- Journal of Science and Technology (Zambia)
- Nigeria Journal of Pure and Applied Physics (Nigeria)
- Southern African Forestry Journal (South Africa)
- South African Journal of Surgery (South Africa)
- Sud Sciences et Technologies (Burkina Faso)
- Western Indian Ocean Journal of Marine Science (Tanzania)
- Zimbabwe Veterinary Journal (Zimbabwe)

CHALLENGES FACING AFRICA

The uptake of institutional repositories and Open Access archives on the Africa continent has been slow due to issues relating to the following:

- Acceptance of electronic information
- Absence of information management strategies/policies
- Copyright and Intellectual Property Rights (IPR) concerns
- Inadequate technical infrastructure
- Lack of awareness and understanding of the concepts
- Lack of funds

Acceptance of Digital Information

Although Africa is also experiencing the digital information revolution, which has brought about new ways of generating and distributing information, there is still a large emphasis on access to the printed word. This situation is well illustrated by the large number of universities and research institutes on the continent that still require their students or researchers to submit print copies of their theses and dissertations, or research reports. Even libraries and documentation that request researchers to submit copies of their seminar papers, conference papers, and journal articles for archival purposes, in most cases ask for print copies even though electronic copies are available on the hard disks of the researchers' computers. As a result, libraries in Africa have not progressed very far in making local content available electronically (Rosenberg 2005:10) and the attitude towards digital information resources has to change if digital information repositories are to flourish on the continent.

Absence of information management strategies/policies

Most institutions on the continent have not yet addressed issues relating to the generation of digital information resources and the preservation of and access to these resources. They do not have policies and strategies supporting the management of digital information resources. A good example can be seen from libraries and documentation centres that have information resources collection development policies which not include the collection of information resources in digital format.

Copyright and Intellectual Property Rights Concerns



Information and communication technologies have transformed the way information is - 11 - being generated, disseminated, preserved, archived, and made accessible. Information is increasingly being generated in digital format, and this raise more difficult and complex copyright issues than traditional printed document collections. Major concerns among most authors, and not only in Africa, are that placing material in the Open Access archives precludes its later publication in scholarly journals (Gadd et al, 2005), and for already published articles, the fear is that depositing the article in an Open Archive would constitute violation to the publisher's copyright (Rajashekar 2005). These concerns often turn out to be perceived rather than actual problems. Authors should note that, despite restrictive copyright transfer agreements practiced by many publishers, there are several legal ways to self-archive their works. In addition, over 90% of journals already officially support self-archiving, and among those who do not yet support it, many will agree to author self-archiving if the author asks; and for those that still don't, self-archiving the preprint before submission and a "corrigenda" file after acceptance is sufficient, and completely legal (Eprints 2005).

There is also a general concern, based on the history of exploitation of indigenous knowledge from Africa by the West, that if outputs of scientific research in Africa, i.e. research into plant medicine, are made accessible via institutional repositories and Open Access archives, the West will exploit the knowledge for commercial gain without compensation to the institutions/countries that generated the knowledge. As a result, it is difficult to convince most research institutions to place their knowledge resources into digital repositories like Open Access archives.

Inadequate technical infrastructure

Development and provision of access to institutional repositories and Open Access archives requires access to adequate ICT facilities, especially the Internet and intranets through which access to the resources is provided. Although Internet access is now widely available on the continent, the speed and reliability of Internet connections is a major challenge faced by most institutions. In addition, most public institutions, local NGOs, some academic institutions, public research institutions cannot afford adequate Internet bandwidth to enable them provide reliable access to institutional repositories hosted on their local servers.

Lack of awareness and understanding of the concepts

Although institutional repositories have become a hot topic over the last three years, to most researchers, library and information managers, administrators of academic and research institutes, government policy and decision makers on the continent, these are still new concepts which are yet to be understood. The new trends are not filtrating into the continent due to lack of adequate advocacy and appropriate capacity building relating to these technologies. Many people still do not know about the Open Access Initiative.

The above being the case, how can the research scientists, policy makers and information professionals push for investment and development of digital based information repositories and services, things which they may not understand?

Lack of funds

Since emphasis is still on the printed document, creating institutional repositories for most institutions means that they have to digitize the documents. Digitization projects, especially when they involve retrospective digitization of printed documents, are time and labour



intensive and generally expensive. A large number of institutions, especially public - 12 - funded institutions in Africa, including many public universities and research institutes, do not have the staff with relevant skills and money to implement digital institutional repositories.

CONCLUSION AND RECOMMENDATIONS

In spite of the opportunities presented by institutional repositories and open access archives in the management, sharing and distribution of information and knowledge resources in digital format, Africa has been very slow to adopt these technologies. The African continent need to be part of the global movement towards providing Open Access to scientific and technological information, since it is the people of Africa likely to benefit from this initiative. To paraphrase the words of Chan, Kirsop, Costa, and Arunachalam (2005), as a body of institutional repositories and Open Access archives is established in Africa, not only will the research community on the continent at last be a part of the international research community, but researchers in the developed world will begin to understand the value of Africa's research and knowledge and its potential contribution to the resolution of the world's major problems in health, agriculture, the environment and more closely defined disciplines such as taxonomy or biodiversity.

However, for this to happen, institutions in Africa need to create an environment that would support the development of digital repositories. This includes placing emphasis on capacity building and advocacy for institutional repositories and open archives, and adopting an approach that takes into account some of the major concerns. In addition, international organizations should also play an important role by supporting the creation of IRs on the continent.

Capacity Building

There is need for institutions to develop capacity in digital information management. This will include ensuring that directors of universities and research institutes, lecturers and research scientists, librarians and documentalists are familiar with the various issues concerning digital information, including available standards for archiving electronic information resources, copyright issues, and many others.

Advocacy

Advocacy for institutional repositories and Open Access archives on the continent should be intensified, and this should target government policy makers, senior management in universities and research institutes, research scientists, and library and information professionals. The importance and need for self-archiving and benefits of open access should be made clear, especially to research scientists, and the international donor community, which in most cases funds scientific research in Africa, can play a very positive by insisting that outputs of research funded by them should also be made available institutional repositories and Open Access archives.

Role of International Organizations: Case of FAO

International donor organizations funding research or those providing assistance in the development of information management and knowledge sharing networks in Africa can play an important role in the advocacy for and the development of institutional repositories on the



continent. They should building capacities of research scientists, research institutes - 13 - and institutions involved in the production of journals on the continent to enable them develop and manage electronic information resources. They also adopt policies that:

- Encourage research scientist to provide access pre-prints and e-prints of their research through institutional repositories and Open Access archives
- Mandate long-term preservation of research outputs in digital format within the research institutes
- Promote the establishment of national and regional discipline based institutional repositories

Donor funded research projects should also include allocations for publishing in institutional repositories the outputs of the research projects. Equally, information and knowledge sharing networks should have Open Access archives as major components of the network. This is the approach currently being promoted by the Food and Agriculture Organization (FAO) under the new strategy for the International Information System on Agricultural Sciences and Technology (AGRIS).

AGRIS was established in 1974 by FAO in response to demand from member states to facilitate information exchange and to bring together world literature dealing with all aspects of agriculture. The system became operational in 1975 as an international initiative aiming to build a common information system for science and technology in agriculture and related subjects, based on a collaborative network of institutions (FAO, 2002). One of the founding principles of AGRIS was that it was to provide a centralised collection of bibliographic details of outputs and activities of national agricultural research programmes, especially non - conventional (grey) literature. Following a review of AGRIS undertaken in 2002, it was found, among other shortcomings, that it was difficult to access the original documents from AGRIS references (bibliographic records). This led to the revision of the AGRIS principles and FAO, in collaboration with the Member Countries, developed the following new principles for the AGRIS network in 2002:

- a **decentralised** approach with greater emphasis on national partnerships with greater autonomy but with improved links;
- a greater **diversity** of research-oriented organizations participating in a strengthened global AGRIS network;
- a strengthened role in **capacity building**, including improved linkages between the AGRIS network and other FAO initiatives in Member Countries;
- a **focus on management of full text of documents in agricultural science and technology information resources**;
- a greater availability of **associated information** about activities, organisations, and people in agricultural science and technology;
- a continually improving set of **web-enabled** AGRIS methodologies and tools (with a focus on the establishment of standards), aimed at effective exchange and retrieval of science and technology information in a multilingual environment, developed and disseminated by FAO in consultation with Member Countries and AGRIS partners.

Under the new AGRIS arrangements, emphasis is being placed on improving electronic publishing of documentation (full-text documents) in agricultural science and technology, linking information about institutions, scientists and researchers, and activities, and using Web-enabled AGRIS methodology and tools to manage and disseminate digital documents. The information repositories to be created are in essence designed to be Open Access



archives, providing access to both the metadata and the full-text documents, via local - 14 - intranets and the Internet.

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