



Barriers to open access to scientific information in Kenya, with particular reference to agricultural information

Florence N.N. Muinde

G. E. Gorman

School of information Management

Victoria University of Wellington

New Zealand

Email: Florence.Muinde@vuw.ac.nz;

Gary.Gorman@vuw.ac.nz

Meeting:

101. Agricultural Libraries

WORLD LIBRARY AND INFORMATION CONGRESS: 75TH IFLA GENERAL CONFERENCE AND COUNCIL

23-27 August 2009, Milan, Italy

<http://www.ifla.org/annual-conference/ifla75/index.htm>

Abstract:

The paper is based on a qualitative PhD study that sought to investigate factors affecting the adoption of ICT for research communication among researchers in research institutions in Kenya. It shares empirical insights and experiences about barriers to open access (OA) initiatives in scientific research communication, with particular reference to agricultural information, that are unique to scholars and researchers in the Kenyan context. The findings reveal socio-cultural, infrastructural, motivational and personal/institutional initiatives barriers to OA and call for clear institutional and policy frameworks to guide the implementation of OA communication initiatives. OA awareness and capacity building is required to enable researchers to take advantage of OA opportunities. Too, the government needs to fund research to ensure that there is local content that can be shared online to facilitate South-South and South-North information flow.

Purpose of this paper - The paper highlights problems and challenges experienced by researchers in research institutions in Kenya in adopting open access (OA) initiatives to communicate scientific research information in the areas of agriculture, biological/biotechnology, environmental and health sciences. It is based on a PhD study that sought to investigate factors affecting the adoption of ICT for research communication among researchers in research institutions in Kenya.

Design/methodology/approach - Following the interpretivist epistemological position, this research seeks to understand, not predict, Kenyan researchers' contextual experience in using open access initiatives for their scientific research communication. Purposive sampling was used to select research sites and participants. Data were collected through document analysis and individual face-to-face interviews. Data analysis followed the three overlapping processes of qualitative data analysis: data reduction; display; and conclusion-drawing and verification (Huberman & Miles, 1998; Miles & Huberman, 1994).

Findings - Initial lack of ICT appreciation in Kenya affected computer-mediated communication. Many researchers in the public institutions, especially the universities, were yet to come to terms with e-communication processes in research, including e-publishing and the open access initiatives and software that can aid free sharing of scientific research information. Computer-mediated ICT, on which OA is predicated, had not been integrated into work routines. Moreover, lack of institutional framework and policy regulations to guide online communication of government information made scientists unwilling to share research information online. Further, both research communication and ICT were not a priority in budget allocation, resulting in infrastructural problems that discouraged OA initiatives. Also, disconnect between the policy-making wing and the research

community resulted in lack of enforcement to communicate research and so no efforts to spearhead open access initiatives that could facilitate access to scientific information. In addition, government control of the telecommunications sector discouraged free flow of information; yet, OA can only work well where there's free flow of information.

Researchers lacked skills to search and manipulate online information systems, write, speak, organize and present their research. There were no institutional repositories that could provide a platform for scientific knowledge sharing and full text open access journals were limited. Conflicting institutional mandates and government regulations where those who produce scientific information are not charged with dissemination and those supposed to disseminate are unfacilitated hindered OA. Contentious also was the model of open access adopted with researchers preferring OA channels that are free of author fees.

Research limitations - The interpretive nature of the study makes the study subjective; thereby, limiting its generalizability. Further, stiff bureaucratic procedures made the data collection procedure arduous.

Practical implications - The findings call for clear institutional and policy frameworks to guide the implementation of OA communication initiatives. OA awareness and capacity building is required to enable researchers to take advantage of OA opportunities. Too, the government needs to fund research to ensure that there is local content that can be shared online to facilitate South-South and South-North information flow.

What is original/value of paper - The paper shares empirical insights and experiences about barriers to OA initiatives in scientific research communication that are unique to scholars and researchers in the Kenyan context. These could provide a base for developing contextual open access implementation frameworks and strategies for scientific research communication.

Keywords

Open access, e-research, agricultural research communication, scientific research communication

INTRODUCTION

The Government of Kenya recognizes the importance of research and its dissemination in its higher education policy objectives (Government of Kenya, 2003a, 2003b, 2005). Nevertheless, agricultural and scientific research communication in Kenya has gone through difficult times since the late 1970s. 1977 marked the beginning of the lean years for Kenya publishing owing to economic decline. This has continued to the present, resulting in little or no research outputs to communicate; as Chakava (1992) observes, "Very little has been written on the Kenyan publishing industry even though it is one of the most important in Africa" (p. 119).

Research institutions in Kenya also became much politicized over the period, with a majority of university professors being absorbed into the state system, thus stifling creativity and intellectual culture and debate on important research (Chakava, 1996). There was curtailment of literary seminars, journals, and writers' workshops, and a general lack of facilities or incentives to promote and reward academic excellence (Chakava, 1996).

The advent of ICT-mediated research communication, and especially free Open Access (OA) initiatives, have been viewed as a boost to agricultural and scientific research communication. As a Kenyan medic stated, "The fact that the latest medical research is just a mouse click away is a major boon for practitioners in the developing countries...practitioners used to go to the library to refer to books and journals, most of which were way out of date," (Osanjo, 2009, n.p). The same views have been supported by OA protagonists (Chan, et al., 2002; Chan & Kirsop, 2001; Harnad, 2004, n.d.; Harnad, et al., 2004; Kirsop, 2002; Kirsop & Chan, 2005; Kling & McKim, 2000; Shrum, 1997; P Smart, 2003; P Smart, 2005; Suber & Arunachalam, 2005; Willinsky, 2006).

There have been 'free' access initiatives by international and donor institutions to strengthen research and its dissemination in developing countries through which Kenya and other African countries have benefited. Although called 'free' access, they are not true OA initiatives, as they are subsidised by sponsoring agencies, donors and other subscribers (Agosti, 2006; Beveridge, 2004; Frandsen, 2009; Guthrie & Nygren, 2007; Kirsop & Chan, 2005; Ouya & Smart, n.d; P Smart, 2005). These have included the Electronic Information for Libraries (eIFL), the Programme for the Enhancement of Research Information (PERI), the Health InterNetwork Access to research Information (HINARI), the Access to Global Online Research in Agriculture (AGORA), the Ptolemy

project, the Online Access to Research in the Environment (OARE), JSTOR African Access Initiative and Aluka¹ (Agosti, 2006; Beveridge, 2004; Guthrie & Nygren, 2007; P Smart, 2005).

These 'free' access initiatives are based on different models (Kirsop & Chan, 2005). These include:

- Consortial licensing approaches such as the Electronic Information for Libraries (eIFL) and the Programme for the Enhancement of Research Information (PERI). eIFL is a Soros initiative which strives for the wide availability of electronic resources by library users in transition and developing countries by negotiating for affordable subscriptions on a multi-country consortial basis and also providing consultancy, training and general support (Kirsop & Chan, 2005). PERI on the other hand seeks to improve access to research and dissemination in developing countries (Kirsop & Chan, 2005; Ouya, 2006; P Smart, 2003; P Smart, 2005).
- Differential Licenses model like the Health InterNetwork Access to research Information (HINARI) and the Access to Global Online Research in Agriculture (AGORA). HINARI was set up by WHO together with major publishers and enables developing countries to gain access to one of the world's largest collections of biomedical and health literature (<http://www.who.int/hinari/en/>). AGORA was set up by the Food and Agriculture Organization of the UN (FAO) together with major publishers and enables developing countries to gain access to an outstanding digital library collection in the fields of food, agriculture, environmental science and related social sciences (<http://www.aginternetwork.org/en/>). In this model institutions in countries with a GNP per capita of US\$1,000 or less are eligible for free access, while countries with a GNP per capita of US\$1,000-3,000 pay an annual fee of US\$1,000 per institution.
- Access through institutions in the North model such as Ptolemy and the eJournals Delivery Service (eJDS). Ptolemy (<http://www.ptolemy.ca>) is a model of electronic access to medical literature in developing countries which gives East African physicians access to the University of Toronto Library online journal collection by making them research affiliates of the Office of International Surgery. eJDS (<http://www.ejds.org>) is a project by the Abdus Salam International Centre for Theoretical Physics in Trieste, helping in the dissemination of mathematics and physics publications. It has made agreements with several key scientific publishers and societies who provide e-content freely which, using open source software information technologies, allows scientists in developing countries to search and download selected scientific articles using email only and/or via web mail gateways to (Kirsop & Chan, 2005).

It is only Bioline International (BI) which, acting as an aggregator of journals from developing countries, and other individual journals such as the *African Journal of Food Agriculture, Nutrition and Development* (AJFAND) and the *African Journal of Biotechnology* (AJB), which offer examples of open access. Bioline International (<http://www.bioline.org.br>) uses open source software and provides free online hosting services to publishers who do not have the resources or technical infrastructure to make their journals accessible online (Kirsop & Chan, 2005).

Most of the free access initiatives have concentrated on making available research findings from the North (Beveridge, 2004; Durrant, 2004; Frandsen, 2009; Guthrie & Nygren, 2007; Ouya, 2006; Ouya & Smart, n.d; P Smart, 2005). There needs to be a corresponding focus on the online availability of information if increased local capacity in research dissemination is to be attained. Moreover, despite the advances in ICT-mediated research communication made possible by freely available open source software, OA and other ICT-mediated research communication channels are not yet widespread among scholars and researchers in many research and higher education institutions in Kenya and Africa in general (Agosti, 2006; Beveridge, 2004; Mutula, 2001a, 2001b; Ondari-Okemwa, 2002; Osanjo, 2009; Ouya, 2006; Shibanda, 2006; P Smart, 2005; Teferra, 2004; Tijssen, Mouton, Va Leeuw, & Boshoff, 2006). The situation suggests the need for an in-depth analysis to unearth the contextual realities pertaining to barriers to OA and ICT-mediated research communication, which this study has sought to do.

¹ 'Aluka' is derived from a Zulu word meaning 'to weave', reflecting Aluka's mission to connect resources and scholars from around the world (<http://ts-den.Aluka.org/fsi/img/misc/pdf/Background.pdf>)

Adopting the Interpretivist paradigm, the study interviewed researchers and scholars, policymakers, library managers and science editors in applied science research institutes and in universities focussing on agriculture, health, biotechnology and environmental research. The aim was to determine the barriers and enablers to ICT-mediated research communication including OA initiatives.

Data was analyzed and coded following Miles and Huberman (1994), and emerging themes were identified. Despite the advantages that have come with OA approaches and ICT-mediated communication in general, to scientific research communication the data revealed contextual barriers that discouraged widespread adoption of the OA initiatives as a means of giving visibility to African research.

ANALYSIS AND DISCUSSION

Lack of/need for strategic research

The findings revealed perceived contextual barriers to OA for agricultural and scientific research information among the various stakeholders. The first barrier has to do with what the researchers and scholars felt should be the priority in addressing research communication issues. They expressed that the priority need in agricultural and scientific research in Kenya was reinforcement of strategic research communication capacity to first ensure there was a message that can be communicated either OA or otherwise. Though we could be talking OA to agricultural information, the findings revealed there was not much research going on in research institution owing to lack of research funding. It emerged research was not a priority in the planning and budgeting for resource allocation. This resulted in a lack of research culture within the research community. Hence, there was a necessity for government and research institutions to prioritize research and its communication in their planning and resource allocations to ensure a research culture is engrafted. It is only after addressing the issue of research resources to ensure there are outputs to be communicated that we can revisit the issue of the tools to facilitate their communication. Thus, lack of appropriate local research outputs was the first barrier to open access to agriculture.

Secondly, participants expressed concern that implementation of ICT-mediated communication was not preceded by an assessment of researchers' needs and institutional e-readiness to avoid haphazard implementation of ICT programmes. This resulted in much focus being laid on the communication technologies and not the output they were meant to communicate. As a research communications' advisor reported, "the easier thing has been to buy computers; sometimes not even based on real needs," what some participants saw as "putting the cart before the horse." Some participants explained implementing ICT without e-readiness assessment has tended to push the ICT technology too fast for majority to come out of their cultural ways and cope. Ndede-Amadi (2006); Rosenberg (2006); Duque, *et. al.* (2005) ; and (Ondari-Okemwa, 2002) stress the need for e-readiness assessment to precede any implementation efforts. Others affirming the same are (Keengwe, Kidd, & Kyei-Blankson, 2009; Limo, 2008; Musa, Mbarika, & Meso, 2005). This also featured widely in the World Conference on Agricultural Information and IT held in Tokyo from 24-27 August 2008, where it was expressed that ICT is about people and processes, not technology and so "considering that ICTs are enabling tool, we need make sure it is needs-driven."

Socio-cultural factors

The findings revealed a gap in the political and institutional leadership that negatively affected scientific research communication in Kenya. Owing to what participants called "non-visionary leadership", it was reported that a research culture had not been established in Kenyan research institutions. The same leadership and cultural factors affecting research communication also affected the adoption of ICT initiatives such as OA for the same reasons. The findings indicated that the leadership lacked an appreciation of ICT in government functions and clear perceptions of its functionality. The fact that their lack of vision was seen as a hindrance to implementation affirms the difficulties in scientists' ability to communicate scientific outputs through any ICT-mediated research communication. Consequently, computer-mediated ICT, on which OA is predicated, had not been integrated into work routines. The result was that many researchers in the public institutions,

especially the universities, were yet to come to terms with e-communication processes in research, including e-publishing and the open access initiatives and software that can aid free sharing of scientific research information.

Government control of the telecommunications sector discouraged the free flow of information; yet OA can only work well where there is a free flow of information. It was reported that an entrenched government monopoly of the communication system resulted in there being only one ISP, Jambonet, and that the lack of competition ensuing from this monopoly limited Internet access. It also made it quite expensive and, therefore, out of reach for many. Telephone and fax have been the most common communication tools in most public institutions. It also emerged during the period running through the 1990s to early 2003 that there was considerable government control of what information was communicated via the mass media. Protocols required researchers to be cleared by their seniors in order to communicate their research. This limited both communication and the development of communication networks; it also hindered the ICT-mediated dissemination of government information, of which agricultural research is a component. Mutula (2001b) and Ondari-Okemwa (2002) affirm the negative effect of bureaucracy on ICT-mediated research communication in Kenyan research institutions.

The literature affirms the need for effective leadership in the implementation of ICT-mediated communication. Oyomno (2006) says it “defines the framework within which stakeholders play complementary roles in the development of a sustainable national ICT capability” (p. 102). He views it as “an overarching function that provides the championship, direction, and coordination required to create a national vision, policy, strategy, architecture and standard for ICT development and deployment in government and in the economy” (p. 103). The IT Governance Institute (2003) stresses the same and views IT governance as consisting of the “leadership and organizational structures and processes that ensure that the enterprise’s IT sustains and extends the enterprise’s strategies and objectives” (p. 11).

Another key socio-cultural barrier to ICT-mediated research communication was the oral and communal nature of the Kenyan/African people as compared to the individualistic and “silent” nature of computer-mediated communication. Participants reported that computer-mediated communication tended to isolate the researchers and users from those surrounding them. This aspect does not endear many to it (Borgman, 2007; Limo, 2008; Sonnenwald, 2007). Participants reported widespread usage of the mobile phone because it aligned with the oral culture of the people and the fact that it could use it anywhere any time without isolating oneself from the group.

Institutional framework

The data revealed an absence of a clear institutional framework to guide ICT-mediated research communication implementation within and among science research institutions in Kenya. It seemed that there were no mechanisms for integrating ICT into work routines in most public research institutions; as one respondent explained “... we have not reached the level of integrating ICTs into our day-to-day work”. Researchers and students were not required to use ICT in their communication. As one individual indicated, “We do not have (up to now) to actually use ICTs to meet or solve their problems and challenges or to use them effectively.” ICT had also not permeated into the rural areas, where the majority of the target groups for the research outputs resided; neither was there any effort to link research institutions with the user communities. Researchers felt it was “futile” for them to have access to ICT if they could not reach their clients in order to disseminate research outputs. Moreover, the lack of institutional frameworks, policy regulations and legislation to guide implementation of online communication of government information made scientists unwilling to share research information online.

Participants also mentioned a lack of institutional mechanisms to link policy-making with the research community, leading to disconnection between the two. This resulted in lack of enforcement to communicate research and the concomitant lack of efforts to spearhead OA initiatives that could facilitate access to scientific information. Of importance too was the lack of clearly defined communication channels among the research stakeholders – researchers, government and the community. Effective communication among all parties in an enterprise is essential if the enterprise’s ICT initiatives are to sustain and extend its strategies and objectives (IT Governance Institute, 2003).

Effective communication denotes the free flow of information to those who need it over the existing mass communication channels (Rogers, 2003). However, the findings revealed that, although Kenyans traditionally value agriculture as a major component in the national economy, and there was a general feeling that ICT-mediated communication would have helped inform agricultural practice, ICT-mediated communication is controlled by the educated, whose culture was quite different from that of rural agriculturalists.

It was reported that ICT-mediated knowledge was empowering those who already “have power in having knowledge, and it is going to reinforce power to those who already have it”, rather than the farmer or villager who engages in agriculture. It was also suggested that this was yet another example of the Digital Divide: urban dwellers are also the people with resources to afford the computer-mediated communication; poverty-stricken village dwellers cannot afford the necessary technology, and lack the skills to utilise such technology. Participants were of the opinion that it will take a long time for ICT-mediated agricultural research communication to affect the lives of the majority in Kenya. This suggests the necessity for the various stakeholders to come together and devise strategies that can help ICT-enabled dissemination of research information to inform the developmental priorities of the country in line with Vision 2030 and the MDGs (Government of Kenya, 2007) .

The findings revealed a lack of demand for ICT-mediated research communication and management information systems (MIS). Some scholars and researchers reported that, while the administrative and financial departments within the research institutions and universities pushed to have relevant MIS, the research fraternity did not express a need for either teaching or research software, as this quote from one of them indicates: “We have all these management information systems and none of them is geared towards specifically research, teaching or consultancy (core functions).” The lack of demand for ICT-enabled research communication was also indicated by the reported non-use of the already existing bandwidth for research communication. This shows there is a gap in Internet use for research and shows the need for research institutions to devise innovative ways of exploiting the benefits of the Internet for improved communication of research outputs.

Researchers also reported they lacked time not only to publish research on the Internet but also to undertake research that could lead to outputs worthy of dissemination. Heavy workloads, especially for those who teach, and the fact that Internet access for most of them was in cyber cafes, did not allow time or a suitable environment to engage in Internet searches or online dissemination of their work. Their inadequate ICT skills could not allow fast Internet surfing. The issue of time contributing to the lack of online content aligns with findings from studies on adoption and use of ICT by faculty members (Hebert, 2007; Keengwe, et al., 2009).

Thus, it was imperative that institutional frameworks and strategies to guide implementation of ICT-mediated communication needed to be in place. The non-integrated application of ICT in research institutions does not reflect the common goal of a scholarly cyber-infrastructure which Borgman (2007) says should be “for the components to work together despite the variety of providers, users, and purposes” (p. 254). Oyomno (2006) sees the institutional framework as a key to “the seamless flow of information and knowledge and the engagement and involvement of a broad spectrum of stakeholders” (p. 104). The same views are shared by others (Casal, 2007; Gebremichael & Jackson, 2006; Mutula, 2001b; Ondari-Okemwa, 2002; Oyelaran-Oyeyinka & Lal, 2005; Van de Sompel, Payette, Erickson, Lagoze, & Warner, 2004).

Policy and strategy and legislation and regulatory framework

As well as the institutional framework, there was a need to understand government policy regulation and legislation in studies on scholarly communication infrastructure, because research communication relies on government for funding and direction. These are also important in the development of an ICT-mediated communication capability. Borgman (2007) confirms the importance of this when she says, “Scholarly infrastructure must be understood in the context of legal, policy and economic arrangements” (p. xviii). Oyomno (2006) further argues that policy is an important dimension of a national ICT environment, for it provides a roadmap for the development of ICT capabilities and denotes an understanding by government about the role of ICT in society. He explains that an ICT policy “is designed to strengthen the information and communication

infrastructure, and address information technology, telecommunication, and postal services, among others” (p. 105).

The findings revealed that lack of or poor government policy and strategy and legislation framework about ICT adoption and use has been a barrier to ICT-mediated communication in Kenya. ICT policy and regulatory and legislation issues were yet to be nationally and institutionally addressed. For example, the lack of legislative and policy frameworks to govern intellectual property rights (IPRO) issues in an electronic environment discouraged many from e-communication and e-publishing, for they feared losing their IPR (Mwaura, 2008). Some participants also expressed the need for ICT policy to guide ICT-mediated communication in the agricultural sector. Hand-in-hand with this was the need to finalize the Science, Technology and Innovation (STI) policy to address matters pertaining to scientific innovation and communication. The absence of an ICT policy regulatory framework to govern ICT implementation both at the national and institutional level has also been reaffirmed in the literature (Bowman-Ngaruiya & Waema, 2006; Mutula, 2001b; Ndede-Amadi, 2006; Odero-Musakali & Mutula, 2007; Sihanya & Odek, 2006).

Participants reported prohibitive legislations such as the Official Secrets Act (Cap 187) (Government of Kenya, 1968) inhibited the free circulation of government information, whether online or physically. Most government information was treated as confidential – reported as “classified; it is touchy”. Restrictive government regulations requiring clearance before one could communicate government information led to a situation of uncertainty avoidance (Hofstede, 2001) where researchers were slow to communicate for fear of contravening legislation. There was also the issue of outdated laws and procedures governing communication of information in the public sector that did not recognize digital communication. The findings pointed to the need for repealing such legislation and policy to guide communication of ICT-enabled government information communication. Wafula & Etta (2006) affirm this and call for “the need for inclusion of policies statements on the management of electronic records in national ICT policies” (p. 12).

Another issue is that, whereas many initiatives have been implemented in conjunction with institutions’ libraries, this study found that many public research institutions’ libraries were at the initial stage of automation. This affirms Rosenberg’s (2006) study of digital libraries in Africa. Moreover, most of the institutional websites were yet to be complete, navigable and loaded with relevant local research content. Further, there were no arrangements for institutional repositories that could provide a platform for scientific knowledge sharing. Only one research institution was reported to be working towards one. Coupled with this, full-text open access agricultural journals were limited.

The findings uphold Mutula’s (2001b) call for policy framework and clear strategies by research institutions, reflecting the institutions’ vision, mission and mandates, to guide and enforce the implementation of ICT-mediated communication. Ondari-Okemwa (2002), drawing from his findings of the AVU, stresses on the need for “a shared purpose or vision”, arguing that “the shared purpose or vision serves as a ‘glue’ of the virtual organization” (p. 325). Similar views on the need to address the ICT adoption framework in Kenya are shared by Wafula and Etta (2006) and Oyomno (2006). Kaniki (2004) stresses the need for an STI policy to address issues pertaining to scientific communication in African countries.

ICT Infrastructure shortcomings

ICT infrastructure problems discouraged OA and other e-publishing initiatives. Participants reported the infrastructure problem was so bad that many researchers in the national institutions could not access donor-subsidized e-resources through programmes like AGORA, HINARI, AJOL, PERI, OARE and Bioline, among others. Osanjo (2009) reported that a medical practitioner at the University of Nairobi had reported that there were only four computers to access OARE and would have wished for 10 instead.

The findings revealed that the disparities in access to ICT tools and infrastructure also existed within and between research institutions. There was good Internet presence in international research institutions unlike public institutions which, apart from those that enjoyed donor funding, lacked essential ICT tools and infrastructure. Researchers lacked PCs, whether individually or institutionally owned. Participants reported that the acquisition of computers and their accessories was predicated on donations or grants. The participants relied on Internet cafes to access information, which was

both expensive and unreliable. Further, many institutions lacked reliable Internet connectivity, especially those outside the major towns. Where the Internet was available, small bandwidth made the speed too slow for effective downloads and uploads of information. The bandwidth in many public institutions was reported to range from 1MB to 20MB. This was not helped by an erratic electric power supply. The literature attests to this situation (Adewuyi, 2008; Ngulube, 2004; Osanjo, 2009). Lack of Internet cabling was reported to be a major barrier; institutions had to look for funding to do the cabling before they could think of Internet connectivity.

As many participants explained, the lack of tools and infrastructure tended to discourage many from adopting ICT-mediated research communication, especially those in rural centres. They explained that the lack of Internet connectivity in most national institutions meant that those who had Internet connectivity, in both national and international research institutions, could not have much impact in communicating research outputs, for they needed to work together with their peers in national institutions and also reach out to the community.

Participants expressed the need for functional information communication systems to facilitate dual communication between those farmers and others at the grassroots level needing information and the researchers. The two sides needed to be provided with modern tools for communication to facilitate information exchange. In this way the dissemination of technologies and/or methodologies was likely to succeed and have the desired impacts.

Lack of skilled human resources

The findings revealed that lack of ICT awareness and skills and lack of communication skills were barriers to ICT-enabled research communication. These are important aspects of human capital which is a requisite national ICT capability and an essential determinant of the capacity of a country to effectively develop and use its ICT assets (Oyomno, 2006).

Lack of ICT/OA awareness and skills

The literature pointed to the need for adequate exposure to any technology to reach the threshold level for maximum use (Adewuyi, 2008; Bagchi & Udo, 2007; Casal, 2007; Durrant, 2004; Mbarika, Jensen, & Meso, 2002; Muinde, 2004; Rogers, 2003; Rosenberg, 2006). Every participant who participated in this study reported lack of/inadequate hands-on ICT skill and exposure as a major barrier to ICT-mediated research communication. ICT-mediated communication requires skill, awareness and exposure to be able to communicate proficiently. The majority of researchers, except for those who had studied in the developed world and those working in the international research institutions or donor-funded projects, lacked training in and exposure to ICT and were just being introduced to the technology; consequently, their ICT competence was insufficient for them to take advantage of the technology. They were said to lack hands-on computer abilities such as keyboard skills. This limited the speed and proficiency with which they could use the computer to communicate. Participants also reported lack of specialized information searching skills, so they could not manipulate ICT tools effectively or access information efficiently.

It also emerged that most researchers were unfamiliar with such e-communication capabilities as e-publishing and e-learning, and preferred the traditional communication system. Many researchers were also unaware of the free software available and tended to rely on the Microsoft packages bought along with the computer. Participants called for the need to build researchers' capacity in how to manipulate publishing software and functions like Photoshop. This would make it possible to anticipate the likely end product and the researchers to collect photos and materials that could aid in repackaging their research outputs in formats easily mounted and accessed online. Some participants said this called for strengthening of the IT departments or specialized professionals who could assist researchers in synthesizing materials for online communication. There was also a need for awareness creation on the ICT that were freely available. This affirms Durrat's (2004) recommendation that there was need for specific open access training.

Lack of communication skills

The ability to originate and communicate a message is the key to effective research communication. ICT is a tool whose application in the communication of research outputs is predicated on other skills

and abilities. Effective researchers must be able to create research outputs that can be communicated via ICTs. However, the findings revealed a gap in the capacity of participants to communicate research outputs because they lacked communication and English language skills. They were said to be poor communicators who were not trained to communicate. They also lacked the capacity to repackage their technical outputs into formats and language that could be easily understood by and communicated to end users who are supposed to make use of research outputs to improve the quality of their lives. As one scientist observed, "... if you are not good in writing and communicating your ideas in writing, then the effectiveness and impact of ICT will still suffer from that inadequacy." It was reported that a needs assessment in 2006 within ASARECA² had identified a shortage of communication skills and pointed to the need to build capacity in Agricultural Information Communication and Management (AICM).

These findings match conclusions drawn in the literature. Adewuyi (2008) says that, technological problems by African authors notwithstanding, "research on communicative competence and academic discourse has for long exposed the linguistic problems that African scholars face in writing scholarly articles in the English language"; he adds, "Writing academic papers in a language other than the mother tongue may pose problems" (p. 4). Citing Alo (2003, p. 117), he explains that communication competencies underpin academic research communication success. Both scholars argue that "writers/scholars must be competent in all the components of communicative competence – linguistic, socio-linguistic, strategic, and discourse – in order to produce well-formed utterances and sentences" (Adewuyi, 2008, p. 4). Adewuyi goes on to comment that "idiosyncratic use of words and phrases by African authors might impede comprehension of what the author is trying to put across..." (p. 5).

Appropriate content

The findings revealed that lack of appropriate content was a key barrier to OA and other ICT-mediated research communication initiatives. This was evident from the websites of the public institutions in the investigation; these were characterized by scanty or irrelevant research content, and they were not communicating the research outputs of the institutions. Many public institution websites displayed information on departments, institutional vision, mission and mandates and profiles of the administrators. Where content was available, participants reported it was not well organized and its nature and format were unsuitable for web hosting. It first needed to be reorganized, digitized and repackaged into formats that could facilitate greater access.

The lack of Internet local content resonates with findings from earlier research on public sector ICT research initiatives in Kenya. Ndede-Amadi (2006) found that many were unclear about the content that should be placed on web sites, while Wafula and Etta (2006) established the need for development of e-content to serve Kenya's diverse cultures. Oyomno (2006) says content and applications are important aspects of a national ICT environment.

That content is vital in any research communication infrastructure cannot be over-emphasized. The content must also be responsive to the expressed needs of the research community to entice researchers to adopt and use a computer-mediated research communication system like OA. The findings affirm Borgman's (2007) proposed layered cyber-infrastructure model in which she shows the supremacy of content by having it on the top while the ICT infrastructure comes at the bottom. She stresses that "To be useful, the content layer must include the right resources, tools, services, and policies for the communities it serves" (p. 186).

OA Model, impact factor and information security

Contentious also was the model of open access adopted, with researchers preferring OA channels that are free of author fees. Research institutions lacked funding for subscription to online resources, and those already existing were donor supported and so unsustainable. Participants expressed the need for free open access journals that employ the no-fee model for both access and dissemination, first because research is publicly funded and, therefore, a public good, and secondly because majority of the scientists from Kenya and Africa in general could not afford subscription. Thus,

² Association for Strengthening Agricultural Research in Eastern and Central Africa (<http://www.asareca.org>)

unlimited open access was viewed as having the potential to overcome research communication problems, an issue supported by Agosti (2006) and other OA advocates (Harnad, 2004; Kirsop & Chan, 2005; Suber & Arunachalam, 2005; Willinsky, 2006).

Some participants raised issues concerning the authenticity and impact factors of OA publishing. There was still doubt about whether OA outlets could be promoted for scholarly recognition. Critical also were information security fears in OA and ICT-mediated research communication in general. Many researchers were afraid of plagiarism, especially when research output was unpublished. They feared they would have no control once the work was in the public domain. Science is competitive, more so due to lack of funding and the fact that it takes a long time to derive results. Hence, researchers feared losing their IPR to better-endowed competitors who could take advantage and publish the results, thereby claiming ownership. A researcher asserted the fear of plagiarism is based on real instances where some “people have sent their proposals for funding and have probably found them executed elsewhere and others’ work was pirated without acknowledgement “even if you put a rider asking people to acknowledge when they cite you, people will still not do so.” Thus, there was need to address these concerns for OA to enhance visibility of African research.

Personal/Institutional initiatives

Some participants felt that a lack of initiative at both individual and institutional levels was partly responsible for the lack of unawareness of the available OA and other electronic research resources and also lack of skills on how to use them. Many researchers who knew how to manipulate the Internet for research resources said they were self-taught. Others felt the libraries were to blame for not creating adequate user education on the use and available free electronic research resources. Mutula (2001a, 2001b) and Odero-Musakali & Mutula (2007) in their studies of ICT adoption and use in university libraries in East Africa, Kenya in particular, seem to concur with this claim, accusing libraries of passivity in their efforts to adopt ICT-mediated research communication. Citing examples from Southern African region which have developed into ISPs, Odero-Musakali & Mutula (2007) allege “universities in Kenya continue using ‘limitation of funds’ as an excuse for their non-active participation in these technological developments” (p. 472). Rosenberg (2006) affirms the lack of user education by libraries.

Motivation

Researchers also reported lack of motivation as a factor affecting ICT-mediated research communication. They said hard economic realities and poor remuneration and terms of service in the public institutions had forced many to look for alternative ways to earn their livelihoods. Participants reported the economic hardships have resulted in a “what’s in it for me’ culture, where Kenyans peg use of the Internet as an information source for financial gain. A scientist illustrated this when she reported, “A Kenyan will not spend two hours on the Internet, unless he knows it has a benefit to him and unless that Internet is free” and even then “we [Kenyans] limit our scope to what information we want to get.” Such a culture is not healthy for research communication which requires extensive exploration of the literature to identify gaps. This confirms Borgman’s (2007) claim that “a scholarly information infrastructure will be effective in facilitating access to the artefacts of research if it takes into account the motivations of those who produce and control those artefacts” (p. 177).

CONCLUSIONS AND RECOMMENDATIONS

Although there is widespread realization of the usefulness of OA in agricultural and scientific research communication, progress in capitalizing on OA initiatives to enhance accessibility and visibility to Kenyan/African research has been slow. This was attributed by participants to:

- lack of research engagement to produce outputs to communicate
- socio-cultural aspects like leadership and the orality/communal life as opposed to the individualistic and “silent” nature of computer-mediated communication
- lack of institutional frameworks and government policy and regulatory and legislative environment
- lack of communication and ICT skills
- lack of ICT infrastructure; the OA model

- fears about impact factor and information security
- lack of personal and institutional initiative and poor motivation.

The availability of appropriate content remains crucial, as does the need for OA and any other ICT-mediated research communication initiatives to be predicated on researchers' needs and e-readiness. On the whole, there was a general recognition of the important role of OA initiatives in facilitating agricultural and scientific information communication. Participants felt the move is towards electronic research communication, and especially OA, although print is still important under the prevailing circumstances.

The study recommends the need for massive awareness campaigns on available OA initiatives and introduction of institutional frameworks and strategies on harnessing OA initiatives to communicate local research outputs. This should be in addition to revision of prohibitive government policy and legislation and introduction of new policy legislation that creates an enabling environment for online communication of agricultural and scientific information. Capacity building, both in communication and ICT capability, should be enhanced. Above all, there is need for both government and donor and other agencies to increase support for research and ICT infrastructure to ensure sustainability.

REFERENCES

- Adewuyi, D. (2008). *African Scholars publishing in American Online Journals: An Empirical Analysis by an Editor*. Paper presented at the Conference on Electronic publishing and Dissemination "Putting African Journals On Line: Opportunities, Implications and Limits", Dakar, Senegal, 6-7 October 2008.
- Agosti, D. (2006). 'Free' access to research should not be limited. Retrieved 13 June 2008, from SciDev.Net: <http://www.scidev.net/en/science-communication/science-publishing/opinions/free-access>
- Alo, M. A. (2003). Communicative Competence and Academic Discourse in an ESL University Setting. In L. Oyeleye & M. Olateju (Eds.), *Readings in Language and Literature* (pp. 115-126). Ibadan: Intec Printers.
- Bagchi, K., & Udo, G. (2007). Empirically testing factors that drive ICT adoption in Africa and OECD set of nations. *Issues in information systems*, 8(2), 45-52.
- Beveridge, M. (2004). *The ptolemy project: Delivering electronic health information in East Africa*. Paper presented at the Open Access and the Public Domain in Digital Data and Information for Science, Paris.
- Borgman, C. L. (2007). *Scholarship in the Digital Age: Information, Infrastructure, and the Internet*. Cambridge, Massachusetts: The MIT Press.
- Bowman-Ngaruiya, W., & Waema, T. (2006). The institutional structures and models for implementing the Kenyan national ICT plan. In G. Outa, F. Etta & E. Aligula (Eds.), *Mainstreaming ICT: Research perspectives from Kenya* (pp. 25-72). Nairobi: MvuleAfrica Publishers.
- Casal, C. R. (2007). ICT for education and development. *Info*, 9(4), 3-9.
- Chakava, H. (1992). Kenyan publishing: Independence and dependence. In P. G. Altbach (Ed.), *Publishing and development in the Third World* (pp. 119-150). London: Hans Zell Publishers.
- Chakava, H. (1996). Publishing and state censorship in Kenya. *Bellagio Publishing Network Newsletter*, 16(Spring), 14.
- Chan, L., Cuplinskas, D., Eisen, M., Friend, F., Genova, Y., Guedon, J., et al. (2002). Budapest Open Access Initiative. Retrieved from <http://www.soros.org/openaccess/read.shtm>
- Chan, L., & Kirsop, B. (2001). Open archiving opportunities for developing countries: Towards equitable distribution of global knowledge. *Ariadne*, 30. Retrieved from <http://www.ariadne.ac.uk/issue30/oai-chan/intro.html>
- Duque, R. B., Ynalvez, M., Sooryamoorthy, R., Mbatia, P., Dzorgbo, D. S., & Shrum, W. (2005). Collaboration paradox: Scientific productivity, the Internet, and problems of research in developing areas. *Social studies of science*, 35(5), 755-785.
- Durrant, S. (2004). *Overview of initiatives in the developing world*. Paper presented at the Open access and the public domain in digital data and information for science, Paris.
- Frandsen, T. (2009). Attached to open access journals: A bibliometric author analysis in the field of biology. *Journal of Documentation*, 65(1).

- Gebremichael, M. D., & Jackson, J. W. (2006). Bridging the gap in Sub-Saharan Africa: A holistic look at information poverty and the region's digital divide. *Government Information Quarterly*, 23(2), 267-280.
- Government of Kenya (1968). *The Official Secrets Act* Retrieved October 10 2008. from http://www.kenyalaw.org/kenyalaw/klr_app/frames.php.
- Government of Kenya (2003a). *Report of the national conference on education and training*. Paper presented at the Meeting the challenges of education and training in Kenya in the 21st century Kenyatta International Conference Centre, Nairobi, November 27 – 29.
- Government of Kenya (2003b). *Report of the sector review and development*. Nairobi: Ministry of Education, Science & Technology.
- Government of Kenya (2005). *Sessional paper no. 1 of 2005 on a policy framework for education, training and research: Meeting the challenges of education, training and research in Kenya in the 21st. century* Nairobi: Ministry of Education, Science & Technology.
- Government of Kenya (2007). *Kenya Vision 2030*.
- Guthrie, K., & Nygren, T. (2007). **Aluka**: Building a digital library of scholarly resources from Africa Retrieved 16 April 2009, 2009, from <http://ts-den.Aluka.org/fsi/img/misc/pdf/Background.pdf>
- Harnad, S. (2004). Open Access to Peer-Reviewed Research through Author/Institution Self-Archiving: Maximizing Research Impact by Maximizing Online Access. In J. Andrews & D. Law (Eds.), *Digital Libraries: Policy planning and Practice*. United Kingdom: Ashgate Publishing.
- Harnad, S. (n.d.). Publish or perish - self-archive to flourish: The green route to open access Retrieved 3 April 2006, from http://www.ercim.org/publication/Ercim_News/enw64/harnad.html
- Harnad, S., Brody, T., Vallieres, F., Oppenheim, E., Stammerjohanns, H., & Hilf, E. (2004). The Access/Impact Problem and the Green and Gold Roads to Open Access. *Serials Review*, 30(4), 310-314.
- Hebert, D. M. (2007). *Innovation in teacher education: Faculty members' and assessment coordinators' perceptions of electronic assessment systems*. Unpublished PhD dissertation, Louisiana State University and Agricultural and Mechanical College, Louisiana.
- Hofstede, G. (2001). *Cultures consequences: Comparing values, behaviours, institutions, and organizations across nations*. Thousand Oaks, CA: Sage.
- IT Governance Institute (2003). Board briefing on IT Governance Available from www.itgi.org and www.isaca.org
- Kaniki, A. (2004). *Information Needs for Basic Research: An African Perspective*. Paper presented at the Open Access and the Public Domain in Digital Data and Information for Science. Proceedings of an international symposium, Paris.
- Keengwe, J., Kidd, T., & Kyei-Blankson, L. (2009). Faculty and technology: Implications for faculty training and technology leadership. *J Sci Educ Technol*, 18, 23-28.
- Kirsop, B. (2002). Electronic Publishing Trust for Development. *Bangalore Electronic Publishing Workshop, 27 March 2002*, from http://www.ias.ac.in/epubworkshop/presentations/epub_DCs/sld007.htm
- Kirsop, B., & Chan, L. (2005). Transforming access to research literature for developing countries. *Serials Review*, 31, 246-255.
- Kling, R., & McKim, G. (2000). Not just a matter of time: Field differences in the shaping of electronic media in supporting scientific communication. *Journal of the American Society for Information Science and Technology*, 51(14), 1306-1320. Retrieved from <http://xxx.lanl.gov/ftp/cs/papers/9909/9909008.pdf>
- Limo, A. (2008, 19 July). Parents must act now to control cyber culture among children. *Daily Nation*, from <http://www.nationmedia.com/dailynation/nmgcontententry.asp>
- Mbarika, V., Jensen, M., & Meso, P. (2002). International perspectives: Cyberspace across Sub-Saharan Africa. *Communications of the ACM*, 45(12), 17-21.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. London: Sage.
- Muinde, F. (2004). *The Public Knowledge Project's Open Journal Systems* Paper presented at the Open Access and the Public Domain in Digital Data and Information for Science. Proceedings of an international symposium, Paris.
- Musa, P. F., Mbarika, V. W., & Meso, P. (2005). Calling for programmed technology transfer and adoption strategies for sustainable LDC growth. *Communications of the ACM*, 48(12), 111-116.
- Mutula, S. M. (2001a). Internet access in East Africa: A future outlook. *Library review*, 50(1), 28-33.

- Mutula, S. M. (2001b). The IT environment in Kenya: Implications in public universities. *Library Hi Tech*, 19(2), 155-166.
- Mwaura, P. (2008, April 19). Kenya is still sleeping on its intellectual property rights. *Daily Nation* Retrieved April 19 2008, from <http://www.nationamedia.com/dailynation/printpage.asp>
- Ndede-Amadi, A. (2006). National digital indicators and e-government models: A status assessment for Kenya. In G. Outa, F. Etta & E. Aligula (Eds.), *Mainstreaming ICT: Research perspectives from Kenya*. Nairobi: MvuleAfrica Publishers.
- Ngulube, P. (2004). Implications of Technological Advances for Access to the Cultural Heritage of Selected Countries in Sub-Saharan Africa. *Government Information Quarterly*, 21(2), 143-155.
- Odero-Musakali, D., & Mutula, S. (2007). Internet adoption and assimilation in Kenyan univeristy libraries. *Library review*, 56(6), 464-474.
- Ondari-Okemwa, E. (2002). Challenges of harnessing virtual information resources in Kenya: The case of the African virtual university. *Journal of Information Science*, 28(4), 321-329.
- Osanjo, T. (2009). Free access to journals gives Kenya science a boost. Retrieved from <http://www.who.int/bulletin/volumes/84/9/06-030906/en/print.html>
- Ouya, D. (2006). Open Access survey of Africa-published journals. *INASP infobrief* 7(June). Retrieved from <http://www.inasp.info>
- Ouya, D., & Smart, P. (n.d). Open Access survey of Africa-published journals. Retrieved from <http://www.ascleiden.nl/Pdf/elecpublicconfouyasmart.pdf> 16 April 2009
- Oyularan-Oyeyinka, B., & Lal, K. (2005). Internet diffusion in sub-Saharan Africa: A cross-country analysis. *Telecommunications Policy*, 29, 507-527.
- Oyomno, G. Z. (2006). National digital indicators and e-government models for Africa: A conceptual and theoretical foundation. In G. Outa, F. Etta & E. Aligula (Eds.), *Mainstreaming ICT: Research perspectives from Kenya* (pp. 73-116). Nairobi: MvuleAfrica publishers.
- Rogers, E. M. (2003). *Diffusion of innovations*. (5th ed.). New York: Free press.
- Rosenberg, D. (2006). Towards the digital library in Africa. *The electronic library*, 24(3), 289-293.
- Shibanda, G. (2006). *Enhancing e-journal use in Kenyan universities*. Paper presented at the CODESRIA ASC Conference on electronic publishing and dissemination 6-8 September 2006.
- Shrum, W. (1997). View from afar: 'Visible' productivity of scientists in the developing world. *Scientometrics*, 40(2), 215-235.
- Sihanya, B., & Odek, J. O. (2006). Regulating and mainstreaming ICT for Kenya's socio-economic development. In G. Outa, F. Etta & E. Aligula (Eds.), *Mainstreaming ICT: Research perspectives from Kenya* (pp. 169-224). Nairobi: MvuleAfrica publishers.
- Smart, P. (2003). *Supporting indigenous published research: The African Journals Online (AJOL) case study* Paper presented at the ELPUB2003: From information to knowledge, June 25-28, Guimaraes, Portugal.
- Smart, P. (2005). African Journals OnLine (AJOL). *Serilas Review*, 31, 261-265.
- Sonnenwald, D. H. (2007). Scientific Collaboration. *Annual Review of information Science and Technology*, 41, 643-681.
- Suber, P., & Arunachalam, S. (2005). Open access to science in the developing world. Retrieved from <http://www.earlham.edu/~peters/writing/wsis2.htm>
- Teferra, D. (2004). African Higher Education: Challenges for the 21 st Century. *Higher Education*, 47(January), 21-50.
- Tijssen, R., Mouton, J., Va Leeuw, T., & Boshoff, N. (2006). How relevant are local scholarly journals in global science? A case of South Africa. *Research Evaluation*, 15(3), 163-174.
- Van de Sompel, H., Payette, S., Erickson, J., Lagoze, C., & Warner, S. (2004). Rethinking scholarly communication: Building the system that scholars deserve. *D-Lib Magazine*, 10(9). Retrieved from <http://www.dlib.org/dlib/september04/vandesompel/09vandesompel.html#waters>
- Wafula, J. M., & Etta, F. (2006). An overview of ICT initiatives in Kenya. In G. Outa, F. Etta & E. Aligula (Eds.), *Mainstreaming ICT: Research perspectives from Kenya* (pp. 7-24). Nairobi: MvuleAfrica publishers.
- Willinsky, J. (2006). *The access principle: The case for open access to research and scholarship*. USA: Massachusetts Institute of Technology Press.