Towards Improved Access to Scientific Information in Africa: The Case for Transforming the Model of Scholarly Communication in the Region

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Abstract

Despite the centrality of scientific information in the research enterprise, scientific communities in many parts of the developing countries including Africa have limited access to this vital commodity. This paper reviews current challenges facing existing scholarly communication in the Africa region and examines how its transformation can be achieved using new practices, and tools of information management in the emerging digital environment. The paper seeks to concretize these practices and tools into a new model for scholarly communication that can bring down costs, and improve access, dissemination and sharing of scientific information among researchers and other key stakeholders in the African region. These tools include digital publishing and open access, library consortia access to scientific information, digital library concepts, use of social media and virtual communities and data digital curation

Keywords

Scholarly Communication, Open access publishing, Virtual Communities, Digital Curation, Digital libraries, Africa

1. Introduction

Scholarly communication has been defined in various ways but a simple way to understand it is that it is "about creating, disseminating and preserving scientific knowledge" (Halliday, 2001). A deeper way is to view scholarly communication as the "the system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community and other consumers, and preserved for future use. The system includes both formal means of communication, such as publication in peer-reviewed journals, and informal channels, such as electronic listservs" (Association of College & Research Libraries, 2003; 2014). Further, it has been defined as "the process of sharing, disseminating and publishing research findings of academics and researchers so that the generated academic contents are made available to the global academic communities (UNESCO, 2015).

Scholarly communication is a fundamental concept in that scientific information is both the most critical resource and product of in research productivity and innovation (Dulle, 2015; Steele, 2014). First, access to quality scientific or scholarly information enables researchers to base their own work on up-to-date information in various disciplines which leads to more relevant research that will solve the urgent problems facing the society. Secondly, sharing research information leads to greater efficiency in research through collaboration and avoidance of duplication of efforts. Thirdly, access to research results is essential to the adoption of innovations by the various consumers and therefore an important factor in improvements in every sphere of human endeavor such as business, health, agriculture, education and training thus guaranteeing brighter future for all communities. Particularly, sharing information between the researchers and those in the public sector is a prerequisite to setting forward-looking national policies, development programmes (Harley, 2010).

Despite the centrality of scientific information, available evidence indicates that scientists, research institutions and communities in many parts of the developing countries including Africa have limited access to the commodity due to a variety of problems facing scholarly communication in the region (Dulle, 2015). The overarching problem is a model of scholarly communication that engenders problems such high cost of scientific information, stagnation of technological applications, lack of collaboration and information exchange among researchers and institutions, duplication of research efforts, and low impact of research on national policy and development.

2. Objectives of the paper

This paper is guided by the following objectives:

a) To examines the current status of scholarly communication in the African region so as to provide a better understanding of the prospects and challenges.
b) To investigates how emerging tools and practices for managing digital content can be used to improve the scholarly communication in the region.
c) To concretize these emerging tools and practices into a new model of conceptualizing change in the scholarly communication in the African region
d) To make recommendations on how to improve scholarly communication in the African region

3. The Problem: Overview of scholarly communication crisis in Africa

Scholarly communication cycle is a four stage-activity that involves discovery of knowledge or research gap, the knowledge generation process, dissemination, sharing, access and use of research findings, and finally the archival and curation of the knowledge generated for reference and re-use (Steele, 2014). There are many ways in which research knowledge gaps are identified including literature review, needs assessment, baseline surveys and community forums. Many

times institutions, countries and even funding agencies have already set research agenda which researchers and institutions seeking funding have to adhere to.

Knowledge generation or research process is geared towards knowledge generation to fill the existing knowledge gaps through field, laboratory and library research. The outcome of research process include recommendations to address the pertinent research questions and areas that require further research as well as possible innovations in the form of new models or frameworks and patents (Hahn, 2008; Sawant, 2008). It is critical that new knowledge be disseminated, shared, discovered and access if the research enterprise is contribute to bettering the society.

The new knowledge has to be stored and archived for use in further investigation hence the existence of, libraries, museums, archives, and their collections, and library and information (LIS) professionals whose main role is the systematic acquisition, organization of knowledge, provision of access, as well as training users in the techniques of information retrieval and application.

The four processes of scholarly communication has in the past brought together four groups of players (Shearer and Birdsall, 2005). These are researchers and specialists, who produce scholarly research content, publishers, who package scholarly research and create information products such as journals and monographs, library and information science professionals who collect, disseminate and preserve scholarly research through digital curation, and consumers who translate research into new research initiatives, government policy, commercial products, public services, etc. However in the modern era, scholarly communication is at the centre of interest of new players such as funding agencies, research institutions and networks (e.g. universities, national research and education networks (NRENS), and aggregators of scientific information.
Similarly, scholarly communication was a straight affair whereby new findings in the form of articles was evaluated by peers or other scholars, and upon acceptance articles the copyright was transferred to publishers who facilitated access upon payment of journal subscriptions by libraries and individual researchers (Republic of Slovenia, 2015).

Review of literature indicates that scientists, research institutions and communities in many parts of the developing countries including the African region have limited access to scientific information model (Dulle, 2010). The limited access to existing knowledge by African scientists and persistently low contribution to global knowledge and innovation by the continent has been blamed on the overarching problems related to the models of scholarly communication in the region. These include challenges such as inadequate funding for research and library services, low publishing levels among African scholars and researchers, high cost of traditional print publishing of scholarly journals and monographs, inordinate control of academic publishing industry by the large commercial publishers as university and small presses face economic crunch, and low intra-Africa collaboration and information exchange among key stakeholders.

Other causes of the crisis are poor adoption of modern technological innovations and practices in scholarly process, lack of national policies on research and development, domination of research enterprise in the region by foreign agenda and the consequently low impact of research in solving local problems (Ezema,2009; Tilvawala, Meyers & Andrande, 2009). Whereas in the past much of knowledge was in print journals and monographs, stakeholders have to deal with

electronic resources, curation of data sets, archiving of research content, models, records and management of big data which have greatly reshaped the model of scholarly communication (Marcum, Schonfeld, & Thomas, 2015)

The global crisis in scholarly communication which has also affected the African region has been aggravated by the following factors:

- High cost of scholarly journals which is rising day by day which has caused the so-called "serial crisis syndrome".
- Diminishing libraries budgets that do not match up with escalating prices of the journals hence libraries subscribe to fewer journals.
- Scholarly monograph publishers especially university presses in degraded by the economic challenges facing the parent institutions.
- The shift from print to electronic form, the legal framework for their use changes from copyright law to contract law which favour publishers
- The battle of ownership verses access with the challenge of negotiating with publishers of journals for long term access and preservation issues (ACRL, 2015; Sullinger, 2015; Dulle, 2015; Steele, 2014)

The above challenges that have created a need to re-think the existing model of scholarly communication. There is need for a new model that is pocket friendly, efficient and sustainable. This is the focus of this paper, to investigate the matter and propose a new way of carrying out scholarly communication that will guarantee better of discovering research need, carrying out research, disseminating and sharing new knowledge and ensuring economy through re-use of the existing knowledge.

4. Methodology

This paper is based on a systematic review of current literature undertaken to achieve the stated purpose and objectives. A literature search of relevant web portals and e-databases was carried to retrieve literature on relevant thematic areas namely:-challenge existing scholarly communication models on the global as well as the Africa region, emerging practices and tools in scholarly communication and the opportunities they present to the research community. The literature search yielded over 200 articles pertinent to the issues under discussion. The author evaluated and selected a number of resources on the basis of relevance and quality.

An analytical literature review was carried out which included identification and evaluation of the issues, factors or variables in the scholarly communication eco-system in Africa and beyond and the relationships between them. These was concretized into various proposals and arguments in the model of scholarly communication presented in this paper. While the survey of literature and discussion here are not exhaustive, the paper proposes a way to conceptualize the key variables in the scholarly communication eco-system and makes recommendations on how to improve the undertaking in the African region.

5. Concretizing a New Model of Scholarly Communication in the African Region

Overview

The challenges facing scholarly communication in Africa unless checked will continue to frustrate research, innovation and development in the region. However the of 21st century digital environment has witnessed the emergence of ICT tools for creating, managing, dissemination and sharing of digital research content among stakeholders which are rapidly transforming scholarly communication globally (Maron & Smith, 2008).

Figure 1 below presents a model of the emerging scholarly communication in Africa which consists of three elements: tools, processes, and pillars of scholarly communication. *Processes* refers to the four stage-activity that constitute scholarly communication cycle namely discovery of knowledge or research gap, the knowledge generation process, dissemination, sharing, access and use of research findings, and finally the archival and curation of the knowledge generated for reference and re-use (Steele, 2014).

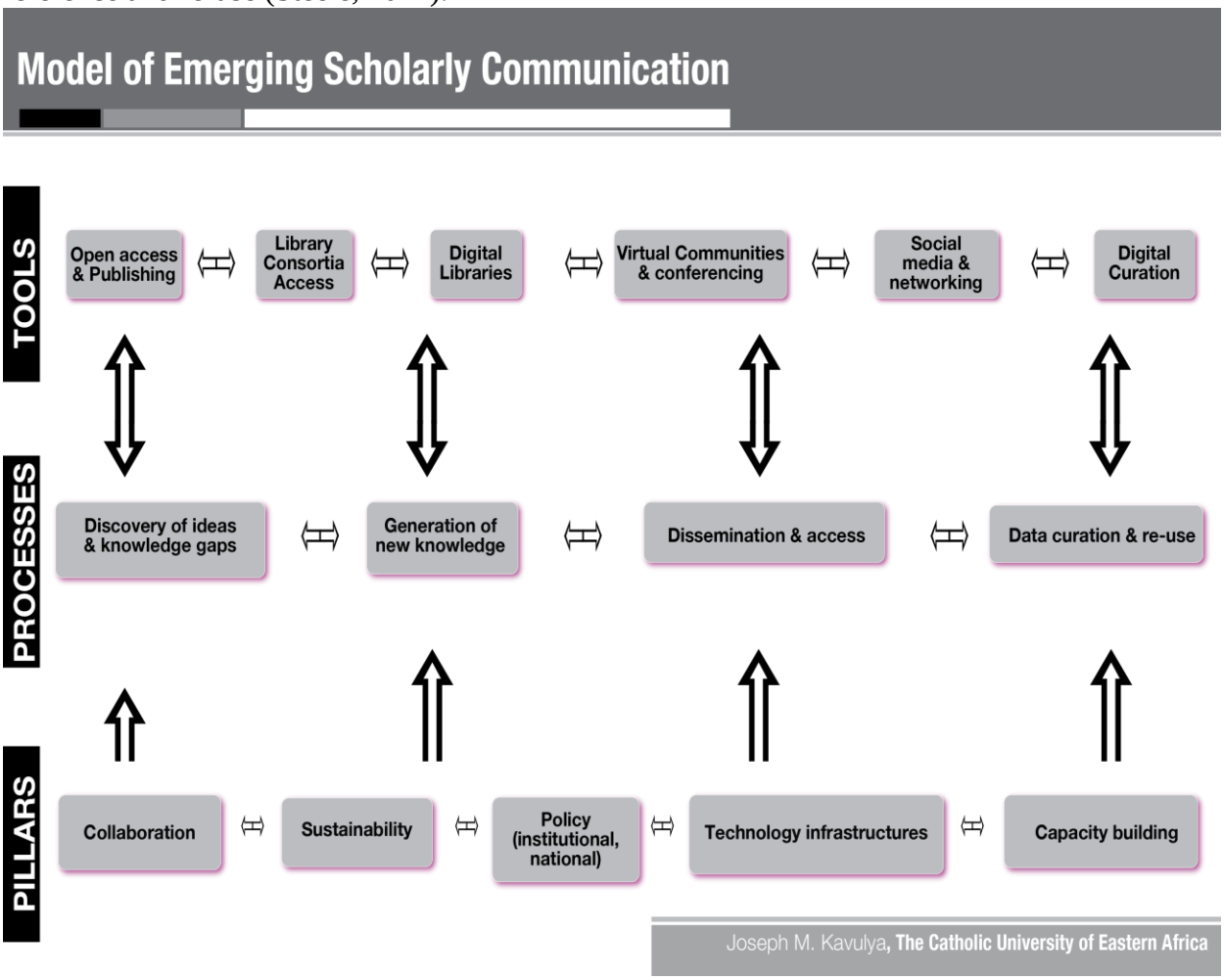

Figure 1: Model of Emerging Scholarly Communication in Africa

Tools are the emerging ICTs and practices for managing content in the emerging digital environment. These include open access and open access publishing and archiving, information sharing through library consortia access to scientific information, use of social media and networking, digital library concepts, virtual communities and sharing, and digital curation through establishing digital knowledge repositories for multimedia content preservation. These tools and genres if well adopted can provide as tools for a cheaper, more efficient model of scholarly communication in the African region. *Pillars* of scholarly communication refers to a set of issues or elements that ensure efficiency, effectiveness and continuity of the process the communication process. In order to fruitfully the transformation of scholarly communication in Africa, there is need to strengthen key pillars namely, collaboration, sustainability, technology infrastructures, capacity levels and policy environment.

6. New Tools for Scholarly Communication Process

i. Electronic and open access publishing

Globally, there is a growing preference among the scientific journal community, as well among producers of other literary genres of scientific literature such as books, research reports, conference proceedings, publishing in electronic formats as opposed to print. For example according to Research Information Network (2010), more than 90% of all scholarly journals available in electronic format. For publishers and institutions in the African region, e-publishing will boost scholarly communication in the region. These benefits include reduced publishing and distribution costs compared to publishing in print, faster speed in the publishing process compared to traditional publishing which can take months or even years. It also gives authors cheaper and better control of the distribution of their work, through the internet which assists products to gain popularity and access among consumers more easily unlike the traditional print publishing. Other benefits are that digitally published material can be easily updated, whereas this is not possible for physical material such as books and the fact that using electronic devices for reading material is becoming more and more common as digital devices are becoming more advanced and portable, as well as more convenient for people to carry around and read from. Readers also store all their reading material digitally in their devices, whereas this is not possible for traditional publishing and readers have to carry around all their hard copy reading materials.

Open access popularly refers to web-access to scientific information that is free of charge to the end-user which enables the re-use of scientific information. The main agenda of the open access movement which began in the 1990s was to encourage unhindered access to scientific information. The practice of open access can take two forms whereby information is "*gratis*" (free of charge) or *libre* which implies it is free of charge with a few restrictions under the Creative Commons Licenses (Burke & Tumbleson, 2016). In either case the author may self-archive in an institutional or shared repository published work after the lapse of embargo imposed by the publisher, popularly referred to as *open green* or may publish in an open access journal with a requirement to pay Author Process Charges (APC), which is referred to as *golden*

open access (Sawant, n.d; Czerniewicz & Goodier, 2015; Republic of Slovenia, 2015; Picarra, 2015).

The main advantage of open access to Scholarly communication in Africa is that both monographs and journal articles are freely available in a situation where lack of access to subscription-based journals is a commonly cited problem for researchers in low-income countries. Overall it a solution to the 'serials crisis since it reduces the costs of article purchase or journal subscription for institutions (Dulle 2015). Open access can also help provide research institutions and scientists in Africa with the opportunity to participate in the international research community and better access to the most recent scientific ideas. For readers and libraries, the benefits of not having to pay for an individual article or journal subscription means that more people can read the results of scholarly research, including those who would otherwise not be able to access that information because they cannot afford the subscription to an expensive journal. It also means that new ideas can be dispersed more rapidly and widely, which in turn triggers new research studies and serves as an impetus for knowledge (Czerniewicz & Goodier, 2015; Republic of Slovenia, 2015; Picarra, 2015).

Since the Budapest Declaration of 2001 and Hague Declaration on Knowledge Discovery, there has been a global emphasis among governments that publicly funded research should be made available through open access (Picarra, 2015). According the proponents of this initiative making publically funded research should be freely has a number of advantages:

- Benefits tax-payers and increases return on investment (ROI) in research
- Increases the social value of research and funding agencies and research organizations
- Gives authors and readers more rights than they have under conventional publishing agreements
- Supports higher education since it implies wider availability of recent knowledge that can be put to immediate use in teaching.
- Amidst skyrocketing prices of journals, open access can help reduce the access costs of scientific information.
- Assists authors disseminate their works which will translate into increased number of citations for the author.
- Anybody can start publishing journals which will encourage colleges, universities and other organisations to become publishers (Sweeney, 2014; Czerniewicz & Goodier, 2015; Republic of Slovenia, 2015; Picarra, 2015; Burke and Tumbleson, 2016).

In recent times the case for making research data especially that which is created through public funding open and accessible with limited restricts has gained ground. This is commonly referred to as open research data which refers to the right of web access and re-use of digital research data through data mining, exploitation, reproduction and dissemination free of charge under set conditions. This would call for open research data to be made better organized, accessible and retrievable using set standards which will reduce duplication of research efforts and increased efficiency of the enterprise across in Africa.

ii. Library consortia access to scientific information

In order to fulfil information requirements of researchers, the practice has been personal or institutional subscriptions and purchase of published literature (e.g. journals, books, proceedings). However, a number of factors has made this difficult for many organizations and individual researchers such as escalating costs of journals, dwindling budgetary allocation for information resources leaving a trail of discontinued subscriptions and incomplete runs of journals (Tariq, 2011). The "Big Deals" concepts whereby publishers sell e-journals in bundles instead of individual titles has made it impossible for libraries to purchase requisite journal titles. This has given birth to Library Consortia arrangements whereby a number of libraries pool resources together to purchase bundles of journal titles as a way of increasing the purchasing power of institutions and reducing cost (Turner, 2013). In the last ten years library consortia have emerged in almost every country in Africa notably: - Consortium of Tanzania Universities and Research Libraries (COTUL), Consortium of Uganda Universities Libraries (CUUL); Kenya Libraries and Information Services Consortium (KLISC); Consortium of Nigerian Libraries (CONLIB) and South African National Library and Information Consortium (SANLic) (Dulle, 2015)

Research communities and institutions in the African region stand to benefit participating in library consortia access through economies of scale and process. Library consortia acquisitions saves personnel hours in acquisition activities as the dedicated staff perform the transactions on behalf of the participating institutions (Gaur and Tripathi, 2012). The consortium consolidates the purchasing power of individual libraries which makes it possible to negotiate lower prices for the resources than any single member institution in the collective (Carbone, 2007; Ossai, 2010). Organizations are also able to streamline procurement processes by not only reducing unit cost, but also the overall transaction costs since only one contract needs to be negotiated and implemented.

iii. Social media and networking (Web 2.0)

According to Dewing (2012: 1), the term social media refers to "the wide range of internet-based and mobile services that allow users to participate in online exchanges, contribute user-created content or join online communities". According to Al Aufi and Fulton, (2014) and Nicholas et al (2014) social networking tools have reshaped how information is produced, communicated, and consumed thus contributing to the changing model of scholarly communication. A number of social media tools and platforms are very suitable the dissemination and access of scholarship, the communication and interaction among scholars, between individuals, institutions and scholarly communities (Harley et al., 2010). These services include blogs, wikis, social bookmarking, social network sites, status-update services such as twitter and linked-In, virtual world content, and media-sharing sites such as YouTube and WhatsApp. Studies have indicated that academics and researchers are increasing adopted social media and networking as tools for scholarly communication (Al Aufi & Fulton, 2014). In a research on the use of blogs, Maron and Smith (2008; 28) noted that, "Blogs are being employed across the disciplines…humanities blogs…social science blogs and science blogs-tend to be read daily or weekly by the scholars…"

The key benefits of social media and networking to scholarly communication across Africa are that it allows users to easily review, exchange views, experiences and comments more easily and ensures faster dissemination and sharing of research information. Users are able to get tailored information to fit personal research needs, interests and preferences. Connect with other researchers and educators, discover the latest research and trends, collaborate with others in research, promote one research work, peer-review and share your research in creative ways (Sawant, n.d; Dewing, 2012; Al Aufi & Fulton, 2014). Social media can also be used by scholars to post comments and respond to the views of others to keep in touch, keep abreast on research in the field, share large quantity of timely and reliable information, share ideas on various questions, as well as in peer process (Maron and Smith, 2008; Haustein, Sugimoto, & Larivière, 2014)

iv. Virtual communities and conferencing

Virtual communities (VCs) are a group of individuals whose members are dispersed geographically find each other and interact through use of cyberinfrastructures (Gupta and Kim, 2004). According to Typaldos (2000) and Akkinen (2005) the core elements of a VC include a group of people who interact socially to fulfil their needs, a shared purpose which may include an interest or need, active participation of members, access to shared resources inform of an online-based platform that support and facilitate interaction, sharing information, trust and shared norms and guide the behaviour of members. There are many types of VCs determined by variables such as age of members, gender, geographical collocation and purpose (Akinnen, 2005; Buhrmann, 2003). According to Akkinen (2005) researchers use VCs to disseminate and share information related to individual and group research projects.

For researchers and scholars VCs several benefits accrue from this practice and which can improve scholarly communication such as timelier sharing/dissemination and access to information (Gupta and Kim, 2004). It incorporates more researchers and other stakeholders and thus facilitates improved collaboration among researchers (Buhrmann, 2003). It can reduce the burden of financial and time burdens of travelling, institutions and researchers if researchers engage in virtual conferencing by connecting to individuals or groups of researchers in different locations in meetings and collaborations on a virtual environment (Akkinen, 2005). Other advantages of methods are removal of time constraints, savings on travel costs, increased productivity, and improved communication (Gupta & Kim, 2004).

Key among these tools that are used by in VCs to deliver workshops or lectures, with different levels of interaction are webinars, webcasts, and web conferences. Webinars and webcasts can deliver messages to the audience, with limited participation from the audience, while web conference tools facilitate sharing of documents in different formats, interaction and collaboration between attendees, unified browsing, remote computer control, polling by participants, as well live or private chatting (Akkinen, 2005). Virtual events such as video conferencing enable people to participate in a shared virtual environment on the web, as opposed to a physical location and are highly interactive just like sharing a physical environments.

v. Digital libraries

Several definitions of digital libraries continue to emerge as the concept continues to evolve. One of the classification and which remains relevant is that by Walters (1998), who views digital libraries as "organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities". As summarized by Cleveland (2008) digital library may be achieved through one of more the following processes: digitization which involves converting paper and other media in existing collections to digital formats, acquisition of originally digital materials produced by publishers and scholars such as e-books, e-journals which may also be aggregated form, e-databases, and by accessing external materials that are not with the institutions but rather held in external web sites, or other library collections, or publishers' servers.

Several authors such as Mutula (2002), Jain (2006) and Rosenberg (2006), Kavulya (2007) and Chowdhury (2014) have consistently documented the benefits of the digital library in dissemination and access to information which makes it a strategic tool for transforming scholarly communication in the Sub-Saharan region. Among these benefits are that:

- Digital libraries provide faster method of accessing and exchanging scientific information
- Digital information can easily be exchanged to reach all those who need to access it
- The ubiquity of the digital library makes it possible to provide researchers in the remotest parts of the Sub-Sahara with current
- Digital libraries are available on 24/7basis which is convenient for students, researchers and members of the community

vi. Digital curation and preservation

Digital curation refers to the selection, preservation, maintenance, collection and archiving of digital assets which establishes, maintains and adds value to repositories of digital data for present and future use Rua, et al, 2015). According to Walters and Skinner (2011), digital curation refers to the actions people take to maintain and add value to digital information over its lifecycle, including the processes used when creating digital content. It aims at continuity of "(1) access, including archiving and preservation; (2) ease of access, including discoverability; and (3) added value that makes the information more meaningful" (Schirrwagen, 2013). Across Africa, considerable amounts of funds spent in research in the region. However, the research data resulting from this considerable investment is lost by the end of research projects or visible as they might be. For full benefit of the research data that is produced, institutions must establish data curation/archiving processes to safeguard/preserve data for future use.

The main benefits of digital curation to the scholarly communication are that it:

- Allows continued access to data despite short-term funding or institutional changes
- Encourages re-use of data by repurposing data for new research questions

- Facilitates sharing of data and research results to maximize the impact of research
- Leads to more transparency and accountability which inspires confidence among the research funding bodies
- Allows investigators to validate published results and explore new analysis methodologies
- Facilitates synthetic studies such as meta-analyses
- Reduces duplication of effort in research data creation by enhancing the long-term value of existing data and making it available for further high quality research University College London, 2010; Tenopir et al, 2015; Osswald and Strathmann, 2012)

7. Enablers of modern scholarly communication

In order to fruitfully the transformation of scholarly communication in Africa, there is need to strengthen key enablers of the process namely: collaboration, sustainability, technology infrastructures, capacity levels and policy environment.

- *Collaboration* entails coordination, stakeholder dialogue communities, partnerships, funding, best practices, and joint projects.
- *Sustainability* will be achieved if do a cost-benefit analysis of various options, and evolve a business model or an eco-that will engender the use of emerging tools of scholarly communication, carry out continuous monitoring and evaluation, adopt community approaches, maintain end user engagement, carry out advocacy among the various stakeholders.
- There is need to implement appropriate *technology infrastructures* such as research software, application data and content systems, web technologies, and collaborative platforms.
- C*apacity building* is required to enable various player to use emerging tools of scholarly communication. Important skill include data and information management skills, information literacy, research & writing skills, use of relevant ICT tools.
- *Institutional and national policies* are required to support transformation of the scholarly communication. For example research policies need to support the establishment of digital libraries, institutional repositories and open-access publishing as well as improve funding to support more research output to justify establishment of more local journals.

8. Challenges in transformation of scholarly communication

The transformation of the model of scholarly communication in the African region faces several challenges. Foremost is the financial outlay to cater for relevant technology and processes such as open and digital publications, and capacity building among librarians, ICT staff, publishing, media specialists as well as researchers to implement new tools of scholarly communication (Metzger, 2010). Digital libraries involves costs of access, while curation initiatives has initial cost requirements to establish and demonstrate return on investment to decision makers, and other stakeholders in this enterprises (University of London, 2010).

The second issue has to do with change management associated with mind sets which are a stumbling block towards adoption of new approaches. For example, there are fears of authors and publisher related to the loss of copyright /intellectual property rights in open access publishing. As we shift from print to electronic form, the legal framework for their use changes from copyright law to contract law. There is also the risk of lowered quality control associated especially with predatory journal publishers where peer review is hardly undertaken. In journal publishing revenue comes from publication fees, journals may be encouraged to publish more articles, with a negative impact on overall quality.

9. Conclusion and recommendations

From the foregoing discussion it is clear that the adoption of emerging digital practices and tools such as digital publishing, open access and open access publishing and archiving, and strategies such as library consortia access to scientific information, digital library concepts, virtual communities and conferencing, digital curation through digital knowledge repositories, use of social media and networking will transform the scholarly communication in the African region.

For the transformation to take off, there is need to address issues which act as the pillars of an efficient scholarly communication. These include collaboration, sustainability, technology infrastructures and capacity building and policy alignment. There is need for collaboration and pulling of resources together among research institutions in the scholarly communication value chain: establish digital libraries, digital curation, strengthen library consortia, implement local open access publishing efforts. For example multi-institutional, regional, national and subject-based repositories are more viable than acting solo. It is to build-in elements of sustainability in implementing any of these initiatives. There is also need for continuous capacity building among key players such as ICT personnel, researchers, librarians, and end users. These skills include information literacy, use of social media, and advocacy efforts required for new model: digital curation, open access,

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