The Role of Open Access in Fostering Knowledge Sharing and Collaboration in Ethiopia: a case study

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Abstract: Only science, technology and research would alleviate the intertwined social and economic challenges of developing nations such as Ethiopia. This study adopts a qualitative approach and uses the case study method. Fourteen researchers and librarians were interviewed in four organizations in Addis Ababa, Ethiopia. This study reveals that the current scholarly communication system in Ethiopia is faced with technological and social challenges. Open access is undoubtedly a viable alternative to Ethiopia. It is viable because it has been proved so in many developing countries. Ethiopian universities and research institutions should adopt open access policies and strategies that would improve the access and dissemination of scientific research results. A concerted effort is required from administrators, librarians, researchers, funding agencies and government to implement and fully harness open access in Ethiopia.

Keywords: open access, scholarly communication, institutional repositories, ETD, developing countries, Ethiopia

1. Introduction

As a distinctive resource, knowledge favours openness and expands through sharing, use and re-use. As pointed out by Arunachalam (2008:7) "knowledge wants to be free". In an earlier article, Arunachalam (2003:pp.16) said "*The quest for exploring unknown territories – the loneliness of a long-distance runner – is the personal aspect. But aggregation and advancement of knowledge takes place by collective efforts of researchers around the world.*" This quest for sharing and openness in science in fact led to the flourishing of new disciplines, professional associations, and communities of practice in which all led to scientific discoveries and innovations. Most of these discoveries and findings have been communicated through journals, conference proceedings and other kinds of formal and informal communication outlets. Especially journals have served as main means of scholarly communication mediums.

The history of journal publishing goes back to 1665 when Henry Oldenburg, the secretary of the Royal Society of London, began to compile and distribute the correspondences of the members of society in a journal named "*Philosophical Transactions of the Royal Society of London*" (Willinsky, 2006; Swan, 2006; & Solomon, 2008). Before 1665, scholars used to communicate using hand written letters and had to make a copy of each correspondence and distribute it to other scholars (Solomon, 2008).

Currently there are more than 25,000 journals and they publish 2.5 million articles per year (Dewatripont at al., 2006; Canessa & Zennaro, 2008). Most of these journals are subscription-based (toll-access) where the reader or his/her institution has to pay a fee to access to the contents. This model has served scientists well until the prices of journals began steeping to a level where even richer universities such as Harvard were unable to afford to subscribe all or most of these huge numbers of journals. Exorbitant journal prices have forced academic institutions and libraries to cut journal subscriptions. Open access is a response to what is known as the "serials crisis". Solomon (2008) claims that the serials crisis covers the time between1970s to the present and it has left many researchers with limited access to peer-review scholarly literature (Chang, 2006; Salo, 2008; Pappalardo, 2008).

While the digital divide continues to widen, the disparity in access to scientific publications between the scholars from developed and developing countries also continues to expand. Ondari-Okemwa (2007) conducted an empirical study by extracting articles indexed from 1997-2007 by the Science Citation Index, the Social Sciences Citation Index and the Arts and Humanities Citation Index and compared developing countries research output with that of developed countries. The findings were rather staggering. From the years 1997-2007, only 235 articles from DR Congo and only 2747 articles from Ethiopia had been indexed. As one may expect, South Africa leads Sub-Saharan countries with 51,738 indexed. On the other hand, in the year 2006 alone, USA and UK produced 100,000 and 97,904 records of scholarly publications respectively. While margins of error for such research remain possible, the figures are a perfect example of the knowledge divide between the developed and developing countries.

Open access is claimed to be one of the solutions to bring scientists on a relatively equal footing in terms of access to knowledge hence researchers in developing countries can disseminate and access scholarly knowledge. The question which open access scholarly model suits to these countries and how open access can be best harnessed remains to be explored. There exists no research on open access in Ethiopia. This research will illuminate the practicalities and

procedures of how open access scholarly communication models could foster and support knowledge sharing and collaboration among Ethiopian researchers. Based on the findings, the recommendations will delineate steps that can be taken by university academics and librarians in Ethiopia to best harness and contextualize open access initiatives to their needs.

2. Methodology

2.1. Case Study as a Method

A case study research method is employed in order to obtain information and understand the awareness about open access and explore how open access would improve the research uptake, collaboration and knowledge sharing among researchers in Ethiopia. According to Yin (2003) case study is a preferred strategy to address the how and why research questions. A case study is a well-suited strategy to empirically investigate "contemporary phenomena" such as open access and its context Ethiopian universities and research institutions. The research problems lend themselves for a case study research because of the need to answer the how and why. Observation and literature showed that there has been little or no effort made to implement open access in Ethiopia. It was therefore a new phenomenon.

Qualitative: The study is qualitative because this approach suits best for a new phenomenon which has not penetrated the daily activities of subjects. If open access had been fully implemented; it would have been much easier to answer the research questions using quantitative research methods. It would have been for example possible to answer the number of articles submitted, accepted, published, the download rate, impact factor and type of software used, standards implemented, and related questions which would easily provide quantitative figures. However, open access has not been implemented in Ethiopia hence qualitative data analysis was preferred.

The case: the case in this case study is "open access". In this research, open access is assumed as contemporary a phenomenon that has been initiated by and for researchers, librarians, and funding agencies. Case study, as a research strategy, is best suited to investigate such interventions (Yin, 2003; Pickard, 2007). Semi-structured interview technique is chosen to collect data from researchers and librarians about open access within their respective institutions.

Controlling bias: Qualitative research and analysis is shaped by both the subject's and researchers' characteristics such as experiences, qualifications and even biases (Warden and Wong, 2007). The researcher of this study has been exposed to several discussions, workshops, lectures and readings about open access and its impact in research. There is a possible bias towards the benefit of open access to developing countries. Some biases are unavoidable. Care has, however, been taken to avoid unnecessary bias.

Interpretive: qualitative data analysis is interpretive (Ezzy, 2002). In this research the case is open access. Open access is considered as a phenomenon that would affect the subjects of this research who are mainly academic researchers and librarians working within a university or research institution context. In fact, whether open access has made significant effects or not, will be seen in this study. The subjects of the research and the researcher's interaction will create an interactive and iterative environment that will enable to collect enough evidences about the case.

Sampling: a purposeful sampling technique was adopted for this research. According to (Ezzy, 2002), a purposeful sample is selected by convenience and ease of use. In this case study, 4 librarians and 4 academic staff members (researchers) from Addis Ababa University; 1 librarian from the International Livestock Research Institute (ILRI) InfoCentre; 2 staff members of Ethiopian Development Research Institute (EDRI) (1 librarian and 1 researchers); 1 staff member of the Ethiopian Ministry of Science and Technology (EMOST), and 2 Ethiopian academics writing their PhD thesis in the UK were interviewed. The information gathered from interviews, websites, reports and secondary sources from these mix of institutions is believed to be representative to inform about the Ethiopian scholarly communication systems.

Context: Warden and Wong (2007, pp.6) argue that because of the context of a qualitative analysis, "meaning is tied to a specific setting and population and it will change over time". The questions asked for this research would bring a different answer over time ones for example a specific technology has changed or a new training has been offered about open access. The awareness of open access by researchers would certainly be different over the next year or so because of possible training interventions in that regard.

Iterative process: Warden and Wong (2007) mention that qualitative analysis is iterative. In the context of this research, the researcher used such approach in order to verify facts or fill gaps that has been forgotten or uncovered during the initial investigation. According to Srivastava and Hopwood (2009: pp.1) argue that an iterative process or qualitative data analysis should be considered "not as a repetitive mechanical task but as a reflexive process, is key to sparking insight and developing meaning". Hence, for Srivastava and Hopwood (2009) the visiting and re-visiting of the facts helps to verify it and also gain a new insight and helps to refine the focus of the research. Additional meetings, phone calls, email exchanges were made. Websites were revisited to verify information that was vague during interview transcriptions and to provide more context to it hence gather meaning out of it.

2.2. Data Collection

Interview method was chosen to collect data from researchers and librarians about open access within their respective institutions. The interview method was therefore preferred from questionnaire as it provides richer information that may be arisen out of the face-to-face conversations. The researcher has observed and read that open access in Ethiopia has not really been a focus of attention. Considering the fact that the awareness about open access is very low in the country, asking researchers and librarians what open access models and strategies they prefer, what kind of software they use for institutional repositories, and which open access journals they use to publish would only provide with limited or no relevant information for the research. Hence the interviewer has to first define and explain about open access. Interviewees were first contacted via email or telephone and asked to cooperate to share their views about open access to scholarly research in Ethiopia. The consent of interviewees was asked in order to voice record the responses and discussions arisen out of the interview and were digitally recorded. All but one of the interviews was conducted in Amharic.

2.3. Limitations of the Study

There exists no research on open access in Ethiopia, hence supporting it with evidence from related literature on the topic was difficult. Due to time constraints, it was not possible to include the regional universities and research institutions in Ethiopia. Only 14 interviewees were selected by convenience.

3. Findings and Recommendations

This section reports and discusses the results obtained through interviews. The responses and observation revealed that the scholarly communication system in Ethiopia is very weak. The research that has been produced does not reach its intended user. Open access initiatives have not made any significant inroads in Ethiopia. There are no institutional repositories to archive research results. There are no open access journals either. The low open access uptake is attributed to both social and infrastructural challenges. Based on the findings, this research provides recommendations on how to implement open access in Ethiopia.

3.1. Access to Electronic Resources (e-journals)

The government of Ethiopia funds public universities and research institutes to subscribe to books and journals. This budget is however very limited. The limited budget does not allow universities to subscribe to international journals. Most of the interviewees reported that their respective institutions do not subscribe to peer-reviewed journals. The results of the interviews revealed that over the last few years Ethiopian universities and research institutions have been involved in projects that aim to provide access to electronic resources. Many of the interviewees (lecturers and librarians) are aware of INASP/PERI project. Some also mentioned HINARI and AGORA projects which provide access to health and agriculture journals respectively.

AAU is a national coordinating institution for the above initiatives and facilitates the registration of institutions to have a negotiated and free access to electronic journals and databases. Some of the electronic databases that are available to Ethiopian libraries and research institutions through the INASP/PERI project are Ebsco Host, Blackwell Synergy, AJOL, Cochrane Library, Cambridge University Journals, JSTOR, and Emerald Insight. EDRI, ILRI and regional universities have also access to such journals. Librarians reported that the usage rate for such journals is very low.

The initiatives by INASP/PERI, HINARI, and AGORA to provide access to scientific scholarly articles have not been matched by adequate access to bandwidth to download articles. In addition, there is lack of awareness about the

availability of resources and it is also reported that the academic staff and researchers lack information literacy skills to use such resources. Hence, this mismatch has slowed the use of electronic journals.

3.2. Dissemination of Ethiopian Research Results

The findings of this study showed that the dissemination outlets for Ethiopian research are mainly print publications and conferences. Many of the publications have limited circulation. There are very few journals and publications to disseminate research. The results from the interview indicate that Ethiopian journals and publications are hardly available online. The interviewees reported that researchers are forced to go to a library in order to find out what has been done on specific topic and in many cases even the libraries do not have list of research works. One respondent underscored that there exists a big gap between the knowledge community and policy makers in Ethiopia.

3.3. Electronic Theses and Dissertations at AAU (AAU-ETD)

AAU-ETD is operational since January 2009. It uses the Dspace software. The system supports to deposit items in English and Amharic languages. The AAU-ETD currently hosts only 1669 items of theses and dissertations which is very few for a university that has tens of thousands of theses and dissertations produced over the years. As it is indicted on the summary given above, the data, content, submission, and preservation policies are not properly defined. The Faculty of Law, Institute of Ethiopian Studies, and Institute of Educational Research have not added a single collection to the repository. This is mainly the lack of action and commitment from staff of the respective faculties.

AAU should extend its ETD; include other types of research works, teaching materials, and conference proceedings. It should also define institutional policies of submission, access and preservation. But most of all, AAU should also create an environment where content can be populated to its ETD smoothly. Jones, Andrew and MacColl (2006, PP.111) exclaimed that "*an empty institutional repository is analogous to a library with empty bookshelves. Even though a lot of time and effort has been spent in setting up the optimal technological infrastructure, the success of the initiative will be ultimately measured by the usefulness to users, and thus, by proxy, the depth and richness of the body of content contained within*."

3.4. The Need to Change the Status Quo: Towards an Open Access Scholarly Communication Model in Ethiopia

Excepting ILRI, which uses its website to link to some of its research results, AAU and EDRI rely only on print publications to disseminate their research results. According to the findings of this study, AAU lacks clear institutional policies and strategies to disseminate its research results. Both AAU and EDRI have no institutional storage/repository for their research outputs. Consequently, their researchers' visibility to the outside world is very low. Researchers, students, industries and the general public have no access to most of the research that has been done within AAU, EDRI.

The current scholarly communication model in Ethiopia is dysfunctional and does not address the needs of the country. The government has embarked on expanding public universities and the number of student intakes increases every year, post graduate education is on the rise, industries are booming, research institutions are being instituted and their number is growing steadily and yet the scholarly communication outlets are very limited and out of date. Many students who are studying abroad and researchers across the world may need to access research work that has been investigated in Ethiopia and yet there are no institutional repositories, electronic journals, and properly designed websites to provide such services. These problems call not for an evolutionary transformation of the Ethiopian scholarly communication model but a revolutionary one. Embracing open access models would help achieve such a complete overhaul of the current print-based and limited distribution model.

Institutions such as AAU should overhaul their research dissemination system. They need to recognize that Ethiopian research is obscured from use by policy makers, scholars, students and industries. As pointed out by Swan (2007) developing countries are hard-hit by the subscription-based scholarly communication model as researchers in these countries cannot simply afford to pay for access. While open access has become a talking point for many researchers and librarians in the developed world and has been embraced by wealthy institutions which recognized they cannot afford to subscribe to the ever increasing number of journals, developing countries are slow to uptake such initiatives. It is therefore essential for countries like Ethiopia to design open access strategies that is contextualized to the needs of researchers.

3.5. The Ethiopian Ministry of Science and Technology (EMOST) should take the Lead

It is apparent that in order for open access initiatives to succeed it should get government support. In order to implement open access and promote open access, the Ethiopian government through its Ministry of Science and Technology should develop a policy in consultation with universities, research institutions, libraries, funding agencies, and renowned researchers. EMOST should coordinate the adoption of an open access policy. Lessons can be learned from South Africa and other countries who have successfully implemented open access. The following recommendations are contextualized from (Suber, 2007).

- The Ethiopian government through EMOST should adopt a national policy that makes it a requirement for government research grantees to provide open access to the research results;
- When research grants are offered to Ethiopian researchers, the grant should made to include money for publication of the research results in author-pays open access journal models;
- Annual government budgets for Ethiopian universities and research institutions should include budget lines for setting up institutional repositories;
- Ethiopian universities and research institutions should include in their contract for employment that any research work conducted by salaried staff members should be made open access;
- EMOST in collaboration with universities, research institutions and other responsible government bodies should work to develop a national open access repository of research. Such online service should be able to harvest those repositories which are located elsewhere in the country and provide a single search interface to browse and search for content from those repositories and to do so the repositories should use OAI-PMH compliant software and appropriate metadata standards such as Dublin Core;
- EMOST should mandate the deposit of a copy of the research conducted through its Local Research Grant (LRG) to institutional archives of the researchers. The ministry should also develop a national science and technology repository which can be accessible freely to everyone through an open access license;

3.6. Awareness about Open Access is Crucial

Awareness about open access is very low among Ethiopian researchers and librarians. Many could not distinguish between free and open source software and open access. As per the interview discussions held with academic staff, researchers and librarians of the various institutions involved in this study, open access has not made any strides in Ethiopia. In relative terms, however, librarians are better informed about open access initiatives. This awareness by librarians is a result of half-day workshop participation on December 22, 2008. The workshop entitled "*Open Access: How to improve accessibility, visibility and impact of your research outputs for librarians and researchers*" was organized by eIFL.net and AAU.

Ethiopian universities and research institutions should have an open access advocates selected both form the researchers and librarians who would organize events to create awareness about open access. This awareness creation can also be done using the institutions' websites, brochures, notice boards and local staff meetings. With support from administrators, librarians should take up the responsibility of creating awareness about open access. Especially, AAU has experienced and well trained library staff than other regional universities and research institutions, so AAU should organize national workshops on open access and should choose open access advocates.

3.7. Institutional repositories: Ethiopia's Green Road to Open Access

None of the organizations involved in this study have institutional repositories. None have institutional policies to mandate depositing or self-archiving. Most of them, especially government organizations, do not have properly designed and maintained websites. In the course of few years, even AAU, the biggest and oldest university in the country, has changed its website from one interface to another. The website's content lacks consistency. It does not have links to many of its faculties, institutes and programs. As reported by the interviewees they cannot possibly see what other research institutes of AAU have investigated/researched as there is no accessible list of researches.

The discussion held with the interviewees, indicated that the problem for not having a website or having a poorly designed and badly maintained one is not technical or even economical. Both AAU and EDRI have qualified ICT staffs who are versatile with advanced web technologies. Both have cutting-edge servers and relatively stable Intranet network infrastructure. The main problem, however, is lack of action and commitment from the responsible people mainly ICT centers and faculty administration. One respondent mentioned that AAU's problem is mainly cultural and attitudinal.

Many major universities and research institutions use their websites as major outlets to disseminate research, promote their activities and reach stakeholders including students. AAU research institutes, the EDRIand other Ethiopian universities and research institutions should not underestimate the power of well-designed and processional websites which are updated and maintained regularly. AAU, EDRI, and ILRI should ensure that their institutional research products including peer-reviewed literature, conference proceedings, and research reports, teaching materials, theses and dissertations are stored, organized and made accessible to anyone in an open access repository.

3.8. Mandating Self-Archiving: the Prophylaxis against Zeno's Paralysis

The results from the interview showed that researchers and librarians believe that self-archiving of research results would benefit themselves and their institutions. However, they also mentioned their fears. Some respondents indicated that they fear that open access would infringe their copyrights and expose their work to plagiarism.

Currently, none of the institutions involved in this study require their researchers to deposit their final research e-prints. The major reasons for this are the absence of institutional repository systems, absence of institutional policies and mandates, and lack of willingness to take such initiatives form both the side of the libraries and university management and researchers themselves. Many experiences of other countries and institutions show that mandating self-archiving is an effective strategy (Guedon, 2006) hence EMOST, AAU, EDRI and ILRI should devise mechanisms to make it a mandatory requirements for researchers to deposit especially public funded research results to an institutional repository designed for such purpose. Suber (2009) recommends that "*if you're serious about achieving OA for the research you fund, you must require it*".

3.9. The Need for National and Institutional Open Access Policies

We recommend that Ethiopian Universities and research institutions should embrace open access as their model for scholarly communication. We also recommend that they should mandate the submission and self-archiving of research results especially those theses and dissertations, research that has been done with public-funding. Public funding here refers those research projects funded by government funds such as the LRG of EMOST. In fact open access can be embraced without national and institutional policies and strategies. Hence, EMOST as a national government body should initiative a national open access policy. Institutions such as AAU, EDRI and ILRI should also adopt institution wide policies. Lessons can be learned from other developing countries and institutions which have adopted open access policies.

Suber (2009) suggests that funding organizations and universities should require not request self-archiving. In many institutions in Ethiopia, there are no electronic repositories. Until that is in place, authors should be required to submit the last PDF version of their research results (theses, dissertation, pre-prints, post-prints, and reports) to their respective libraries. Libraries will therefore be required to develop digital repositories and make such works accessible to all.

As also suggested by Suber (2007), the open access policies should require (not only encourage) the archiving of research articles and pre-prints. Such a requirement should, however, be rewarded with promotion and training opportunities. The policies should stipulate that when authors publish in non-OA journals, they should retain their rights to self-archive in their institutional repositories. Peter Suber also recommends that when funding agencies do not cover publication costs, author institutions should cover such costs. Post graduate students should be required to submit final copies of their theses and dissertations. Besides, conference proceedings need to be open access (Suber, 2007).

3.10. Use of Licenses in Institutional Repositories

Authors and librarians need to know about the Creative Commons (CC) licenses and other alternative licenses. Librarians need to advise researchers on the use of CC licenses and continually consult SHERPA's RoMEO website to check the publisher's copyright & archiving policies. Institutional repository managers in consultation with authors and university managers should customize the CC licenses to their interests and make sure that the authors understand these licenses and submit their contents.

In customizing CC licenses, Ethiopian universities and research institutions should ensure libre open access instead of gratis open access. While the first type of open access removes only price barriers, the second removes both price and permission barriers. In other words, the licenses should allow optimum flexibility in the use, adaption, and even commercial use of content. The license should ensure the works should be used with integrity and proper attribution.

3.11. Free and Open Source Institutional Repository Software

It is important to note that highly scalable, tried and tested software for institutional repository development is free and open source. One such software is Dspace which is being used at AAU. There are also other major software such as E-print, CDS Invenio, and Fedora. Ethiopian universities and research institutions should develop technical capacity and form online software communities to support the customization, installation, configuration and maintenance of such systems. Such communities should customize and contextualize the Free and Open Source software to the needs of Ethiopian researchers. One obvious need is having Ethiopian languages interface software. AAU may take such initiative to organize trainings to regional universities.

3.12. Federation of Ethiopian Institutional Repositories

Jones, Andrew and MacColl (2006) argue that setting up federating institutional repositories than a central one offers more scalability and the feeling of ownership by the institution and also the scholars who provide content to the repositories. They recommend distributed and grid storage mechanisms.

Ethiopian universities and research institutions should therefore work towards a federated digital repository where content can be harvested using OAI-PMH compliant architecture where standardized metadata such as Dublin Core is used. Such architecture offers the ability for users to search all systems in one interface.

3.13. Institutional Repositories Should Use OAI-PMH Compatible Software

Institutional repositories should fulfil some minimum technical requirements in order to be harvested and used optimally. Jones, Andrew and MacColl (2006) specify that institutional repositories should use software that which is open and interoperable. The institutional repository needs to be interoperable with other repositories. To this end, it needs to be OAI-PMH compatible. The OAI-PMH protocol is a technical solution using HTTP, XML and Qualified Dublin Core and enables to harvest metadata and provide cross searching of repositories.

3.14. One More Value Proposition for Institutional Repository Investment: Preservation

Digital information is more fragile than paper. Due to the fast pace of technological changes, the medium for digital objects obsoletes. If institutional repositories do not adopt viable preservation strategies (such as migration and emulation), it is highly probable that the content within such repositories will not be accessible within a short time frame. Institutional repository advocates and developers can cite preservation of the institution's research cultural heritage as one of the major value propositions.

3.15. Open Access Journals: the Golden Road towards Open Access to Ethiopian Knowledge

In choosing the golden road to open access what AAU, EDRI and ILRI should consider starting an online open access journal while continuing with the print subscription-based journals. Such a hybrid model would allow them to continue the subscription-based print journals while allowing converting these journals to electronic forms and made them accessible as open access journals. Open source software such as the Open Journal Systems (OJS) may be used to run and manage open access journals.

3.16. Incentives will drive open access forward

It has been noted that mandating self-archiving is an essential strategy of open access. However, the mandate to self archive should be motivated by well-planned incentive mechanisms. Such incentives should be inclusive to benefit all. It is also recommendable to take a carrot and stick approach to reward those who deposit or self-archive or to penalize who fail to do so. These incentives should be in the form of both tangible(salary increment, research grants, promotion, etc) intangible benefits such as promotion on one's academic career, prestige, and authority that also comes through the impact of making one's research visible.

3.17. Conclusion

Ethiopia should embrace the opportunities presented through open access initiatives. Funding agencies, universities and research institutions should take bold actions in adopting open access policies and strategies in a concerted fashion. Ethiopia should learn lessons from Southern African countries that have successfully lied down visions and strategies for an open access to knowledge. Ethiopian universities, research institutions and funding agencies should mandate self-archiving especially for research that has been carried out through public-funded money. Open access journal publishing models should also be embraced with strategic viable plans that take into account the challenges of setting up and running journals. With the availability of open source journal management software, existing print journals of AAU and publications of ILRI and EDRI should start OA journals.

Open access offers alternatives to the current dysfunctional scholarly communication system in Ethiopia. It is dysfunctional because it has not addressed the needs to researchers, industries and the general public. It is dysfunctional because it has made Ethiopian research invisible and consequently researchers have lost the research impact that they should have gained through the use of their works by others. Open access is an alternative model of scholarly communication and should be considered as a double edge sword: it improves access to research and provides an opportunity to disseminate own research. It maximizes research usage and consequently optimizes research impact. It allows South-South and North-South knowledge sharing and collaboration. Ethiopia should not miss this golden opportunity to leapfrog the knowledge divide that has persisted for so long.

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