

GREEN OPEN ACCESS IN KENYA: A REVIEW OF THE CONTENT, POLICIES AND USAGE OF INSTITUTIONAL REPOSITORIES

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ABSTRACT

There is scant research-based evidence on the development and adoption of open access (OA) and institutional repositories (IRs) in Africa, and in Kenya in particular. This article reports on a study that attempted to fill that gap and provide feedback on the various OA projects and advocacy work currently underway in universities and research institutions in Kenya and in other developing countries. The article presents the findings of a descriptive study that set out to evaluate the current state of IRs in Kenya. Webometric approaches and interviews with IR managers were used to collect the data for the study. The findings showed that Kenya has made some progress in adopting OA with a total of 12 IRs currently listed in the Directory of Open Access Repositories (OpenDOAR) and five mandatory self-archiving policies listed in the Registry

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of Open Access Repositories Mandatory Archiving Policies (ROARMAP). Most of the IRs are owned by universities where theses and dissertations constitute the majority of the content type followed by journal articles. The results on the usage and impact of materials deposited in Kenyan IRs indicated that the most viewed publications in the repositories also received citations in Google Scholar, thereby signifying their impact and importance. The results also showed that there was a considerable interest in Swahili language publications among users of the repositories in Kenya.

Keywords: institutional repositories, green open access, Kenya, university libraries, open archives, self-archiving, digital repositories, open access policies, open access mandates, webometrics, altmetrics

1. INTRODUCTION AND BACKGROUND INFORMATION

Institutional repositories (IRs) have emerged alongside the open access (OA) initiative on scientific literature which advocates for free, online access to digital scholarly materials (Ferreira et al. 2008). OA can be achieved through publishing work in OA journals, which is generally referred to as the golden route to OA, or by depositing scholarly publications in IRs, which is generally known as the green route to OA or self-archiving (BOAI 2002).

An IR is defined as a resource or a system that facilitates the capture, storage, preservation and dissemination of institutional intellectual output in electronic form (Rosenblu 2008). The historical development of IRs can be traced back to 1991, when a discipline-based repository for preprints in physics was developed. Going by the name arXiv, this subject-based repository was developed to replace a multinational manual email distribution list for preprints in physics (<http://arxiv.org>). The repository was later expanded to include preprints from other fields, such as mathematics, astronomy and computer science (MacColl, Jones and Andrews 2006).

Currently, there are thousands of IRs around the world based at universities, research institutions and other organisations. At the time of conducting this study, the Directory of Open Access Repositories (OpenDOAR) had a listing of 2 600 IRs, most of them based in Europe (1 200 or 46%), North America (527 or 20%) and Asia (456 or 18%). Africa had 94 (or 4%) of the repositories worldwide, with the majority of them being in South Africa (42 or 44%), followed by Kenya (12 or 13%) and Nigeria (8 or 9%). The statistics from OpenDOAR therefore placed Kenya as the second-largest contributor of IRs in Africa, after South Africa. Based on the repository counts, Kenya has made some progress compared to its neighbouring East African countries, with Tanzania and Uganda having five and two repositories, respectively. However, these numbers continue to change as more and more IRs are listed every day.

Kenya has experienced rapid development of IRs over the past few years. The number of IRs in Kenya listed in OpenDOAR rose from two in 2009 to 12 currently. In addition, many more universities are in the process of developing their IRs. Some of them are already on the World Wide Web (or Web) but not yet listed in OpenDOAR, and some still operate on their institutions' local area network (LAN). These include Moi University, Egerton University, Maseno University, the Technical University of Mombasa, Kabarak University, the Aga Khan University, the University of Eastern Africa Baraton, KCA University, Kisii University, the Technical University of Kenya, Daystar University, and St Paul's University (Munge, Kamilie and Nasieku 2012; Otando 2011).

However, so far there is scant empirical evidence on the development of IRs in Kenya and in Africa as a whole. Onyancha (2011) points out that the status of OA repositories and self-archiving services and practices in Africa is not known. Kenyan IRs are still in their very early infancy and the extent of their impact remains to be seen, which makes it all the more important to assess them.

Although the number of IRs in Kenya and Africa in general is low, it is worthwhile to assess their content and study their impact. Matsuura (2008) points out that when it comes to IRs, the accurate measure of success is not growth and IR count alone – detailed scrutiny and evaluation of the content are also needed. Xia and Sun (2007) further argue that IRs have developed to the stage where assessment has become necessary and that good assessment will help IR professionals to determine what has been done in the operation of current IRs, and point out future directions. In another study, Thomas (2007) points out that IRs remain an innovative but marginalised technology, largely because there is no consensus about a set of performance indicators that will demonstrate their overall impact on the research enterprise of Kenyan universities. This article tries to fill this gap by assessing the current state of IRs in Kenya; and analysing the content of materials deposited in Kenyan IRs and OA policies adopted by the universities hosting the IRs. The article will also assess the scientific impact of the materials archived in Kenyan IRs by analysing their altmetrics and possible citation in Google Scholar.

2. LITERATURE REVIEW

The literature review is presented in three subsections, namely: content of materials deposited in IRs; OA policies on self-archiving; and altmetrics and the impact of materials deposited in IRs. Empirical studies related to these sub-topics are also reviewed.

2.1. Content of materials deposited in IRs

The intellectual output stored in IRs varies from institution to institution and may include theses and dissertations, published papers, unpublished preprints, working

papers, conference presentations, data sets, and teaching materials, among others (Rosenblum 2008). The decision as to what content should be included in the IR is normally made at institutional level, depending on the available content, content collection and digitisation policies, as well as copyright considerations. More recently, learning materials, open education resources and research data have also been deposited in IRs (Ochoa and Duval 2009).

Several authors have called for a wider view/approach when considering materials to be included in the IR (Genoni 2004; Lynch 2003; Ochoa and Duval 2009; Suber 2012). The Scholarly Publishing and Academic Resources Coalition (SPARC 2002) outlines four categories of potential materials to be included in IRs. The first category is published materials, such as postprint research articles. The second category includes grey literature, such as preprints, working papers, theses and dissertations, research and technical reports, conference proceedings, newsletters and bulletins, papers in support of grant applications, status reports to funding agencies, committee reports and memoranda, statistical reports, technical documentation and surveys. The third category comprises curriculum support and teaching materials, such as online lecture notes, concept illustrations, visualisations, models, simulations, course videos, and the like. The fourth category is for students' electronic theses and dissertations (ETDs).

Several studies have been conducted to assess IRs in various countries. Abrizah, Noorhidawati and Kiran (2010) studied the state of 191 OA repositories at Asian universities. The study described the characteristics of the repositories of Asian universities in terms of type, content, discipline, language, technical and operational issues, policy, web performance as well as their performance according to the Ranking Web of Repositories (RWR). Abrizah et al. (2010) determined that Japan was the biggest contributor to Asian repositories, followed by India and Taiwan. In Japan, Tsuchide, Suzuki and Sugita (2013) found that more than 300 universities and research institutions had set up repositories and that the number of full text items on repositories exceeded one million. Other studies describing IRs in Asian countries include those of Lee-Hwa and Noorhidawati (2013) and Wani, Gul and Rah (2009).

Several studies have presented the situation of IRs in Africa and developing countries in general (Chalabi and Dahmane 2012; Chisenga 2012; Ezema 2013; Kusekwa and Mushowani 2014; Mapulanga 2013; Raju, Smith and Gibson 2013; Uzuegbu 2012). Chisenga (2012) points out that very little research output from Africa finds its way into the international journals, because much of it is in the form of grey literature. Due to several factors, this literature is neither visible, nor easily accessible to potential users. In his recommendations, Chisenga (2012) mentions that the use of information and communications technology (ICT) for the management and distribution of digital-based scientific information and knowledge, and in particular establishing IRs and OA archives, has the potential to improve access to

the scientific and technological data, information and knowledge being generated in Africa.

In South Africa, Onyancha (2011) conducted an exploratory study of IRs at South African higher education institutions (HEIs) and studied the practices, challenges and opportunities of self-archiving by library and information science/studies (LIS) scholars in South Africa. Onyancha (2011) confirmed what was mentioned earlier – that there are few IRs in Africa as a whole and that South Africa has the highest number of these. The author also found that most IRs are located at HEIs; that some IRs are subject-specific while others are multidisciplinary; and that a variety of documents are self-archived.

2.2. OA policies on self-archiving

OA self-archiving policies are strategies implemented by institutions requiring scholars to deposit copies of their research publications in a repository or on a website, a procedure commonly referred to as self-archiving. OA policies on self-archiving are normally created either to encourage or mandate researchers to deposit copies of their publications in IRs (Suber 2012). On the one hand, voluntary policies either encourage or ask authors to deposit copies of their publications in an IR. On the other hand, OA policies can be mandatory, whereby authors are required to deposit copies of their publications in IRs. These stronger OA policies are usually called OA mandates (Suber 2012).

To date, many universities, funding agencies and even national governments have put in place either mandatory or voluntary OA policies on self-archiving with the aim of providing free access to research publications. A study by Xia, Sarah and Nathaniel (2012) outlines the historical development of OA mandates and policies on self-archiving in IRs. The study points out that the earliest OA mandate was a policy successfully created and employed by the School of Electronics and Computer Science at the University of Southampton in the United Kingdom (UK), in 2003. This was followed by the UK Parliament's Science and Technology Committee which recommended a funder-based mandate self-archiving policy to all researchers funded by the UK Research Councils and other government agencies. The United States (US) House of Representatives followed suit in 2004 by voting to set conditions and requirements for federal grant recipients to self-archive any articles resulting from government-funded research.

In the context of universities, the turning point came about with the implementation of a mandate by Harvard University in the US in 2008, which not only required Harvard scholars to deposit their works in OA repositories, but also to grant the university non-exclusive copyright licences to archive and publicly distribute all faculty-produced scholarly articles (Priest 2012; Xia et al. 2012). A number of other universities around the world, including universities in Kenya, have since adopted

similar policies. OA mandates have become an important component of the OA movement because it is widely believed that scholars are more likely to make their articles freely available online if they are required to do so by their university or funding institutions (Priest 2012). OA mandates are believed to be a solution to the problem of content accumulation in IRs and therefore most OA policies address green OA with the aim of increasing the content of material deposited in IRs and ensuring that self-archiving is done (Poynder 2014; Vincent-Lamarre, Boivin and Gargouri 2014). Various studies have confirmed that adopting a good OA policy can have a positive effect on the rate of repository content accumulation and self-archiving (Björk, Laakso and Welling 2014; Gargouri et al. 2010; Gargouri et al. 2012; Gargouri, Larivière and Harnad 2013; Xia et al. 2012). However, OA mandate policies are not a magic solution to the problem of content accumulation in IR. None of the studies mentioned above reported a 100 per cent compliance rate of the mandates indicating that adopting an OA mandate is only part of the equation as policy implementation and compliance is more complicated. The findings from various studies (Harnad 2013; Tsuchide et al. 2013; Xia and Sun 2007) report that so far the implementation of OA mandates has been reduced to librarians trying to chase after authors to provide their papers, or trying to retrieve their authors' published papers from the web. The situation in Kenya is no different, which calls for a need to review these policies so as to enhance their implementation and compliance.

2.3. Usage of materials deposited in IRs

Whereas citation and journal impact factor have long been used as a measure of scholarly impact, other sources of evidence of scholarly publications use or value, such as page views, downloads, comments, reviews, bookmarks, mentions in social media platforms or news stories, are now being considered as useful alternative metrics for measuring the impact of research (Das and Mishra 2014; Konkiel and Scherer 2013; Rodgers and Barbrow 2013). These new metrics for measuring scholarly impact, also known as 'alternative metrics' or altmetrics, are being proposed as alternatives to the widely used journal impact factor and personal citation indices like the h-index (Adie 2014).

If properly collected and analysed, altmetrics can be a useful tool for IR managers and authors who deposit publications in IRs. Altmetrics can be a valuable tool in the context of developing countries where most of the publications archived in IRs constitute grey literature and other unpublished materials, such as theses and dissertations. Altmetrics can provide evidence of the value and impact of these publications as most of them are not published and may never receive citations. Konkiel and Scherer (2013) point out that by reporting altmetrics for their content, IRs can add value to existing metrics and prove their relevance and importance. IR managers can also use altmetrics to help promote popular content within their IRs.

By analysing usage statistics and altmetrics it is possible to determine the scholarly impact of materials deposited in IRs. This information may be useful in the IR advocacy strategies and in seeking support for the repository projects from both the university administrators and authors. As pointed out by Kelly, Sheppard and Delasalle (2012), there is a need for quantitative evidence in order to help demonstrate the value of online services, such as IRs, as such evidence can also help to detect emerging patterns of usage and identify associated operational best practices. Usage and citation statistics can reveal the demographics of those accessing materials in IRs and the type of content that is most popular. Authors can also use the statistics to gain basic insight into the reach of their scholarship (Konkiel and Scherer 2013).

A study by Rehemtula, Rosa and Leitão (2014) sought to find out if and how IRs are using altmetrics as a value-added service to showcase their content impact. The study used the 100 top IRs from the 2014 edition of the RWR as a source of data. The study found that the majority of IRs exhibit usage statistics but only a few provide citation counts and altmetrics, such as mentions in blogs, social media platforms or news stories. In their conclusion, Rehemtula et al. (2014) point out that although in its infancy, altmetrics has been revealed to be very useful in providing data about the impact of non-journal publications. The study urges IR managers to familiarise themselves with the tools available to implement and disseminate altmetrics and to be prepared to enter into the 'Age of Altmetrics'.

For the purpose of the current study, a combination of various techniques was applied to determine evidence of usage of materials deposited in IRs, including, usage statistics, citations in Google Scholar (GS) and data from Google Analytics (GA). Scholars have recommended the use of GS as an alternative tool for evaluating research in developing countries, particularly those situated in Sub-Saharan Africa as it is affordable and easily accessible when compared to the Institute for Scientific Information (ISI) citation index and Scopus, which are subscription based (Onyanha and Ocholla 2009). The fact that GS indexes not only scholarly articles but also non-published materials makes it useful for evaluating the impact of materials deposited in IRs. GA is the most widely used website web analytic tool that generates statistics about website traffic (Clifton 2012).

3. PURPOSE OF THE STUDY

The purpose of the study was to analyse the current state of IR development in Kenya, specifically to examine:

- the content of materials deposited in Kenyan IRs;
- the OA policy adoption and implementation in universities hosting the IRs;
- the usage and impact of materials deposited in Kenyan IRs.

The three concepts covered in the article (i.e., content, policy and usage of materials deposited in IRs) are interlinked and they form important building blocks of the IR system. Analysing the content of materials deposited will help to provide information on what has been done so far and what needs to be done to have more content added to the IRs. It will also highlight self-archiving challenges that IR managers face and how to overcome them. Providing evidence of the usage and impact of publications archived in IRs may be useful in demonstrating the value and functionality of services offered by IRs.

Studying the rate of adoption and implementation of mandate policies adopted by universities hosting IRs will help to shed some light on the overall development of OA and in particular the green OA and IRs in Kenya. Analysing declarations made in these policies will help to identify the strengths and/or weaknesses of these policies and provide information that can be incorporated when the policies are being reviewed or upgraded. The real value of IRs will only be realised when substantial content that is accumulated regarding IRs and OA policy mandates plays an important role in this.

3.1. Significance of the study

Research-based evidence on the development and adoption of OA and IRs in Africa, and in Kenya in particular, is scant. The article attempts to fill that gap and provide feedback to the various OA projects and advocacy work currently underway in universities and research institutions in Kenya and in other developing countries. The article provides information that may be used by library policy makers in Kenya and in other countries with similar socio-economic conditions and who are interested in establishing IRs and adopting OA policies for their institutions. The information will be useful in their decision making process regarding content type to include in the repositories, whether or not to mandate self-archiving and other policy considerations that will contribute to the growth and effectiveness of their IRs. The article will also be useful for IR managers of established repositories. The discussion on usage statistics as applied to the content of materials deposited in IRs will provide IR managers with one more tool that they can use in their advocacy campaigns and in their quest for support for IR projects both from university management and authors.

In addition, the article will be of interest to researchers, students, information professionals, organisations and funding agencies interested in promoting OA in developing countries and anybody interested in the subject of OA.

4. MATERIALS AND METHODS

A combination of webometric approaches, content analysis and interviews with IR managers was applied to collect the data for the study between March and June 2014. Webometric approaches, defined by Thelwall (2009) as the quantitative study

of web-based content or phenomena, were used to collect quantitative data about the IRs and OA policy adoption and implementation in Kenya. Interviews conducted with IR managers provided additional information about IRs and OA policies which could not be obtained on the Web.

4.1. Webometric approaches

Webometric approaches were applied to analyse the current state of IRs and OA policy adoption in Kenya. Two directories were consulted, namely, the Directory of Open Access Repositories (OpenDOAR 2014) and the Registry of Open Access Repositories Mandatory Archiving Policies (ROARMAP 2014). OpenDOAR is a database hosted by the University of Nottingham in the UK, which provides a worldwide list of repositories and aids users in locating the OA repositories of institutions and organisations around the world. Once the Kenyan repositories were identified from OpenDOAR, each IR was examined in order to extract relevant information to conduct the study. ROARMAP is a site created and maintained by the University of Southampton in the UK as an online location for OA policy registration. A complete list of policy proposals and implementations from Kenyan institutions was collected from ROARMap and analysed using content analysis.

4.2. Interviews with IR managers

Interviews were conducted with IR managers at four institutions, namely: the University of Nairobi (UoN); Kenyatta University (KU); Strathmore University (SU); and Pwani University (PU). An unstructured interview guide with only open-ended questions was used to interview the IR managers at all four universities. Slight modifications were made to fit the instrument to the specific conditions and circumstances of each university. However, the instrument was only used as a guideline and more information was obtained by way of probing and asking follow-up questions. The interviews were tape-recorded, transcribed and analysed according to themes. All the themes derived from the interview data are discussed in detail under each relevant sub-section in the results and discussion section below. The interviews were done on site, which also gave the researcher the opportunity to access IR content which was not available on the Web.

5. RESULTS AND DISCUSSION

This section provides and discusses the results in three sub-sections, based on the purposes of the study as follows: an overview of OA repositories in Kenya; a review of IR content in Kenyan repositories; and an analysis of OA policy adoption and implementation in universities and usage and impact of materials deposited in Kenyan IRs. In each sub-section, the findings derived from the webometric approaches and the interviews with IR managers are discussed.

5.1. OA repositories in Kenya

This sub-section deals with the findings that followed from the webometric study, the content analysis of IRs, and the interviews with the IR managers. It covers the number of IRs in Kenya and content types of material deposited in Kenyan IRs.

As stated in the introduction, at the time of conducting the research, Kenya had a total number of 12 OA repositories listed in OpenDOAR. Table 1 presents a summary of IRs in Kenya. As shown in Table 1, the institutions which have developed IRs in Kenya and had them listed in the worldwide directory of IRs include the UoN, KU, SU, PU, Jomo Kenyatta University of Agriculture and Technology (JKUAT), Dedan Kimathi University of Science and Technology (DeKUT), International Livestock Research Institute (ILRI), Rift Valley Institute (RVI), Lake Victoria Basin Commission (LVBC), Kenya Human Rights Commission (KHRC) and Kenya Agricultural Research Institute (KARI).

As indicated by this analysis, most IRs (7 or 58%) are owned by universities, with SU hosting two IRs and UoN having the largest repository in terms of total item count (62 130 records). UoN is the oldest and largest university in Kenya. It was established in 1956 and currently has a student population of about 57 000. JKUAT and KU have student populations of 23 000 and 35 000, respectively, while DeKUT (student population 6 000) and PU (student population 5 000) are fairly new universities that were established in 2007 as constituent colleges and subsequently gained fully-fledged status in 2012 and 2013, respectively. All these universities are public-owned except SU, which is a private institution.

Table 1 further shows that three (25%) of the repositories are owned by multinational organisations which have their headquarters in Kenya, including the ILRI, LVBC and RVI.

The content of each of these three repositories is subject-specific in terms of its scope, namely: livestock research for the ILRI; endangered archives of the government records of South Sudan which were damaged during the 1983–2005 civil war for the RVI; and environmental management for the LVBC. In addition, in terms of their geographic coverage, the materials in these repositories reflect the multinational nature of the organisations, as they contain content from all the different countries from which these organisations are operating. Considering that these repositories are subject-specific and that their content is very different from the university-based repositories, they were excluded from further analysis.

Table 1 also shows that two (17%) of the repositories are owned by Kenya-based organisations, namely, the Kenya Human Rights Commission (an NGO which is campaigning for the entrenchment of human rights and democratic culture in Kenya), and the Kenya Agricultural Research Institute (KARI, a government research institution). Unfortunately these two were not available during the time of the study and were therefore not included in the analysis.

Table 1: OA repositories in Kenya

Institution	Name of repository	Software	URL	Number of documents
University of Nairobi	University of Nairobi Digital Repository	Dspace	http://erepository.uonbi.ac.ke/	62 130
Kenyatta University	Kenyatta University Institutional Repository	Dspace	http://ir-library.ku.ac.ke/	7 668
Strathmore University	SU Portal	Dspace	http://www.digital.library.strathmore.edu/	1 093
	SU + Digital Repository	IR Plus	http://ir.library.strathmore.edu	592
Jomo Kenyatta University of Agriculture and Technology	JKUAT Digital Repository	Dspace	http://ir.jkuat.ac.ke/	465
Pwani University	e-Space	Dspace	http://elibrary.pu.ac.ke/ir/	237
Dedan Kimathi University of Science and Technology	DeKUT Repository	Dspace	http://repository.dkut.ac.ke:8080/xmlui/?Itemid=250/	72
International Livestock Research Institute	Mahider	Dspace	http://cgspace.cgiar.org/handle/10568/1	12 334
Rift Valley Institute	Sudan Open Archive	Greenstone	http://sudanarchive.net/	–
Lake Victoria Basin Commission	Repository @ LVBC	Dspace	http://195.202.82.11:8080/jspui/browse?type=dateiHYPERLINK http://195.202.82.11:8080/jspui/browse?type=dateissued	178
Kenya Human Rights Commission				
Kenya Agricultural Research Institute				

5.2. Content types included in Kenyan IRs

Table 2 shows the variety of content, as well as the number of each content type stored in IRs in Kenya. As indicated in Table 2, in 2014 there were a total of 19 unique types of item covered by Kenyan IRs, including, among others: theses and dissertations; journal articles; research papers/reports and research projects (ongoing); images; books and chapters in books; conference papers; learning objects; presentations, lectures and speeches; policies and reports; and university publications.

Table 2: Content types included in Kenyan IRs

Institution	UoN	KU	SU Portal	SU +	JKUAT	PU	DeKUT	Total
Books/monographs	1 759	151	–	9	–	12	4	1 935
Chapters in books		78	–	14	–	–	–	92
Conference papers	6 153	294	–	131	–	7	–	6 585
Theses and dissertations	24 328	4930	158	–	404	3	17	29 840
Journal articles	22 905	1637	–	121	61	177	48	24 949
Research papers/ reports	1914		–		–		–	1 914
Theses and dissertations (ongoing)	–	274	–	–	–	–	–	274
Research projects (ongoing)	–	–	–	–	–	23	–	23
Newsletters	340	3	–		–	–	–	343
Special collections	12	–	–	–	–	10	–	22
University publications	2 604	–	–	69	–	5	–	2 678
Images	127	–	–	2	–	–	–	129
Learning objects	369	–	–	89	–	–	–	458
Presentations	–	–	–	156	–	–	–	156
Technical reports	–	–	–	2	–	–	–	2
Archives	2 774	–	–	–	–	–	–	2 774
Lectures and speeches	503	–	–	–	–	–	–	503
Policies and reports	57	4	–	–	–	–	–	57
Past exam papers	–	5 000*	935	–	2 000*	3 763*	–	

* Past exam papers stored in a separate database.

The UoN repository had the largest variety of items, including lectures and speeches, policies, reports, newsletters, graduation booklets, and images. Past examination papers were commonly found in Kenyan IRs. In some cases these were hosted in the same IR as the other documents, in others a separate database was created for past examination papers only. Some universities, such as KU, SU, PU and JKUAT, created a separate installation of the Dspace or Greenstone software and used it for the purpose of building a database for past examination papers only.

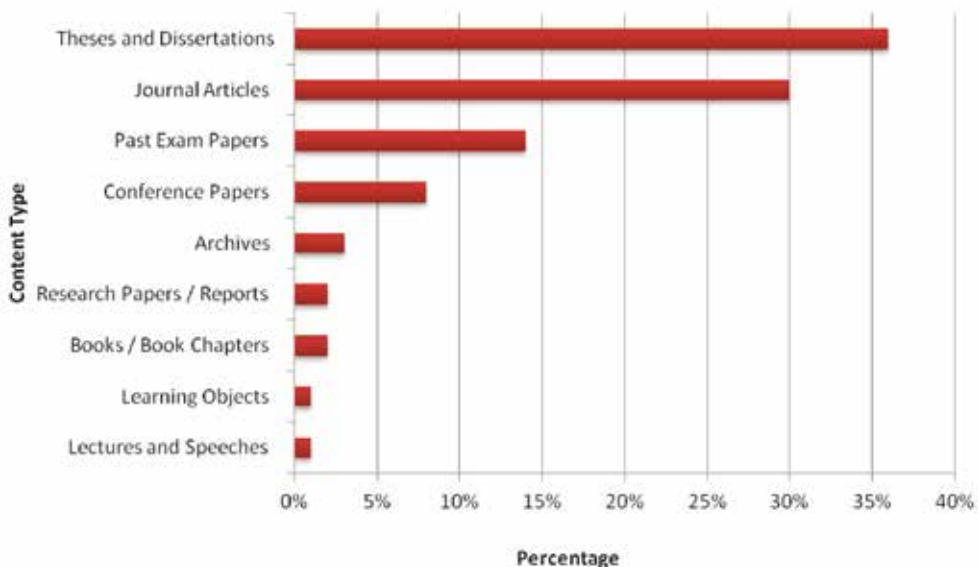


Figure 1: Content types in OA repositories

As indicated in Figure 1, the most abundant type of content in IRs in Kenya were theses and dissertations (both ongoing and completed) at 30 114 (36%). This was followed by journal articles at 24 949 (30%); past examination papers at 11 898 (14%); conference papers at 6 585 (8%); archives at 2 774 (3%); research reports at 1 937 (2%); books and chapters in books at 2 027 (2%); while learning objects and lectures and speeches constituted 1 per cent each. Other content types, such as newsletters, technical reports, special collections, images, presentations and policies, made up less than 1 per cent each and are therefore not shown in Figure 1.

These findings are consistent with IR studies done in other countries. Onyanha (2009) found that theses and dissertations made up the majority of documents in South African IRs. In Hong Kong, Chan (2009) reported that the percentages of archived work were low for journal and conference papers, but moderate for graduate theses. Uzuegbu (2012) also pointed out that journal articles and theses and dissertations were the prime content in African repositories, while in Asia, studies (Abrizah et al. 2010; Nazim and Mukherjee 2011) showed that the majority of deposited content were journal articles, followed by theses and dissertations. Studies in Japan (Matsuura 2008; Tsuchide et al. 2013) indicated that most of the content in IRs were Japanese departmental bulletins called ‘Kiyō’, followed by academic journal articles.

5.3. Policies on self-archiving in Kenya

The main source of data for OA mandate policies was the ROARMap website (roarmap.eprints.org). Five OA policies from Kenya were identified on the ROARMap websites. The institutions behind these policies were SU, which was the first to register its policy in 2011; JKUAT, whose OA policy was registered in 2012; while the UoN and KU policies were registered in 2013 and 2014, respectively. The PU thesis mandate was registered in 2014.

At the time of the study, Europe had 284 and North America had 169 policies registered on the ROARMap website, while there were only three other African countries which had policies registered on ROADmap, apart from Kenya. These included South Africa, which had registered five policies, and Nigeria and Ghana, which had registered two policies each (see Table 3). A comparison of the number of policies in these African countries versus their repositories is shown in Table 3.

Table 3: A comparison of repositories versus policies count in Africa

Country	No. of repositories	No. of policies	Percentage of policies (%)
South Africa	42	5	12
Kenya	12	5	41
Nigeria	8	2	25
Ghana	3	2	66

An attempt was made to gauge the OA proliferation in Africa in terms of OA policy adoption by calculating the percentage of policies as compared to available IRs per country. This was calculated by dividing the total number of policies in each country by the total number of its repositories. The results for this are shown in Table 3, with Ghana having three repositories and two policies; hence bringing the percentage of policies to 66 per cent. The striking difference came with South Africa being the country with the highest number of repositories in Africa, but having only five policies, that is, the lowest percentage of policies at 12 per cent. In addition, a report by the Open Access Tracking Project (OATP 2012) pointed out that while there is a growing adoption of OA in South Africa, mandatory policies are lacking. What made South Africa achieve such a high number of repository count, size and content and yet very little progress has been made in terms of OA policy adoption and formulation is a question of further research. More research on the concept of OA repositories and policies in African countries is required to shed light on what is working and what is not working. Research will also provide the much needed feedback for OA projects and advocacy work which is currently dominating the literature on OA in Africa.

5.3.1. OA policy formulation in Kenyan universities

It takes tremendous efforts for an OA mandate policy to be discussed, proposed and implemented, particularly at the institutional level (Xia et al. 2012). The literature shows that all the Kenyan policies were formulated through a rigorous process by these universities, which involved several workshops and training sessions conducted to raise awareness on both the policies and the OA movement (EIFL 2012a, 2012b, 2014a; Kabugu 2012). The librarians at these universities in collaboration with organisations such as the Kenya Library and Information Services Consortium (KLISC), Electronic Information for Libraries (EIFL) and International Network for Availability of Scientific Information (INASP), played a big role in spearheading the OA policy formulation process.

Both the EIFL and INASP through their various OA programmes have played a significant role in capacity building and advocacy for OA in Kenya. Through funding from the two organisations, KLISC has been able to organise workshops, training programmes and advocacy campaigns in various institutions in the country (Otando 2011). Various libraries have also benefited from the annual funding provided by INASP to participate in the OA week, a global event that calls for OA as the new norm in scholarship and research. Libraries have used the opportunity provided by the OA week to raise awareness on the concept of OA, launch IRs and conduct OA workshops (INASP 2015). With regard to OA policy mandates, the EIFL through its OA policies advocacy programme provided expertise, capacity building and technical support that led to the adoption of the OA policy mandates at UoN, KU, JKUAT and SU (EIFL 2014b).

Interviews with IR managers at UoN and KU revealed that an effort was made to ensure that the OA policy making process was as inclusive as possible. Before the policy was adopted by the two institutions, stakeholder consultation was done thoroughly whereby an advert was placed in a daily paper to allow the university community, former students, alumnae and members of the public to comment and give their views about the policy. The adverts also served to inform former students that their theses/dissertations would be digitised and uploaded online. The IR managers revealed that in both cases nobody raised any objections to the policy hence giving libraries the go ahead to digitise and upload the theses/dissertations in full text.

5.3.2. Declarations made in OA policy mandates adopted by Kenyan universities

The section that follows presents a summary of the declarations made in the OA policies adopted by Kenyan universities. The summary is provided under the following points: mandatory self-archiving; objectives of establishing repositories; content type; time line for the policy to take effect; policy waiver and embargo; where to publish; time limits for deposits; and compliance and verification.

A summary of the four institution-based OA policy mandates (UoN, KU, JKUAT and SU) is presented, while a summary of the PU thesis mandate is presented in a separate section. The discussion will be limited to the effect of these policies on OA adoption by these universities from the perspectives of the IR managers. The discussion on whether these policies are legally sound, or whether they will improve self-archiving practices in these universities, is beyond the scope of the article.

- **Mandatory self-archiving:** All the OA policies from Kenyan universities listed on ROARMap are mandatory policies also known as OA policy mandates (Suber 2012), which makes it compulsory for members of the institution to deposit their scholarly articles in the IR. In addition, all the Kenyan OA policies are also permission mandates which are based on the type of policy adopted at Harvard University; thus, such policies are also commonly termed Harvard-style policies. The Harvard Open Access Project (HOAP 2014) lists over 50 universities around the world with permission mandates. Permission mandates grant universities a non-exclusive licence to archive and distribute all faculty-produced scholarly articles (Priest 2012). By granting a non-exclusive permission to the university, the authors of the scholarly works agree to extend one of their rights under the copyright law (in this case, the right to distribute the work) to a third party (in this case, the university). The authors, however, retain other rights provided under the copyright law, such as the right to reproduce; the right to prepare derivative works (e.g., translations); the right to display publicly; and the right to perform publicly. As opposed to an exclusive transfer of the copyright, which means a complete handover after which the copyright holder no longer has the right, a non-exclusive transfer of the copyright is an extension of one or more rights to another party, where the right still belongs to the original copyright holder. After granting non-exclusive permission, the authors still retain ownership and complete control of the copyright in their work and they can exercise their rights under copyright including transferring them to a publisher if they so desire (Suber 2012).
- **Objectives of establishing repositories:** As stated in the OA policy reviewed, the main purpose of establishing an IR in all the institutions is summarised as follows: (i) to promote the university's research profile by providing an online access to its research output; (ii) to increase citation rates and the impact of the research done in the institution; (iii) to expose institutional research output to the wider global community and thereby enhance its visibility; and (iv) to enhance the feedback loop to university researchers, the university, and other stakeholders. This shows that enhancing institutional research output, visibility and impact has been the most important motivation for Kenyan universities to establish IRs. This motivation could be linked to the desire to reverse the problem of invisibility of scholarly research from African countries. As pointed out by

Trotter, Kell and Willmers (2014), traditional metrics of visibility (especially the Institute for Scientific Information (ISI)/Web of Science (WoS) impact factor) have failed to make legible a vast amount of African scholarly production, thus underestimating the amount of research activity on the continent. In addition, various mechanisms and metrics of ranking universities based on their web presence, such as the Webometric ranking of universities, could have also played a role in Kenyan universities desiring to be comparable to other universities on the continent and in the East African region. The highly ranked universities are more likely to attract more students and research funding.

- **Content type:** All four institutions' OA policies state that the policy will apply to all scholarly articles authored or co-authored by members of the institution including academic staff, visiting researchers and students. Apart from the scholarly articles, such as journal articles, book chapters and conference papers, the policies also list other content to be incorporated in the IR, including: theses and dissertations, learning objects (past examination papers, teaching modules etc), technical reports, commissioned reports, working papers, government submissions, research reports, inaugural lectures, newsletters, and so on. One policy (UoN) lists some unique types of documents, including: images, audio visual materials, admissions lists and graduation lists, to name a few. In terms of content type and as pointed out in the literature (Genoni 2004; Lynch 2003; SPARC 2002), the policies are indeed inclusive and widespread as they include both published scholarly work, grey literature and various documents produced by the institution.
- **Time line for the policy to take effect:** Three of the policies declare that the policy will apply to all scholarly articles authored or co-authored while the person is a member of the university except for any articles completed before the adoption of the policy. These three policies leave it to the authors' discretion to decide whether or not to archive publications produced before the adoption of the policy. One policy, however (UoN), states that the policy will apply to all scholarly works completed before and after the adoption of the policy. This means that authors are mandated to archive all their articles including those that were published before the policy was adopted. If it is implemented effectively, the latter will render more content available to the IR.
- **Policy waiver and embargo:** An embargo can be defined as a specific period of time during which full text access to the published material is restricted. All policies make provision for an embargo; however, the policy does not state the time frame of the embargo. The policies state that the application of the policy could be waived upon written request by the author explaining the need. Scholars in the OA community have raised concerns about such waivers saying that they make the policies less mandatory (Harnad 2013).

- **Where to publish:** All the policies apply to green OA meaning that members of the institutions are allowed to publish in their journals of choice and then submit copies of their publications to the IR. In most cases green mandates do not specify where the authors should submit their papers for publication (Xia et al. 2012). However, one policy (UoN) states that authors are encouraged to publish their scholarly work in peer-reviewed OA journals. The policy further states that those who publish in OA journals shall not be disadvantaged during promotion and tenure considerations. These kinds of endorsements for gold OA outlets are generally good and are a welcome addition to the policy; however, institutions should put in place mechanisms to curb predatory OA publishers who lure researchers with quick and easy publishing which oftentimes does not involve adequate peer review (Beall 2012). A complete list of publishers categorised as predatory is available from Bells blog, an academic librarian from the University of Colorado (Beall 2015). An example of mechanisms put in place to address the problem of predatory journals (with no peer review), is the requirement that was recently put in place by the Department of Higher Education and Training (DHET) in South Africa that requires proof of peer review to accompany all accredited journal articles submitted to the department to be counted as part of the research output for subsidy, tenure or promotion.
- **Time limits for deposits:** Regarding time limits for deposits, the policies mentioned that the archiving should be done no later than the date of publication. However, one policy (UoN) states that the archiving should be done at the time of acceptance for publication, meaning that researchers are required to submit preprint versions of their work to the repository, if the published policy permits.
- **Compliance and verification:** None of the policies covered issues of compliance and verification. All the policies are silent about compliance and the consequences of not complying with the policy. Compliance is an issue that IR managers and university managements need to address in order for IRs to survive and accumulate enough content. Studies have shown that even when mandates are in place, compliance levels are often very low (Poynder 2012, 2013; Taylor 2013). In addition, the current situation in Kenya and in other places where self-archiving is done by the librarians and not the authors themselves, makes it difficult to access postprint and preprint versions of the published research papers.

Recommendations have been put forward to ensure compliance in OA mandates that target IRs. One such recommendation is to designate the repository as the only mechanism for submitting publications for individual and institutional research performance assessment and evaluation (Gargouri et al. 2013; Poynder 2014). If such a policy is adopted, staff members will have to submit their list of publications with live links from the copies deposited in the IR, either in full text or abstract, in order for them to be considered for tenure or promotion. Universities in Kenya

can take up such recommendations and incorporate them during policy reviews or upgrading. Institutions which are currently developing their policies can also take up such recommendations to increase the compliance levels of their mandates.

The PU thesis mandate is also a mandatory and permission-based policy. It has a provision for a waiver for a maximum of two years to allow students to publish or patent their work upon written request by the students and their thesis supervisor. The policy further outlines procedures for electronic submission of the theses. As a compliance measure the policy states that failure to follow the policy will result in the student not graduating for that semester.

The benefits of the policies as pointed out by the IR managers include: libraries are provided with a legal basis to collect and archive full text content; they have led to an increase in full text content in the repositories; and the consultations involved in making the policies have made the university community aware of the benefits of OA.

5.4. Usage and impact of materials deposited in Kenyan IRs

Several techniques were used to find evidence of the impact and usage of materials deposited in IRs, including: altmetrics and usage statistics; citations in GS; and data from GA. The results from these techniques are presented below.

5.4.1. Usage statistics

As discussed earlier and as shown in Table 1, most IRs in Kenya have been implemented using Dspace software with the exception of one that uses IR plus software. For the IRs implemented using Dspace, none of them had their statistics displayed to repository users. The statistics were only available to administrators. In Dspace the statistics report can be made either public or private depending upon users' preferences (Lewis and Yates 2010). Therefore, in the case of Kenyan IRs, most IR managers chose to make this information private and only available to a user logged in as an administrator. Due to this the author had to ask for this information from the IR managers and the information provided was page views and statistics from GA. None of the repositories had implemented an altmetrics reporting service that provides metrics such as bookmarks on academic or social reference manager sites or mentions and shares on social media. The metrics obtained from the IR managers were combined with citation counts in GS to provide a rich picture of the impact of the materials deposited in IRs.

5.4.2. Most viewed articles

Information on page views was the most used statistic across IRs in Kenya. Tables 4–6 show the ten most viewed items across three repositories, namely, UoN, KU and

PU. For UoN the statistics gathered were only for one month (May 2014), while for KU and PU the statistics were for the entire duration of the IRs. Page views only says the information was viewed but does not say much about how that information was used or the possible impact of that information. Therefore, the most viewed items were also checked in GS to see whether they had been cited. As pointed out by Priem, Piwovar and Hemminger (2012), there is correlation between the number of online views and downloads of an article and the number of times that article will be cited in future research.

Table 4: Most viewed articles and their citations on GS (UoN)

Title	Author(s)	Document type	Language	Full text/ Abstract	Views in IR	GS citations
Uhakiki wa kimaudhui na kifani wa kidagaa Kimemwozea	Rono, P.	Thesis	Swahili	Full text	202	-
What is the 'right-based approach' all about: Perspective from international development agency	Nyamu-Musembi, A.	Working paper	English	Abstract	137	90
Satire in Okot p'Bitek's poetry: A critical analysis of Song of Lawino, Song of Ocol ...	Ogweno, E.A.	Thesis	English	Abstract	94	-
Stakeholders involvement in strategy implementation at Lake Victoria South water service board	Munene, A.J.	Thesis	English	Abstract	75	-
The impact of China in Southern Africa	Kaplinsky, R.	Working paper	English	Abstract	61	179
Factors affecting the performance of small and micro enterprises (SME) traders at City Park ...	Nabintu, N.	Thesis	English	Abstract	54	-
Envelope Function Approximation (EFA) bandstructure calculations for III-V non-square stepped alloy ...	Kaduki, K.A. et. al	Journal article	English	Abstract	50	10
Bancassurance as a penetration strategy used by insurance companies in Kenya	Ombonya, E.	Thesis	English	Abstract	46	-
Correlations between yield and malting quality in barley	Ayiecho, P.O.	Journal article	English	Abstract	46	-
Environmental security in national security: The case of the Horn of Africa	Oriama, D.	Thesis	English	Abstract	45	-

Table 5: Most viewed articles and their citations on GS (KU)

Title	Author(s)	Document type	Language	Full text/ Abstract	Views in IR	GS citations
Mwongozo wa Kidagaa Kimemwozea (Tahakiki Kamili)	Maitaria, J.M.	Book guide	Swahili	Abstract	6698	–
Challenges faced by Board of Governors in secondary schools management: A case of Taita – Taveta County, Kenya	Mkongo, P.D.	Thesis	English	Abstract	1730	–
Mwongozo wa Damu Nyeusi na Hadithi Nyingine	Maitaria, J. N.	Book	Swahili	Metadata	1511	–
The Contribution of christian missionaries to education in Meru 1908–1963	Micheni, S.	Thesis	English	Full text	1432	–
The challenges faced by the Board of Governors (BOG) in the management of secondary schools and their impact on KCSE performance: A case of Manderu County, North Eastern Province, Kenya	Orpha, O.	Thesis	English	Abstract	1092	–
Ushairi wa Kiswahili: maendeleo na mabadiliko ya maudhui	Masinde, E.W.	Thesis	Swahili	Abstract	1060	–
Specific challenges facing guidance and counselling teachers in public secondary schools in Kiambaa Division of Kiambu District	Macharia, J.	Thesis	English	Full text	979	1
The effects of peer pressure on the educational achievement, educational aspirations and occupational aspirations of form four students in Kericho District	Rono, R.	Thesis	English	Abstract	920	1
Management challenges facing Kenya's public universities and implications for the quality of education	Mbirithi, D.	Thesis	English	Full text	805	–
Role of Board of Governors in the management of secondary schools in Kasikeu Division, Nzaui District, Kenya	Mutuku, E.	Thesis	English	Full text	791	–

Table 6: Most viewed articles and their citations on GS (PU)

Title	Author(s)	Document type	Language	Full text/ Abstract	Views in IR	GS citations
Beef production in the arid and semi-arid lands of Kenya: Constraints and prospects for research and development	Kahi, A.K. et. al	Journal article	English	Full text	167	11
Suitability of GIR cattle genetics in enhancing the dairy value chain at the coastal lowland tropics of Kenya	Rewe, T.O.	Research Project	English	Abstract	130	-
Analysis of community participation in water resource management in Kilifi County, Kenya	Okeyo, B.	Research project	English	Abstract	119	-
Information and communication technologies and sustainable livelihoods: A case of selected rural areas of Tanzania	Chilimo, W.	Thesis	English	Abstract	84	11
The effects of untreated bednets on malaria infection and morbidity on the Kenyan coast	Mwangi, T. et. al	Journal article	English	Full text	68	39
Development of breeding objectives for production systems utilising the Boran breed in Kenya	Rewe, T.O.	Thesis	English	Full text	67	5
CD4 T Cell responses to a variant antigen of the malaria parasite Plasmodium Falciparum, Erythrocyte Membrane Protein-1, in individuals living in Malaria-endemic areas	Allsopp, C.E. et al	Journal article	English	Full text	66	17
Combining quantitative and qualitative methods in ICT and sustainable livelihoods research	Chilimo, W.	Conference paper	English	Abstract	66	-
A taste of fame	Otieno, A.	Book	English	Abstract	63	-
Clinical algorithms for malaria diagnosis lack utility among people of different age groups	Mwangi, T. et. al	Journal article	English	Full text	63	61

5.4.3. Most viewed publications and their citations on GS

As shown in tables 4–6, out of the 30 most viewed items, 16 (53%) were theses, six (20%) were journal articles, and three (10%) were books; while working papers and on-going research projects were represented by two (7%) each, and there was one (3%) conference paper. The majority of the most viewed items were available in IRs as abstracts (20 or 67%) while there were only ten (33%) full text items.

In terms of GS citations, the journal articles and working papers that were mostly viewed also received citations. Although theses constituted the majority of the items viewed, most of the theses viewed were not cited. Only two theses (7%) were viewed and also received citations.

Table 7 provides statistics on the most viewed journal articles, their source and OA availability. Four of the most viewed and highly cited journal articles were published in subscription-based journals, namely: *Outlook of Agriculture*; *Journal of Transactions of the Royal Society of Tropical Medicine and Hygiene*; *Journal of Tropical Medicine and International Health*; and *Journal of Infectious Diseases*. All four articles published in the above listed journals had their final versions available in full text as OA either from the IR, subject specific repositories or both. The page view statistics and GS citations signify the impact of these scholarly works in their field and probably reinforce the proposition that OA availability increases the citation advantage of the articles.

One article was published in a journal that is currently published as an OA journal (*Indian Journal of Agricultural Sciences*) but the articles from the older journal are unavailable as OA, nor have they been self-archived; hence, they are unavailable as OA.

The results of this analysis also indicated that there was a considerable interest in Swahili language publications among users of the repositories in Kenya. In two repositories, namely, UoN and KU, the top most viewed items were Swahili publications (i.e., a guide and a thesis) based on a popular Swahili novel *Kidagaa Kimemwozea* by Ken Walibora. Both the novel and publications derived from it are highly used by secondary school students who are studying Swahili as a language in Kenya. However, it was interesting to note that none of the Swahili publications received any citations. This is probably due to the fact that these publications are mainly used as part of the Swahili language curriculum in secondary school classroom settings and hence may not be cited by other researchers.

Table 7: Most viewed journal articles, their source and OA availability

No.	Title	Author/s and year	Source	Journal type	OA availability	GS citations
1	Clinical algorithms for malaria diagnosis lack utility among people of different age groups	Mwangi, T. et al. (2005)	Tropical Medicine and International Health	Subscription-based	Available as OA	61
2	The effects of untreated bednets ...	Mwangi, T. et al.	<i>Transactions of the Royal Society of Tropical Medicine and Hygiene</i>	Subscription-based	Available as OA	39
3	CD4 T Cell responses to a variant antigen of the malaria parasite ...	Allsopp, C.E. et al.	<i>Journal of Infectious Diseases</i>	Subscription-based	Available as OA	17
4	Beef production in the arid and semi-arid lands of Kenya ...	Kahi, A.K. et al. (2006)	Outlook of Agriculture	Subscription-based	Available as OA	11
5	Envelope Function Approximation (EFA) bandstructure ...	Kaduki, K.A. et al. (1999)	Physica Scripta	Subscription-based	Not available as OA	10
6	Correlation between yield and malting quality in barley	Ayiecho, P.O. (1983)	Indian Journal of Agricultural Sciences	Open Access	Not available as OA	–

5.4.4. Google Analytics

The researcher was able to gain access to GA statistics from three repositories that have implemented GA to track use of the repository. Currently, there is no option to display GA metrics to repository visitors and therefore this information was obtained from the IR managers at these universities. Table 8 presents the results from GA statistics which show the countries from which Kenyan IRs are accessed and the number of times the IRs have been accessed from these countries.

Table 8: Countries accessing Kenyan IRs and the number of visits

Institutional repository	KU	UoN	PU
Countries accessing Kenyan IRs and number of visits	Kenya (544)	Kenya (12 360)	Kenya (116)
	United states (122)	Netherlands (3 483)	Netherlands (33)
	Netherlands (24)	United States (1 719)	United states (14)
	Germany (19)	India (1 317)	India (12)
	EU (18)	United Kingdom (1 063)	Indonesia (8)
	Tanzania (18)	Indonesia (969)	United Kingdom (7)
	China (15)	South Africa (722)	Namibia (7)
	Ethiopia (14)	Tanzania (524)	Brazil (6)
	Zimbabwe (9)	Malaysia (395)	Malaysia (4)
	Russia (8)	Nigeria (387)	

Based on the data provided by GA, across the three repositories, the main users originated from Kenya. It is also interesting to note that across the three repositories, the countries that visited Kenyan IRs the most were the Netherlands and US. Other countries that visited Kenyan IRs included: UK, Malaysia, India, Germany, Brazil and China. The results show further that the repositories were not accessed much by users from the rest of Africa, with only 30 per cent of the visitors being from Africa countries. Limited connectivity and bandwidth problems on the continent could be some of the reasons contributing to this trend. These results show further that the Kenyan repositories are being used and they contribute to global scholarly landscape as they attract users from various countries.

6. CONCLUSION AND RECOMMENDATIONS

Kenya has a total of 12 OA repositories listed in OpenDOAR, which puts it in the second position in Africa, after South Africa. There are indications that very soon more universities are going to have IRs that promote OA. However, the study results have shown that IRs in Kenya are still in their infancy. Generally speaking, IRs in Kenya are few and still underdeveloped. For instance, only six universities have their IRs listed in OpenDOAR, against a total number of 60 universities currently operating in the country. For the situation to improve, advocacy is needed to ensure that more IRs are created. In addition, IRs operating on their institutions' intranet should be made fully OA-compliant and become visible globally. IR managers need to make more content available and increase access to full text items especially.

Kenya has made some progress in OA proliferation in terms of OA policy adoption; however, there is a need for IR managers to monitor compliance rates of the policies and where necessary take measures to ensure compliance. Further research is also needed to determine the effectiveness of the policies in terms of deposit rates, that is, the percentage of annual published output that is deposited. In

addition, comparative studies on the effectiveness of various policy models will help institutions planning to adopt OA policy to pick the most effective model.

IR managers should pay more attention to IR statistics and consider making those statistics public and accessible to repository users. These will encourage authors as it will give them an indication of the use and impact of their work. In addition IR managers should consider upgrading their repositories to the most current version of the software they are using, as it was found that some IRs were using older versions of the software which has limitations in terms of the statistics provided by the software. IR managers may also improve the statistics provided in their repositories by including statistics plug-ins available in various IR software packages or embedding their IRs with altmetrics services, such as Altmetrics.com, Impact Story and Plum Analytics. Embedding IRs with altmetrics reporting services will provide a more complete picture of the impact and use of materials deposited in these repositories.

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