

# **A Webometric study of selected academic libraries in Eastern and Southern Africa using link analysis**

By

**Omwoyo Bosire Onyancha<sup>1</sup>**

University of Zululand, Private Bag X1001 Kwadlangezwa, South Africa

Email: [bosireo@ueab.ac.ke](mailto:bosireo@ueab.ac.ke)

## **1. Introduction**

Worldwide, library practices are undergoing revolutionary changes that stem from the proliferation of the Internet and its features. Librarians can now effectively perform previously labor-intensive tasks over the Internet using applications such as: (a) Electronic Mail (E-mail), which librarians can use to communicate with colleagues and clients or participate in discussion groups and share experiences and ideas; all the while creating and monitoring discussion groups of interest to patrons; (b) Telnet, through which librarians can connect to remote computer resources and explore other library catalogs, access database services, and share resources; and (c) File Transfer Protocol (FTP) which librarians can use to obtain software programs, text images, and sound files (McKenna, 1994). Several authors have noted the opportunities that the Internet offers librarians and libraries (Ahmed, 2002; McKenna, 1994). McKenna (1994) outlines some of these opportunities thus: leadership opportunities (leadership in the introduction of Internet services to the industry and community, and user training); utilizing cost and time savings (as afforded by the internet); providing question answering services, international interlibrary loans, document delivery services, online transactions and government information; and facilitating information sharing.

Libraries in Sub-Saharan Africa have embraced the Internet fairly recently and are therefore still struggling to overcome Internet-related challenges such as the construction and development of library websites, subscription to online resources (journals, databases, e-books, etc), the implementation of Online Public Access Catalogs (OPAC) – sometimes referred to as Webcatalogs –, online communication (with patrons, suppliers, etc), online library acquisitions, library networking (interlibrary loans), etc. All these services require online connectivity on the part of libraries. Thus library websites are increasingly becoming a tool that enables libraries to offer and market their services online. Partnerships or consortiums (among libraries and between libraries and other institutions) through the Internet are deemed necessary for the effective management of library services. The realization of Internet-related benefits and opportunities, therefore, depend not only on a library's connectivity to the Internet but its Web presence, structure

---

<sup>1</sup> Omwoyo Bosire Onyancha is a PhD student at the Department of Library and Information Science, University of Zululand, South Africa and a Deputy Librarian at the University of Eastern Africa, Baraton, P.O. Box 2500, ELDORET - Kenya

and impact. It is thus crucial to periodically audit the libraries' websites in order to measure their web presence, structure and impact.

## **2. Purpose**

This study sought to audit and map selected university libraries' websites in order to measure the libraries' web structures, content, and visibility/presence. The study's focus areas included the number of web pages, in-links, out-links, location of library links on universities' websites, and the most popular link(s) targeted by these universities. The most popular sites were examined in order to determine the institutions/organizations/sites with which these libraries are linked and/or partner.

## **3. Objectives**

The study's objectives were to:

1. Examine the location of the libraries' websites in the university website.
2. Measure each library's link performance in terms of web page, directory, domain and site out-links and in-links.
3. Examine each library's performance with regard to the provision of essential online services (e.g. webcatalogs, web forms, web search engines, etc).
4. Map the libraries' inter-linkages.
5. Find out the most targeted web-sites/pages.

## **4. Literature Review**

Historically, the Internet and the World Wide Web (WWW) are relatively new concepts which, upon inception, have since elicited a lot of excitement and interest from numerous scholars as illustrated by the exponential growth in literature that discusses their features, opportunities, challenges and impact. Attempts have been made to develop indicators that can be used to measure research and evaluate the performance of individuals, institutions, and countries on the Internet as a whole and more particularly, on the WWW. Virtually all disciplines, including library and information science (LIS), have utilized these Internet-related studies. Specifically, the Internet's (and the WWW's) impact on libraries and the use of Internet-related services by libraries have received attention from researchers based in various countries from a variety of disciplines, including LIS (e.g. Henry, 1996; McCreedy, 1997; Clausen, 1999; Falk, 1999; Saeed, Asghar, Anwar & Ramzan, 2000; Arte, 2001; Covert, 2001; Kochtanek, Hein & Kassim, 2001; Still, 2001; Westman, 2001; Ahmed, 2002; Cordeiro & de Carvalho, 2002; Hildebrand, 2002; Booth & Napier, 2003; Hundie, 2003; Pacios, 2003; Clyde, 2004; Kennedy, 2004; Xue, 2004; Falk, 2005; Nielsen, 2005; etc). What follows is a brief review of some of these studies.

Henry (1996) provides a description of WebCATS – a directory of online public access catalogs that offers access to OPACs with WWW interfaces. A similar description is offered by Kochtanek, Hein & Kassim (2001) concerning what the authors call 'Project DL'. The project involved creating a site capable of assisting users in accessing digital library collections as well as information resources related to the study of digital libraries. McCreedy's (1997) study offers a variety of suggestions toward the implementation of a 'library-related' website. The study focused on the need for a library website, the personnel required to develop the website, evaluating its usage, and organizing and

structuring it. Westman (2001) adds to this by providing librarians with resources (i.e. database-backed web pages) that they can use for the effective construction of library websites. Falk (1999) argues that a library webpage is supposed to serve two functions, namely provide a means to users to access remotely available information from the library while serving as a patron's guide to the library's collections, and also as a gateway to the resources of the WWW. Saeed, Asghar, Anwar & Ramzan (2000) sought to survey the use of the Internet in university libraries of Pakistan. The authors found that university libraries in Pakistan use the Internet for reference work, classification and cataloguing, document delivery services, and subscription to online journals, etc. On their part, the Arabian Gulf libraries use the Internet to offer such services as web catalogs, web forms, orientation and training and web search engines (Ahmed, 2002). Arte (2001:93) studied the role of the research library website in the management of the scientific information environment and argues that "each library can develop an individualized change management program that takes into consideration the basic elements of experienced staff, new staff, and creative supervisory practices". Several studies have been carried out in order to introduce main ideas and concepts underlying web services, and resources and opportunities that the Internet offer libraries and librarians (e.g. Cordeiro & de Carvalho, 2002; Hundie, 2003); and library website maintenance (Kennedy, 2004).

Several indicators can be used to evaluate libraries' websites for quality, some of which include design and structure; quality of information; links and navigation; aesthetic impression; miscellaneous; and general assessment (Clausen, 1999). According to Clausen (1999:83), "*one of the most serious and widespread objections against information found on the World Wide Web is that the quality in many cases is doubtful*". Using the above indicators in the evaluation of Danish academic libraries, the author noted that the libraries' websites were [in general] above average when compared to other web sites. However, they did not measure up to expectations as "*virtual expressions of the quality levels of the libraries*" (Clausen 1999:83). A study with different implications was conducted by Xue (2004), who used user statistics to assess the Government Publications Library at the University of Colorado, USA. She examined the library website's organization (including access, searchability, and structure) of electronic government information in subject category format and noted, among other observations, that the website attracted a large volume of traffic partly because of its comprehensive coverage of federal and state government, foreign country and international organizations; detailed classification of subjects; and detailed annotation for each link. She proceeded to conclude that usage statistics are useful for monitoring search engine ranking, improving display, structure and searchability. Pacios (2003) sought to examine management-related documents posted on Spanish libraries' websites by analyzing the structure and contents of the web pages and other related aspects. Pacios (2003:536) observed that the "*information is scanty in many cases – often resulting from a lack of a suitable information policy for determining what is published on the Web – although libraries are beginning to evaluate the quality of their services*".

From this brief review, it is significant that little has been achieved in evaluating libraries using link analysis. Link analysis is a measure of the quality and relevance of a set of

links pointing to a given site ([www.2020visible.com/re-terminology.html](http://www.2020visible.com/re-terminology.html)). This analysis is meant to assist in determining websites that promote a given website and measure popularity. Link popularity measures how many other sites indexed in the same search engine have links to one's site by the number of links to that particular site. This method has been used to: measure universities' web impact factors (Thelwall, 2002a); find the most important university web pages (Thelwall, 2003); identify link relationships between universities (Thelwall, 2002b; 2002c); classify link types in academic environments on the Web (Bar-Ilan, 2005); and to rank universities (InterLab, 2005).

## 5. Methods and tools

The following procedures were followed in the process of data collection:

1. *Selection of countries*: out of a total of 18 countries (excluding islands) in Eastern and Southern Africa, three countries each from Eastern Africa (i.e. Kenya, Tanzania, and Uganda) and Southern Africa (Botswana, South Africa and Zimbabwe) were purposefully selected for this study. The countries' proximity to each other in each region partly dictated the selection process.
2. *Selection of universities*: universities in each country were identified using several sources including:
  - Catalogue of world universities ([http://www.webometrics.info/university\\_by\\_country\\_select.asp.htm](http://www.webometrics.info/university_by_country_select.asp.htm))
  - Canada's University and College Information Center (<http://www.canadian-universities.net/index.html>)
  - International Network for Higher Education in Africa (2003) ([http://www.bc.edu/bc\\_org/avp/soe/cihe/inhea/index.htm](http://www.bc.edu/bc_org/avp/soe/cihe/inhea/index.htm))
  - Study in South Africa (<http://www.studysa.co.za/index.php>)

A total of 59 universities with their own websites were identified from 65 universities in the six countries.

3. *Selection of libraries*: each university's website was browsed for information regarding the library's home page [URL] address. This address was significant as it was used to measure the libraries' performance on the WWW. A total of 76 libraries belonging to 65 universities in the selected six countries were targeted for study. Upon browsing the universities' websites for libraries' URL addresses, only 35 libraries were selected for study based on home page ownership. Excluded from the analysis were academic libraries whose:
  - a) URL home page addresses were long and contained punctuation marks.  
(e.g. <http://www.unisa.ac.za/Default.asp?Cmd=ViewContent&ContentID=17>)
  - b) home pages were still under construction.

A complete list of the academic libraries in the six countries is provided in Table 1. The last column provides notes as to why some of the libraries were excluded from the final analysis.

Relevant data was extracted from the Internet in the month of July 2006 by crawling the web using SOCSIBOT computer software (developed by Prof. Mike Thelwall). Data was analyzed using the SOCSIBOT toolkit, which consists of Matrix and Pajek tools, in order to:

1. find out the volume of each library's total web pages
2. find out the volume of each library's total out-links
3. measure each library's in-links from, and out-links to other libraries in the six countries
4. measure each countries total library web pages and out-links
5. calculate the average number of web pages and out-links per library in each country
6. rank libraries according to the number of pages, out-links and out-links per page

Pajek computer software was used to prepare the visual networks.

**Table 1: Countries, universities and libraries selected for study**

<b>UNIVERSITY</b>	<b>COUNTRY</b>	<b>LIBRARY HOME PAGE</b>	<b>NOTES</b>
Botswana Collge of Agriculture [BCA]	Botswana		Under construction (Excluded)
University of Botswana [BU]	Botswana	<a href="http://www.ub.bw/library/">http://www.ub.bw/library/</a>	
Africa Nazarene University [ANU]	Kenya	<a href="http://www.anu.ac.ke/library/default.html">http://www.anu.ac.ke/library/default.html</a>	
The Catholic Univ. of Eastern Africa [CUEA]	Kenya	<a href="http://www.cuea.edu/library/lib.htm">http://www.cuea.edu/library/lib.htm</a>	
Daystar University [DU]	Kenya		No library website (Excluded)
Egerton University [EU]	Kenya	<a href="http://www.egerton.ac.ke/academics/library/index.php">http://www.egerton.ac.ke/academics/library/index.php</a>	
Maseno University [MASENO]	Kenya	<a href="http://www.maseno.ac.ke/library/">http://www.maseno.ac.ke/library/</a>	
Moi University [MU]	Kenya	<a href="http://www.mu.ac.ke/library/index.html">http://www.mu.ac.ke/library/index.html</a>	Under construction (Excluded)
University of Eastern Africa, Baraton [UEAB]	Kenya	<a href="http://www.ueab.ac.ke/library/">http://www.ueab.ac.ke/library/</a>	
University of Nairobi [UONBI]	Kenya	<a href="http://library.uonbi.ac.ke/">http://library.uonbi.ac.ke/</a>	
United States International University [USIU]	Kenya	<a href="http://www.usiu.ac.ke/library/index.htm">http://www.usiu.ac.ke/library/index.htm</a>	
Jomo Kenyatta Univ. of Agri. & Tech. [JKUAT]	Kenya		No library website (Excluded)
Kabarak University [KABARK]	Kenya	<a href="http://www.kabarak.ac.ke/library/index.htm">http://www.kabarak.ac.ke/library/index.htm</a>	
Kenya Methodist University [KEMU]	Kenya		No library website (Excluded)
Kiriri Women's Univ of Sci&Tech [KWUST]	Kenya		Under construction (Excluded)
Strathmore University [STRATHMORE]	Kenya	<a href="http://www.strathmore.edu/academics/library.html">http://www.strathmore.edu/academics/library.html</a>	
Cape Peninsula Univ of Tech [CPUT]	South Africa	<a href="http://www.cput.ac.za/library/">http://www.cput.ac.za/library/</a>	
Central Univ of Technology. Free State [CUT]	South Africa	<a href="http://www.cut.ac.za/web/academics/library/homepage">http://www.cut.ac.za/web/academics/library/homepage</a>	
Durban Institute of Technology [DUT]	South Africa	<a href="http://library.dit.ac.za/index.html">http://library.dit.ac.za/index.html</a>	
Nelson Mandela Metropolitan Univ [NMMU]	South Africa	<a href="http://www.nmmu.ac.za/default.asp?id=2330&amp;bhcp=1">http://www.nmmu.ac.za/default.asp?id=2330&amp;bhcp=1</a>	Un-crawable address (Excluded)
Rhodes University [RU]	South Africa	<a href="http://www.ru.ac.za/library/">http://www.ru.ac.za/library/</a>	
Stellenbosch University [SUN]	South Africa	<a href="http://www.sun.ac.za/library/">http://www.sun.ac.za/library/</a>	
Tshwane University of Technology [TUT]	South Africa	<a href="http://lib.tut.ac.za/">http://lib.tut.ac.za/</a>	
Univ of KwaZulu Natal [UKZN – WEST]	South Africa	<a href="http://www.ukzn.ac.za/westvillelibrary/">http://www.ukzn.ac.za/westvillelibrary/</a>	
Univ of KwaZulu Natal [UKZN – HOWARD]	South Africa	<a href="http://www.library.und.ac.za">http://www.library.und.ac.za</a>	Used <a href="http://www.library.und.ac.za">www.library.und.ac.za</a>
Univ of KwaZulu Natal [UKZN – HOWARD]	South Africa	<a href="http://www.library.und.ac.za/med/medical.htm">http://www.library.und.ac.za/med/medical.htm</a>	Used <a href="http://www.library.und.ac.za">www.library.und.ac.za</a>
Univ of KwaZulu Natal [UKZN – HOWARD]	South Africa	<a href="http://www.library.unp.ac.za/">http://www.library.unp.ac.za/</a>	Used <a href="http://www.library.und.ac.za">www.library.und.ac.za</a>
University of Cape Town [UCT]	South Africa	<a href="http://www.lib.uct.ac.za">http://www.lib.uct.ac.za</a>	
University of Fort Hare [UFH]	South Africa	<a href="http://www.ufh.ac.za/library/index.html">http://www.ufh.ac.za/library/index.html</a>	
University of Johannesburg [UJ]	South Africa	<a href="http://www.uj.ac.za/library">http://www.uj.ac.za/library</a>	
University of Limpopo (North) [UNORTH]	South Africa	<a href="http://www.unorth.ac.za/Library/index.html">http://www.unorth.ac.za/Library/index.html</a>	
University of Pretoria [UP]	South Africa	<a href="http://www.ais.up.ac.za/">http://www.ais.up.ac.za/</a>	
University of South Africa [UNISA]	South Africa	<a href="http://www.unisa.ac.za/Default.asp?Cmd=ViewContent&amp;ContentID=17">http://www.unisa.ac.za/Default.asp?Cmd=ViewContent&amp;ContentID=17</a>	Un-crawable address (Excluded)
University of the Free State [UOVS]	South Africa	<a href="http://www.uovs.ac.za/faculties/index.php?FCode=12">http://www.uovs.ac.za/faculties/index.php?FCode=12</a>	Un-crawable address (Excluded)
University of the North [UNORTH]	South Africa	<a href="http://www.unorth.ac.za/Library/index.html">http://www.unorth.ac.za/Library/index.html</a>	
University of the Western Cape [UWC]	South Africa	<a href="http://www.uwc.ac.za/library/">http://www.uwc.ac.za/library/</a>	
University of Venda [UNIVEN]	South Africa	<a href="http://www.univen.ac.za/library/library.php">http://www.univen.ac.za/library/library.php</a>	
University of Witwatersrand [WITS]	South Africa	<a href="http://www.wits.ac.za/library/index.htm">http://www.wits.ac.za/library/index.htm</a>	
Vaal University of Technology [VUT]	South Africa	<a href="http://www.vut.ac.za/metadot/index.pl?id=2860">http://www.vut.ac.za/metadot/index.pl?id=2860</a>	Un-crawable address (Excluded)
Walter Sisulu University [WSU]	South Africa	<a href="http://www.wsu.ac.za/library/mainlibrary.htm">http://www.wsu.ac.za/library/mainlibrary.htm</a>	

Dar es Salaam Institute of Technology [DIT]	Tanzania		Site couldn't be accessed (Excluded)
Dar es Salaam University [UDSM]	Tanzania	<a href="http://www.udsm.ac.tz/library/index.htm">http://www.udsm.ac.tz/library/index.htm</a>	
Hubert Kairuki Memorial University [HKMU]	Tanzania		No library website (Excluded)
International Med. & Tech Univ [IMTU]	Tanzania		No library website (Excluded)
Mount Meru University [MMU]	Tanzania		No Library website (Excluded)
Mzumbe University [MZUMBE]	Tanzania	<a href="http://www.mzumbe.ac.tz/libary.htm">http://www.mzumbe.ac.tz/libary.htm</a>	
Sokoine University of Agriculture [SUANET]	Tanzania	<a href="http://sna1www.suanet.ac.tz/index.html">http://sna1www.suanet.ac.tz/index.html</a>	
Bugema University [BUGEMA]	Uganda		Site couldn't be accessed (Excluded)
Central Bugema University [CBU]	Uganda		No Library website (Excluded)
Islamic University in Uganda [IUU]	Uganda		No Library website (Excluded)
Kampala International University [KIU]	Uganda	<a href="http://www.kiu.ac.ug/index.php?option=com_content&amp;task=blogcategory&amp;id=79&amp;Itemid=56&amp;lang=en">http://www.kiu.ac.ug/index.php?option=com_content&amp;task=blogcategory&amp;id=79&amp;Itemid=56&amp;lang=en</a>	Un-crawlable address (Excluded)
Makerere University [MAKERERE]	Uganda	<a href="http://www.makerere.ac.ug/mulib/">http://www.makerere.ac.ug/mulib/</a>	
Mbarara University of Sci. & Tech [MBARARA]	Uganda	<a href="http://www.must.ac.ug/index.php?option=content&amp;task=view&amp;id=20&amp;Itemid=34">http://www.must.ac.ug/index.php?option=content&amp;task=view&amp;id=20&amp;Itemid=34</a>	Un-crawlable address (Excluded)
Africa University [AFRICAU]	Zimbabwe	<a href="http://www.africau.edu/Library/index.htm">http://www.africau.edu/Library/index.htm</a>	
Chinhoyi University [CHINHOVI]	Zimbabwe	<a href="http://www.cut.ac.zw/library/home.html">http://www.cut.ac.zw/library/home.html</a>	
Midlands State University [MSU]	Zimbabwe	<a href="http://www.msu.ac.zw/libraries/index.php">http://www.msu.ac.zw/libraries/index.php</a>	
National University of Sci. & Techn. [NUST]	Zimbabwe	<a href="http://www.nust.ac.zw/library/index.htm">http://www.nust.ac.zw/library/index.htm</a>	
Solusi University [SOLUSI]	Zimbabwe		No library website (Excluded)
University of Zimbabwe [UZ]	Zimbabwe	<a href="http://www.uz.ac.zw/library/">http://www.uz.ac.zw/library/</a>	



## **6. Results**

This section presents the results and covers the following main areas of study: location of the library(ies) URL on university website(s); essential web-based services offered by each library service; number of pages and out-links; distribution of library web pages and out-links by country; most commonly targeted web pages and Top Level Domains (TLDs); number of in- and out-links in the libraries' websites; and the libraries' networks.

### **6.1 Location of library links on the universities' websites**

The location of a library's link (URL) on the university's home page was evaluated in order to assess the accessibility of the library's website. Out of the total 36 library websites surveyed, 34 (94.4%) libraries' links were provided on their respective universities' home pages. Only two (5.6%) libraries' websites required access through the academic programs' directory.

### **6.2 Essential Web-based Online Services**

Libraries' websites were compared using four essential services, i.e. the provision of search engines, web-based Online Public Access Catalogs (OPACs), Web forms and library guides (including training and orientation resources), as shown in Table 2. 12 (33.3%) libraries provided search engine options on their websites, while 29 (80.6%) libraries offered clients' OPACs. Only three libraries provided web forms. The rest (30 or 83.3%) posted special library guides (orientation and training resources) on their websites.

### **6.3 Number of pages and out-links**

Table 3 illustrates the rank distribution of the libraries according to the total number of web pages, out-links and out-links per page. In total, there were 22508 web pages and 275775 out-links, a situation that generated an average of 12.2523 out-links per page. Dividing the total number of pages and out-links by the total number of libraries yielded 625.2 web pages and 7660.4 out-links per library. Overall, the RU library came first with 628 pages, 19694 out-links and 31.3599 out-links per page, followed by [all in the order of pages, out-links and out-links per page] CPUT library (335, 9774, 29.1761), SUN library (917, 16784, 18.3032), UKZN – Howard College Campus library (218, 9578, 43.9358), and the UCT libraries (16468, 173616, 10.5426). When ranked according to the total number of pages, the list was headed by UCT library, followed by UP, SUN, UFH, and RU libraries, and in terms of the total number of out-links, the result [in this order] produced UCT, RU, SUN, UP, and CPUT. UKZN – HOWARD libraries topped the list of libraries with the most out-links per page (i.e. 43.9358) followed by RU library (31.3599), CPUT library (29.1761), UKZN – Westville library (25.8125) and Strathmore library (23.0000), etc.



**Table 2: Provision of web-based essential services**

No.	Library website	Search Engine	OPAC	Web forms	Library guides
1	<a href="http://www.ru.ac.za/library">www.ru.ac.za/library</a>	√	√	√	√
2	<a href="http://www.ais.up.ac.za">www.ais.up.ac.za</a>	√	√	√	√
3	<a href="http://www.cut.ac.za/web/academics/library">www.cut.ac.za/web/academics/library</a>	√	√	√	√
4	<a href="http://www.ufh.ac.za/library">www.ufh.ac.za/library</a>	√	√	√	√
5	<a href="http://www.wits.ac.za/library">www.wits.ac.za/library</a>	√	√	√	√
6	<a href="http://www.makeerere.ac.ug/mulib">www.makeerere.ac.ug/mulib</a>	√	√	x	√
7	<a href="http://snalwww.suanet.ac.tz">http://snalwww.suanet.ac.tz</a>	√	√	x	√
8	<a href="http://www.msu.ac.zw/libraries">www.msu.ac.zw/libraries</a>	√	√	x	√
9	<a href="http://library.dit.ac.za">http://library.dit.ac.za</a>	√	√	x	√
10	<a href="http://www.uj.ac.za/library">www.uj.ac.za/library</a>	√	√	x	√
11	<a href="http://www.uz.ac.zw/library">www.uz.ac.zw/library</a>	√	√	x	√
12	<a href="http://www.ueab.ac.ke/library">www.ueab.ac.ke/library</a>	x	√	√	√
13	<a href="http://www.cput.ac.za/library">www.cput.ac.za/library</a>	x	√	x	√
14	<a href="http://www.sun.ac.za/library">www.sun.ac.za/library</a>	x	√	x	√
15	<a href="http://www.library.und.ac.za">www.library.und.ac.za</a>	x	√	x	√
16	<a href="http://www.lib.uct.ac.za">www.lib.uct.ac.za</a>	x	√	x	√
17	<a href="http://www.uwc.ac.za/library">www.uwc.ac.za/library</a>	x	√	x	√
18	<a href="http://www.ub.bw/library">www.ub.bw/library</a>	x	√	x	√
19	<a href="http://www.ukzn.ac.za/westvillelibrary">www.ukzn.ac.za/westvillelibrary</a>	x	√	x	√
20	<a href="http://lib.tut.ac.za">http://lib.tut.ac.za</a>	x	√	x	√
21	<a href="http://www.cut.ac.zw/library">www.cut.ac.zw/library</a>	x	√	x	√
22	<a href="http://library.uonbi.ac.ke/website">http://library.uonbi.ac.ke/website</a>	x	√	x	√
23	<a href="http://www.usiu.ac.ke/library">www.usiu.ac.ke/library</a>	x	√	x	√
24	<a href="http://www.anu.ac.ke/library">www.anu.ac.ke/library</a>	√	x	x	√
25	<a href="http://www.nust.ac.zw/library">www.nust.ac.zw/library</a>	x	√	x	√
26	<a href="http://www.univen.ac.za/library">www.univen.ac.za/library</a>	x	√	x	√
27	<a href="http://www.udsm.ac.tz/library">www.udsm.ac.tz/library</a>	x	√	x	√
28	<a href="http://www.unorth.ac.za/library">www.unorth.ac.za/library</a>	x	√	x	√
29	<a href="http://www.africau.edu/Library">www.africau.edu/Library</a>	x	√	x	√
30	<a href="http://www.kabarak.ac.ke/library">www.kabarak.ac.ke/library</a>	x	x	x	√
31	<a href="http://www.maseno.ac.ke/library">www.maseno.ac.ke/library</a>	x	x	x	x
32	<a href="http://www.egerton.ac.ke/academics/library">www.egerton.ac.ke/academics/library</a>	x	x	x	x
33	<a href="http://www.strathmore.edu/academics">www.strathmore.edu/academics</a>	x	x	x	x
34	<a href="http://www.wsu.ac.za/library">www.wsu.ac.za/library</a>	x	x	x	x
35	<a href="http://www.cuea.edu/library">www.cuea.edu/library</a>	x	x	x	x
36	<a href="http://www.mzumbe.ac.tz/library">www.mzumbe.ac.tz/library</a>	x	x	x	x

**Key:** √ = Service available; x = Service not available

**Table 3: Number of pages and out-links**

No	Overall rank	Site	Pages		Out-links		Out-links per page	
			r	f	r	f	r	f
1	1	<a href="http://www.ru.ac.za/library">www.ru.ac.za/library</a>	5	628	2	19694	2	31.3599
2	2	<a href="http://www.cput.ac.za/library">www.cput.ac.za/library</a>	8	335	5	9774	3	29.1761
3	3	<a href="http://www.sun.ac.za/library">www.sun.ac.za/library</a>	3	917	3	16784	11	18.3032
4	4	<a href="http://www.library.und.ac.za">www.library.und.ac.za</a>	10	218	7	9578	1	43.9358
5	5	<a href="http://www.lib.uct.ac.za">www.lib.uct.ac.za</a>	1	16468	1	173616	22	10.5426
6	6	<a href="http://www.uwc.ac.za/library">www.uwc.ac.za/library</a>	7	436	8	8335	10	19.1170
7	7	<a href="http://www.ufh.ac.za/library">www.ufh.ac.za/library</a>	4	664	6	9658	18	14.5452
8	8	<a href="http://www.ais.up.ac.za">www.ais.up.ac.za</a>	2	1488	4	14789	23	9.9388
9	9	<a href="http://www.ub.bw/library">www.ub.bw/library</a>	14	49	11	1033	7	21.0816
10	10	<a href="http://www.ukzn.ac.za/westvillelibrary">www.ukzn.ac.za/westvillelibrary</a>	16	32	13	826	4	25.8125
11	11	<a href="http://www.wits.ac.za/library">www.wits.ac.za/library</a>	6	451	9	5320	19	11.7960
12	12	<a href="http://www.makerere.ac.ug/mulib">www.makerere.ac.ug/mulib</a>	13	55	12	911	12	16.5636
13	13	<a href="http://snalwww.suanet.ac.tz">http://snalwww.suanet.ac.tz</a>	15	45	14	671	17	14.9111
14	14	<a href="http://lib.tut.ac.za">http://lib.tut.ac.za</a>	22	17	18	339	9	19.9412
15	15	<a href="http://www.msu.ac.zw/libraries">www.msu.ac.zw/libraries</a>	17	27	17	403	16	14.9259
16	15	<a href="http://www.maseno.ac.ke/library">www.maseno.ac.ke/library</a>	9	327	10	1340	31	4.0979
17	16	<a href="http://www.cut.ac.zw/library">www.cut.ac.zw/library</a>	19	20	19	316	13	15.800
18	17	<a href="http://library.uonbi.ac.ke/website">http://library.uonbi.ac.ke/website</a>	12	62	15	523	25	8.4355
19	18	<a href="http://www.egerton.ac.ke/academics/library">www.egerton.ac.ke/academics/library</a>	27	7	22	159	6	22.7143
20	19	<a href="http://library.dit.ac.za">http://library.dit.ac.za</a>	11	76	16	486	29	6.3947
21	20	<a href="http://www.usiu.ac.ke/library">www.usiu.ac.ke/library</a>	18	21	20	196	24	9.3333
22	21	<a href="http://www.strathmore.edu/academics">www.strathmore.edu/academics</a>	29	1	30	23	5	23.0000
23	22	<a href="http://www.kabarak.ac.ke/library">www.kabarak.ac.ke/library</a>	26	8	24	125	14	15.625
24	23	<a href="http://www.anu.ac.ke/library">www.anu.ac.ke/library</a>	17	27	21	185	27	6.8519
25	24	<a href="http://www.nust.ac.zw/library">www.nust.ac.zw/library</a>	24	12	23	131	20	10.9167
26	25	<a href="http://www.cut.ac.za/web/academics/library">www.cut.ac.za/web/academics/library</a>	29	1	31	20	8	20.000
27	26	<a href="http://www.wsu.ac.za/library">www.wsu.ac.za/library</a>	28	3	28	45	15	15.000
28	26	<a href="http://www.univen.ac.za/library">www.univen.ac.za/library</a>	25	10	25	108	21	10.8000
29	27	<a href="http://www.uj.ac.za/library">www.uj.ac.za/library</a>	20	19	24	125	28	6.5789
30	28	<a href="http://www.ueab.ac.ke/library">www.ueab.ac.ke/library</a>	23	13	27	90	26	6.9231
31	29	<a href="http://www.uz.ac.zw/library">www.uz.ac.zw/library</a>	21	18	26	101	30	5.6111
32	30	<a href="http://www.udsm.ac.tz/library">www.udsm.ac.tz/library</a>	18	21	30	23	34	1.0952
33	31	<a href="http://www.unorth.ac.za/library">www.unorth.ac.za/library</a>	25	10	29	24	33	2.4000
34	31	<a href="http://www.cuea.edu/library">www.cuea.edu/library</a>	19	20	32	19	36	0.9500
35	32	<a href="http://www.africau.edu/Library">www.africau.edu/Library</a>	29	1	33	4	32	4.0000
36	33	<a href="http://www.mzumbe.ac.tz/library">www.mzumbe.ac.tz/library</a>	29	1	34	1	35	1.0000
<b>TOTAL</b>			<b>22508</b>		<b>275775</b>		<b>12.2523</b>	

Key: r = rank, f = frequency (i.e. number of pages, out-links and out-links per page, respectively)

#### 6.4 Distribution of library web pages and out-links by country

The total number of library web pages and out-links were computed for each country in order to find out the most productive country. South Africa led with 21793 library web pages, followed by Kenya (486), Tanzania (67), Zimbabwe (58), Uganda (55) and Botswana (49). The number of out-links was highest in South Africa (269837) followed by Kenya (2660), Botswana (1033), Uganda (911), Tanzania (695) and Zimbabwe (639). When ranked according to the average number of pages per library, South Africa again topped the list with 1210.72 pages per academic library followed by Uganda (55.00), Kenya (54), Botswana (49), Tanzania (22.33), and Zimbabwe (14.50). The distribution

pattern of the number of out-links per library was as follows: South Africa (14990.94), Botswana (1033.00), Uganda (911.00), Kenya (295.56), Tanzania (231.67), and Zimbabwe (159.75).

**Table 4: Distribution of library web pages and out-links by country**

no.	country	pages	Outlinks	pages/library	outlinks/library
1	South Africa	21793	269837	1210.72	14990.94
2	Kenya	486	2660	54.00	295.56
3	Tanzania	67	695	22.33	231.67
4	Zimbabwe	58	639	14.50	159.75
5	Uganda	55	911	55.00	911.00
6	Botswana	49	1033	49.00	1033.00

### 6.5 Most commonly targeted web pages and Top Level Domains (TLDs)

Table 5 provides 74 top sites and TLDs commonly targeted by academic libraries in the region. In descending order, these sites include adobe.com/ (104), nlm.nih.gov/ (103), biblioline.nisc.com/ (91), thor.sabinet.co.za/ (83), sciencedirect.com/ (69), gateway.ovid.com/ (58), serialsolutions.com/ (53) and search.rdsinc.com/ (52). Others are home.ncifcrf.gov/ (46), scirus.com/ (44), mg.co.za/ (43), isiknowledge.com/ (38), opencube.com (31), search.epnet.com/ (31). Adobe is a company that develops computer programs such as the Adobe Engagement Platform – built around Adobe PDF and Flash technology – which greatly enhances how people create, manage, deliver and engage with information. Following this is the website of the National Library of Medicine (NLM), a medical library situated on the campus of the National Institute of Health in Bethesda, Maryland. The company collects health related material and provides information and research services covering all areas of biomedicine and health care. One of its best known products is the MEDLINE database. The National Services Corporation (NISC, USA) provides information products accessed through BiblioLine, a Web search service, or on CD-ROM. BiblioLine provides a straightforward and sophisticated approach to online searching via the internet. SABINET is short for the South African Bibliographic and Information Network. SABINET facilitates electronic access to information, largely through the provision of bibliographies, while ScienceDirect is an online database that offers more than a quarter of the world's scientific, medical and technical information. Its scope covers over 2,000 peer-reviewed journals; hundreds of book series, handbooks and reference works; and back files.

An examination of the top level domains indicates that the .com or .co TLDs are the most common, recording 59 hits (i.e. 79.7% of the 74 top ranking sites or web pages), followed by .edu (4 or 5.4%). The .gov, .net and .org TLDs recorded 3 hits each, while .nl had only one hit.

Evidently, there were a variety of sites targeted by E&S African academic libraries. When classified according to the types of services or products these sites provide, the following categories emerged: news sites (e.g. nytimes.com, daily-mail.co.zm, etc.), search engines (e.g. google.com), electronic databases (e.g. sabinet.co.za), database

publishers (e.g. nlm.nih.gov, sciencedirect.com, etc), computer software companies (e.g. adobe.com), government sites (e.g. gov.za), and electronic books and general reference resources (e.g. yourdictionary.com).

**Table 5: Most commonly targeted web pages and TLDs**

No.	Rank	TLD targeted	Hits	No.	Rank	TLD targeted	Hits
1	1	.adobe.com/	104	38	19	.observer.co.uk/	24
2	2	.nlm.nih.gov/	103	39	19	wwwlib.umi.com/dissertations/	24
3	3	biblioline.nisc.com/	91	40	20	.library.uq.edu.au/training/	23
4	4	thor.sabinet.co.za/	83	41	20	.webstat.com	23
5	5	.sciencedirect.com/	69	42	20	.jutralaw.co.za/	23
6	6	gateway.ovid.com/	58	43	20	.update-software.com/	23
7	7	serialssolutions.com/	53	44	20	.rekord.co.za/	23
8	8	search.rdsinc.com/	52	45	20	.safm.co.za/	23
9	9	home.ncifcrf.gov/	46	46	20	.naspers.co.za/	23
10	10	.scirus.com/	44	47	21	.nepru.org.na	22
11	11	.mg.co.za/	43	48	21	.the-times.co.uk/	22
12	12	isiknowledge.com/	38	49	21	.arttoday.com/	22
13	13	.opencube.com	31	50	21	.sky.com/	22
14	13	search.epnet.com/	31	51	21	.public.iastate.edu/	22
15	14	.nytimes.com/	30	52	21	dictionary.oed.com/	22
16	15	.zoutnet.co.za/	28	53	22	.paarlpost.co.za/	21
17	15	.daily-mail.co.zm/	28	54	23	.sabcnews.com/	20
18	15	.zamnet.zm	28	55	23	.gov.za/	20
19	15	.fingaz.co.zw	28	56	23	.xe.net/ucc/	20
20	16	.memeza.com/zambia/	27	57	23	.pta-online.co.za/	20
21	16	.witness.co.za/	27	58	23	.portland.com/	20
22	16	.headlines.co.za/	27	59	24	.google.com/	19
23	16	wagne.net	27	60	25	.swetsnetnavigator.nl/direct/	18
24	17	.123world.com/	26	61	25	afronet.org.za/monitor.htm	18
25	17	.news24.co.za/	26	62	25	.lexis-nexis.com/professional/	18
26	17	.sowetan.co.za/	26	63	25	.economist.com.na	18
27	17	.jstor.org/	26	64	25	.newafrica.com/	18
28	18	.suntimes.co.za/	25	65	25	.herald.co.zw/	18
29	18	.sundaymail.co.zw/	25	66	25	.nigeriacentral.com/	18
30	18	.republikein.com.na	25	67	25	.libraryspot.com/	18
31	18	.nyenzi.co.tz/	25	68	25	.namibianews.com	18
32	18	galenet.galegroup.com/	25	69	25	.nyenzi.co.tz	18
33	19	library.uncg.edu/	24	70	25	.yourdictionary.com/	18
34	19	.nn.independent.co.za/	24	71	25	.namibian.com.na	18
35	19	.time.com/time/	24	72	26	wagne.net/messenger	17
36	19	.theexpress.com	24	73	26	.bday.co.za/	17
37	19	.bbjonline.com/	24	74	26	.wisc.edu/ltc/	17

**Table 6: In- and out-links among the academic libraries in the six countries**

<i>Name</i>	<i>Page inlinks</i>	<i>Directory inlinks</i>	<i>Domain inlinks</i>	<i>Site inlinks</i>	<i>Page outlinks</i>	<i>Directory outlinks</i>	<i>Domain outlinks</i>	<i>Site outlinks</i>
library.und.ac.za	40	8	5	5	0	0	0	0
lib.uct.ac.za	15	15	6	6	25	25	15	15
.uz.ac.zw/library	10	7	1	1	0	0	0	0
.sun.ac.za/library	9	8	6	6	13	13	3	3
.wits.ac.za/library	7	6	4	4	2	2	2	2
.uwc.ac.za/library	6	6	3	3	10	10	9	9
.univen.ac.za/library	6	5	5	5	0	0	0	0
ais.up.ac.za	5	4	4	4	6	6	6	6
.ru.ac.za/library	5	5	3	3	19	10	10	10
.cput.ac.za/library	4	4	3	3	0	0	0	0
.wsu.ac.za/library	4	3	3	3	0	0	0	0
.ukzn.ac.za/westvillelibrary	4	3	3	3	34	3	1	1
.uj.ac.za/library	4	3	3	3	0	0	0	0
library.dit.ac.za	3	2	2	2	10	10	10	10
.ufh.ac.za/library	3	3	2	1	1	1	1	1
.cut.ac.za/web/academics/library	2	2	2	2	0	0	0	0
.unorth.ac.za/library	2	2	2	2	0	0	0	0
lib.tut.ac.za	1	1	1	1	0	0	0	0
mzumbe.ac.tz/library	1	1	1	1	0	0	0	0
.makerere.ac.ug/mulib	0	0	0	0	0	0	0	0
.ub.bw/library	0	0	0	0	0	0	0	0
.anu.ac.ke/library	0	0	0	0	0	0	0	0
.cuea.edu/library	0	0	0	0	0	0	0	0
.egerton.ac.ke/academics/library	0	0	0	0	0	0	0	0
.maseno.ac.ke/library	0	0	0	0	0	0	0	0
.ueab.ac.ke/library	0	0	0	0	0	0	0	0
.usiu.ac.ke/library	0	0	0	0	0	0	0	0
library.uonbi.ac.ke	0	0	0	0	0	0	0	0
.udsm.ac.tz/library	0	0	0	0	0	0	0	0
.africau.edu/library	0	0	0	0	0	0	0	0
.cut.ac.zw/library	0	0	0	0	10	7	1	1
.msu.ac.zw/libraries	0	0	0	0	0	0	0	0
.nust.ac.zw/library	0	0	0	0	0	0	0	0
.strathmore.edu/academics	0	0	0	0	0	0	0	0
Snalwww.suanet.ac.tz	0	0	0	0	1	1	1	1
.kabarak.ac.ke/library	0	0	0	0	0	0	0	0
.strathmore.edu/academics/library.html	0	0	0	0	10	8	1	1
library.uonbi.ac.ke/website	0	0	0	0	9	3	1	1
Total no. of links	150	99	61	60	150	99	61	61
Links per library	4.17	2.75	1.69	1.67	4.17	2.75	1.69	1.67

## 6.6 Number of In- and out-links among the libraries

Table 6 ranks the libraries according to the total number of page in-links. The Table provides the total number of in- and out-links (page, directory, domain, and site) that each library received from, or gave to, other universities respectively. As such, the

UKZN [HOWARD] libraries received a total of 40 page links, 8 directory links, 5 domain links and 5 site links from the libraries surveyed, while offering no out-links to any other libraries. In contrast, UCT libraries provided a number of links to other libraries, amounting to 25 page and directory out-links, 15 domain out-links and 14 site out-links. Several university libraries (e.g. MAKERERE, BU, ANU, CUEA, EGERTON, MASENO, UEAB, USIU, UDSM, AFRICAU, NUST, and KABARAK) did not receive links from, nor provide links to, any of the other libraries. Overall, there were a total of 150, 99, 61, and 60 page, directory, domain and site in-links and out-links, respectively. On average, each university received and produced 4.17, 2.75, 1.69, and 1.67 page, directory, domain and site in-links and out-links respectively, as illustrated in Table 6.

### 6.7 Libraries' networks

When plotted visually, Table 4 yields figures 1, 2 and 3. Fig 1 maps the site in-links and out-links of the 36 academic libraries. The map produced three networks, marked A, B and C. A is a network of two academic libraries, namely, the University of Zimbabwe library and the CHINHOVI library, both situated in Zimbabwe. Network B consists of 17 university libraries in South Africa, while network C is composed of two academic libraries in Tanzania. Kenya's, Uganda's, and Botswana's university libraries are not represented, primarily because these libraries do not have any links to or from any other university in the domain.

Fig 1: Academic library networks: site in- and out-links

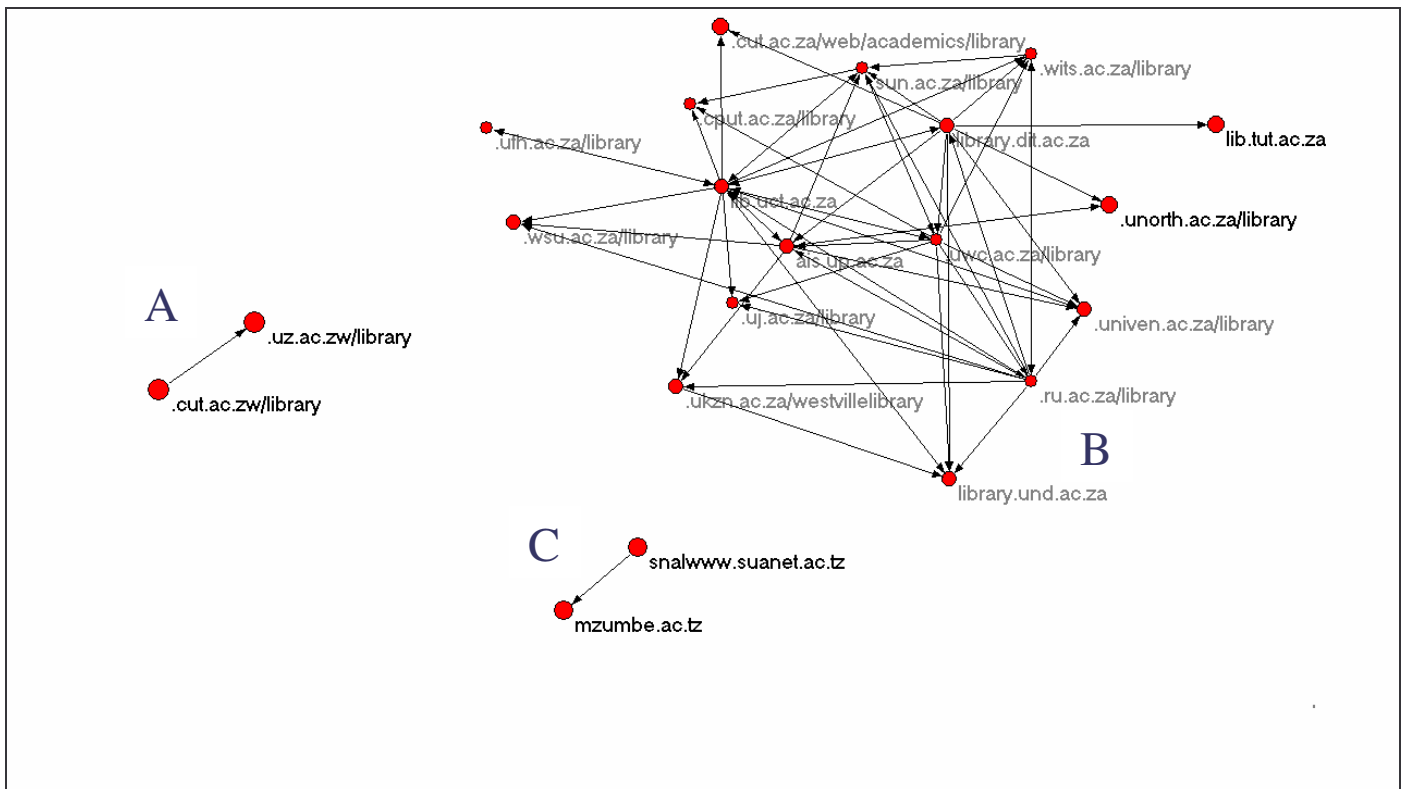


Fig 2: Academic library networks: directory in- and out-links

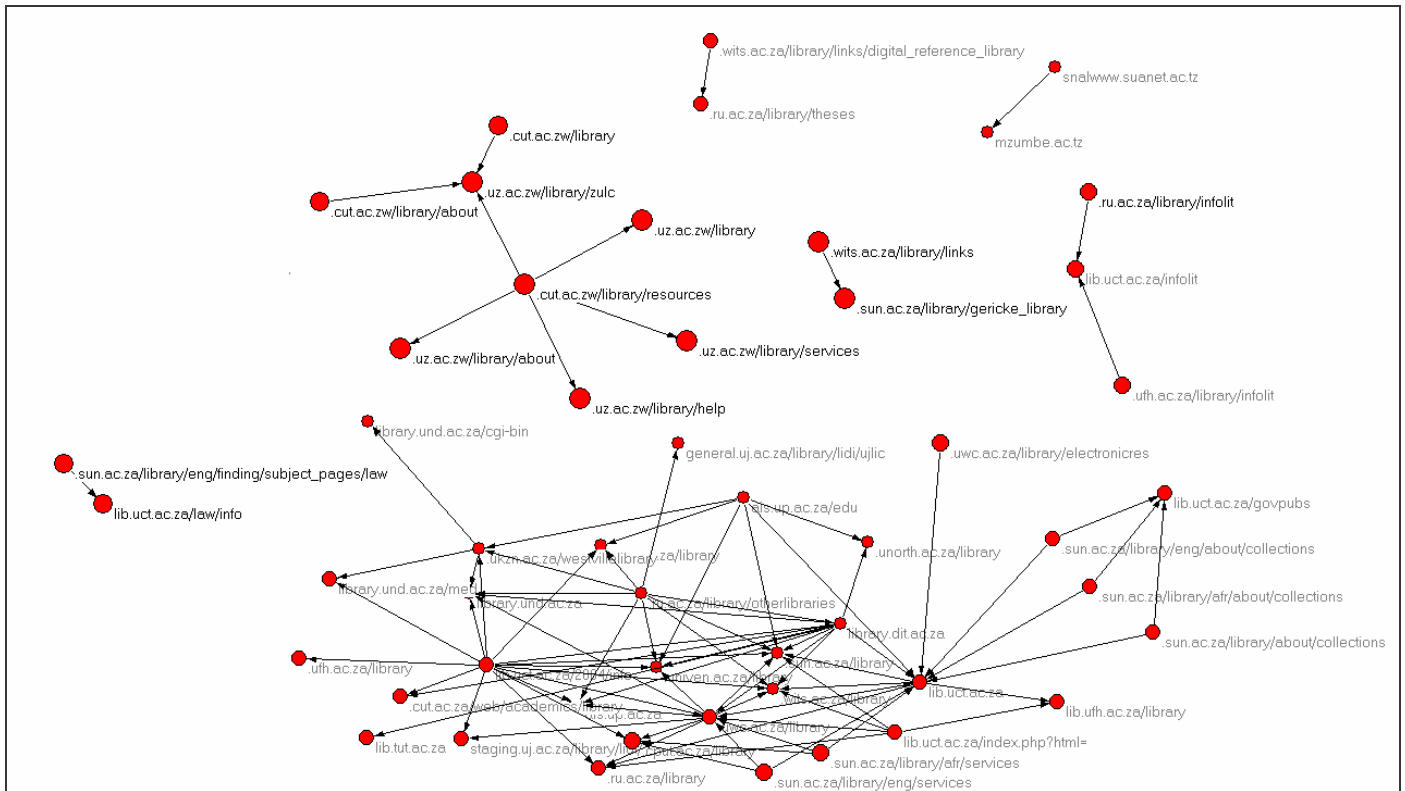


Fig 2 is a visual representation of the inter-linkages occurring amongst the libraries using directory in- and out-links. The nature of the directory links was identifiable. Some of the linked directories are concerned with library services, information about the library, information literacy, resources, digital reference library sites, electronic resources, library collections, etc.

Finally, the libraries' web pages network reveals several inter-linkages. Fig's 3 and 4 provide a map of the web page links with and without labels, respectively. Both illustrations demonstrate dense networks that originated largely from South African academic libraries. There were a total of 8 networks belonging to libraries in South Africa, while Tanzania and Zimbabwe produced one network each.



Fig 3: Academic libraries' network map: page in- and out-links

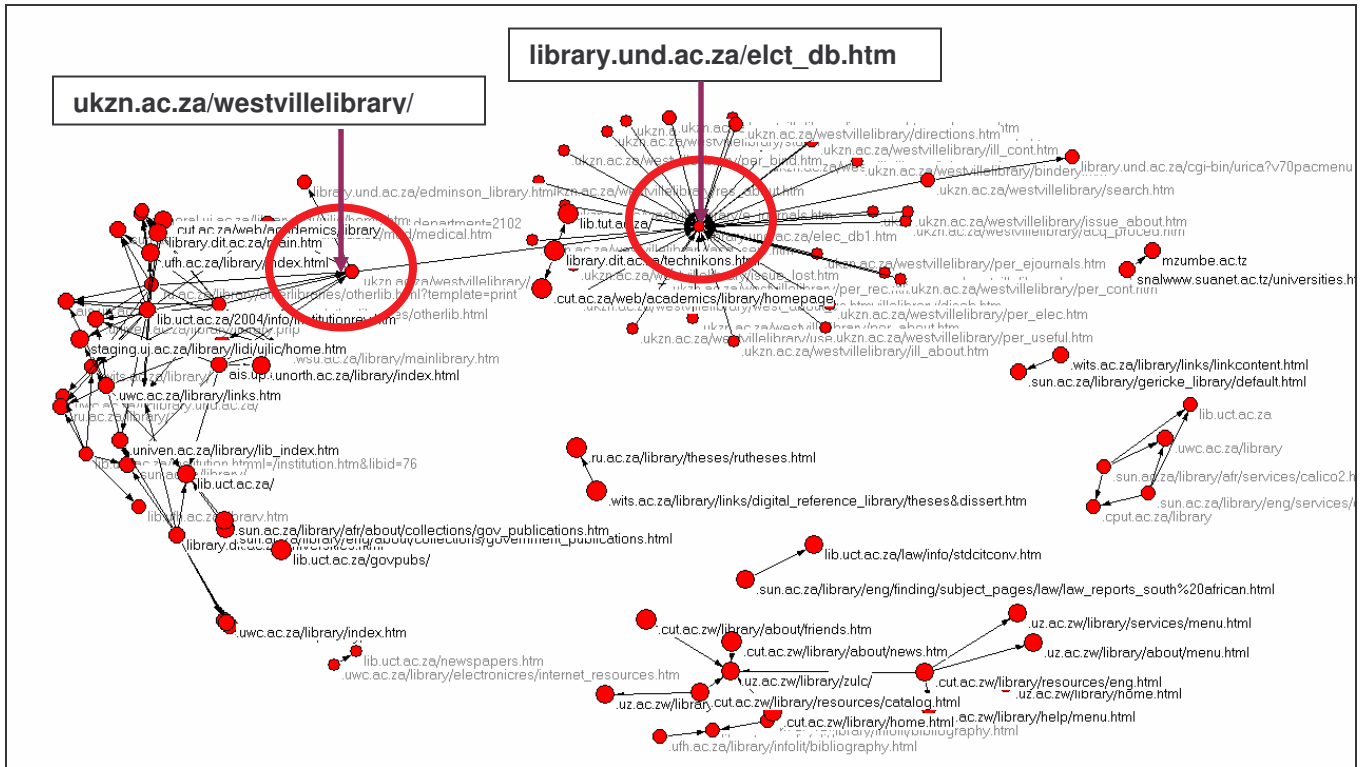
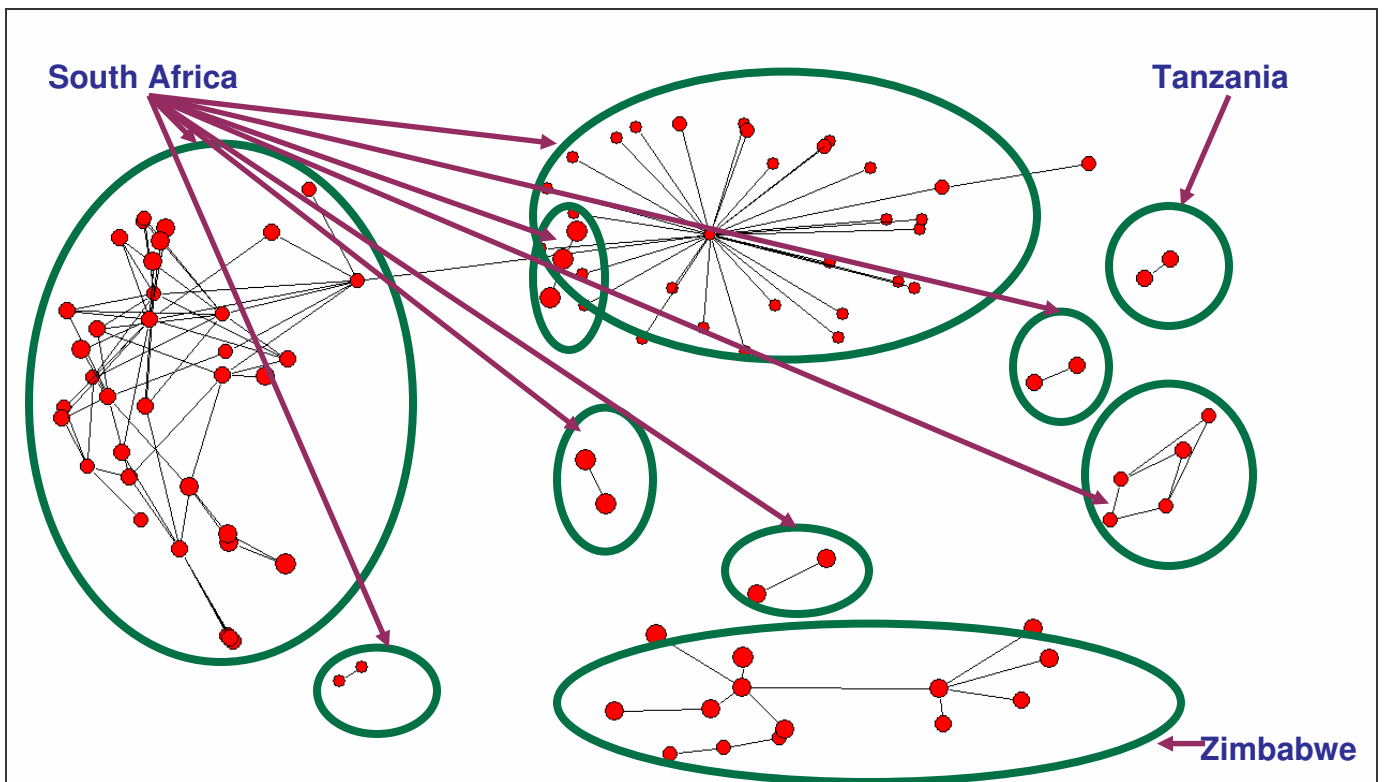


Fig 4: Academic libraries' network map: page in- and out-links



## 7. Discussions, Conclusions and recommendations

Notably, libraries in Eastern and Southern Africa are well aware of the benefits and opportunities of the Internet and the WWW. Despite the digital divide and technological barriers in the third world, librarians in the two regions have expedited the construction of library websites. Out of a total 59 universities in the six countries that owned websites, only 9 (15.3%) did not have library websites. Information available from three university websites indicated that the library websites were under construction.

It is our conviction that the location of a link to the library's website on the university's website/home page should be seriously considered when designing the website, for direct access entails that a library whose website is hidden is as good as a library without one.. To illustrate this more clearly, take for example a library's link that is provided on or under a university's "Facilities" website. Library users are left guessing and without direction when accessing such a library's website, and the eventual outcome may be the disuse of a library's services, resources and products. In this study, it was observed that the accessibility of three libraries' websites was of concern. Links to these libraries' websites were provided under the 'academics' website. One university provided one page of a description of its library services under the directory heading 'facilities', implying that the library is similar to any other facility in the university. Some of the 'other' facilities that were described alongside the library were components relating to sports and recreation. However, it is comforting to note that the university in question does not have a library website, which may help explain why the university chose to provide information regarding the library in this manner. These three are the exception, as the rest of the libraries' websites had their links located, clearly labeled and identifiable on the respective universities' main home pages.

Concerning the provision of essential web-based services, it was noted that online public access catalogs are highly regarded by libraries, possibly because they are valuable tools in accessing a library's collection. Equally essential library services are the guides (or orientation and training resources). Little emphasis is placed on search engines. Web forms were the least popular. Whereas OPACs and guides are library-specific (i.e. specific to the library offering them), search engines and web forms are always not, and this perhaps explains why their provision on the libraries' websites is not deemed necessary, as they can be accessed through other means (e.g. search engines such as Google can be accessed through its google.com website). However, libraries are advised to provide these services on their websites in order to make it easier for clients to navigate the Internet from their site. As Ahmed (2002:266) rightly observes, "*library users value the services that they access from their desktops because the services save time*". Concerning web forms, the author argues that they make it easier and more convenient for users to communicate with libraries. Communication can be in the form of comments, suggestions, and requests for instruction, etc.

Ranking libraries according to the total number of web pages, out-links and average out-links per page led to the following observations:

- South African university libraries performed better than their counterparts in Botswana, Kenya, Tanzania, Uganda and Zimbabwe.

- No university library ranked uniformly throughout the three variables.
- Libraries that had branch libraries registered a higher number of pages and out-links. For instance, the Howard College Campus library of the University of KwaZulu Natal comprises four libraries, namely, EG Malherbe (Main), Barrie Biermann (Architecture), GMJ Sweeny (Law), and Eleanor Bonnar (Music) while the UCT library consists of the main library and nine branch libraries.

Overall, Rhodes University library came first, followed by Cape Peninsula University library, Stellenbosch University library, KwaZulu Natal (Howard College) libraries, and University of Cape Town libraries. Perhaps librarians from other academic libraries in the region could learn from the Rhodes University library, whose web performance supersedes that of the others.

The distribution of the total number of pages, out-links and average out-links per page showed that South Africa was the most prolific country, followed by Kenya, Uganda, Botswana, Tanzania and Zimbabwe. Whether this pattern is attributable to technological advancement and/or the availability and implementation of information technology and communication (ICT) policies in the respective countries could not be determined from the data. Of course, recent developments in the formulation of ICT policies in Kenya and South Africa could explain the two countries' performances. There was no available information regarding the other countries' strategies in the formulation of ICT policies. A study that was recently conducted by Onyancha & Ocholla (2006), also noted remarkable performance on the part of South African universities, implying therefore that university libraries performance on the WWW is to some extent dependent on the university's web presence.

The most commonly targeted websites and TLDs include adobe.com, nlm.nih.gov, biblionline.nisc.com, thor.sabinet.co.za, sciencedirect.com, gateway.ovid.com, serialssolutions.com, search.rdsinc.com, home.ncifcrf.gov, scirus.com, etc. Among the 74 top ranked websites and TLDs were online newspapers' sites (e.g. nytimes.com – USA, daily-mail.co.zm – Zambia, sowetan.co.za – South Africa, suntimes.co.za –South Africa, sundaymail.co.zw – Zimbabwe, etc.), electronic databases and database publishers (e.g. nlm.nih.gov, biblionline.nisc.com, sabinet.co.za, sciencedirect.com, isiknowledge.com, etc.), and book- and periodical sellers (e.g. serialssolutions.com, swetsnetnavigator.nl, etc.). This perhaps indicates the importance that libraries place on electronically available resources that have cut down their subscription fees. Library resources (e.g. journals, magazines, books, reference materials, etc) that only used to be available in print are increasingly becoming available electronically, thus changing the libraries' traditional means of providing such products to clients. This has called for online subscriptions to journals and other periodicals previously accessed through print subscriptions. Thus the high ranking of electronic databases and TLDs may be attributed to changes that libraries are undergoing and have embraced. Accessing these resources, however, requires computer software compatible with the formats in which they are published, which may explain adobe.com's popularity among libraries. Most full-text papers are currently published in PDF format.

Figures 1, 2, 3, and 4 provide libraries' networks based on site, directory, and page in-links and out-links respectively. It was observed that South African academic libraries have a well developed network that includes all the libraries surveyed in this study. Only two libraries, each from Tanzania and Zimbabwe, formed networks. Contrary to expectations, none of the libraries had links with other libraries outside the countries in they are located. The few networks that were generated comprised libraries from the same country. This may imply less collaborative activities between libraries in different countries, although this may not necessarily be true since there is "*little knowledge about models and motivations of linking*" (Zeinolabedini, Maktabifard & Osareh, 2006). However, it is generally acknowledged that South African libraries have an established system of inter-library cooperation, which helps explain the high level of activity witnessed between its libraries.

Some libraries were excluded from the analysis on the grounds that their website addresses either contained punctuation marks, or were too long to be crawled by the personal SOCSIBOT computer-aided software. Librarians are advised to provide simple and short website addresses, in keeping with improving accessibility. Library users may wish to access the library's website through the library's website address, and if the address is too long and/or contains characters/symbols, it may be difficult to memorize, thus impeding accessibility. In addition, it is recommended that:

- Libraries should provide space for Open Access repositories which could potentially increase in-links.
- Libraries should develop useful websites that attract users and ensure that these websites are always functional.
- Libraries should develop partnerships with others.
- Libraries should develop in-house ICT policies which can be entrenched in the main library policy(ies).

Finally, it is recommended that librarians become more involved in the construction of their libraries' websites. They should actively participate in policy formulation as regards the legislation of internet-related laws and in the organization of services and resources on the internet. Libraries need to regularly update their websites in order to keep up with the current proliferation of Internet-based resources increasingly becoming freely available. For instance, the current agitation for the availability of journal articles through open access provides opportunities for libraries to improve on link development. Library cooperation (e.g. resource sharing, inter-library loans, etc) needs to be encouraged between academic libraries in Kenya, Tanzania, Uganda and Tanzania so as to improve their web networks. Further studies are recommended to:

1. Cover all academic libraries in Sub-Saharan Africa.
2. Study the coverage of African academic libraries in major search engines and other online indexing services.
3. Use other performance measurements such as quality, relevance, etc. in evaluating library websites.
4. Study ICT policies that guide in the construction and maintenance of library websites in Africa.

## References

Ahmed, S.S. (2002). Managing change to enhance web-based services in the Arabian Gulf libraries. *Online Information Review*, 26(4): 265-270

Arte, A. (2001). The management of the scientific information environment: the role of the research library web site. *Online Information Review*, 25(2):88-93

Bar-Ilan, J. (2005). What do we know about links and linking? A framework for studying links in academic environments. *Information processing and Management*, 41:973-986

Booth, K. & Napier, J. (2003). Linking people and information: web site access to National Library of New Zealand information and services. *The Electronic Library*, 21(3):227-233

Clausen, H. (1999). Evaluation of library web sites: the Danish case. *The Electronic Library*, 17(2): 83-87

Clyde, L.A. (2004). School library web sites: 1996-2002. *The Electronic Library*, 22(2):158-167

Cordeiro, M.I. & De Carvalho, J. (2002). Web services: what they are and their importance for libraries. *VINE*, 32(4):46-62

Covert, K. (2001). How the OCLC CORC service is helping weave libraries into the Web. *Online Information Review*, 25(1):41-46

Falk, H. (1999). Projecting the library onto the web. *The Electronic Library*, 17(6):395-399

Falk, H. (2005). State library databases on the Internet. *The Electronic Library*, 23(4):492-498

Henry, M. (1996). WebCATS. *Campus-Wide Information Systems*, 13(4): 11-13

Hildebrand, I. (2002). The South Australian public libraries network web site (iNet): efficiencies through collaboration. *Online Information Review*, 26(6):375-384

Hundie, K. (2003). Library operations and library resources. *The Electronic Library*, 21(6):555-564

InterLab. 2005. Webometrics ranking of world universities. [Online]. Available <http://www.webometrics.info/> (Accessed 10<sup>th</sup> April 2006)

Kennedy, P. (2004). Dynamic web pages and the library catalogue. *The Electronic Library*, 22(6):480-486

Kochtanek, T.R., Hein, K.K., Kassim, A.R.C. (2001). A digital library resource web site: Project DL. *Online Information Review*, 25(1):29-40

McCready, K. (1997). Designing and redesigning: Marquette libraries' web site. *Library Hi Tech*, no. 59-60:83-89

McKenna, M. (1994). Libraries and the Internet. [Online]. [www.ericdigests.org](http://www.ericdigests.org) Accessed 27 April 2006

Nielsen, H.J. (2005). New media and new roles of librarianship: illustrated by a literary website of Danish libraries. *New Library World*, 106(1218/1219):510-518

Onyancha, O.B. & Ocholla, D.N. (2006). African institutions of higher learning: Ripe for Cybermetric studies? Performance of South African and Kenyan universities on the World Wide Web. *Proceedings of the 8th Annual Conference on World Wide Web Applications 6-8 September 2006, Bloemfontein, South Africa*. [Online]. <http://www.zaw3.co.za> Accessed 10 November 2006

Pacios, A.R. (2003). Management-related information in Spanish university library web pages. *The Electronic Library*, 21(6): 528-537

Saeed, H., Asghar, M., Anwar, M. & Ramzan, M. (2000). Internet use in university libraries of Pakistan. *Online Information Review*, 24(2):154-160

Still, J.M. (2001). A content analysis of university library web sites in English speaking countries. *Online Information Review*, 25(3):160-164

Thelwall, M. 2002a. A comparison of sources of links for academic web impact factor calculations. *Journal of Documentation*, 58(1):66-78

Thelwall, M. 2002b. An initial exploration of the link relationship between UK University Web sites. *ASLIB proceedings*, 54(2):118-126

Thelwall, M. 2002c. Evidence for the existence of geographic trends in university Web site interlinking. *Journal of Documentation*, 58(5):563-574

Thelwall, M. 2003. Can Google's PageRank be used to find the most important academic web pages? *Journal of Documentation*, 59(2):205-217

Westman, S. (2001). Database-backed library web pages. *The Electronic Library*, 19(6):424-431

Xue, S. (2004). Web usage statistics and web site evaluation: a case study of a government publications library web site. *Online Information Review*, 28(3):180-190

Zeinolabedinio, M. H., Maktabifard, L. & Osareh, F. (2006). Collaboration analysis of world national library websites via webometric methods. *Proceedings on International Workshop on Webometrics, Informetrics and Scientometrics & Seventh COLLNET Meeting, COLLNET 2006, SRDI-INIST-CNRS-LORIA Nancy, France, 10-12 May 2006.*