ARCADIA

The Association of Commonwealth Universities

Growing knowledge:

Access to research in east and southern African universities

by Jonathan Harle

November 2010

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Executive summary

This study, undertaken in 2009 and 2010, explores the many interrelated issues surrounding researchers' access to the latest academic information, in the form of peer-reviewed journals and other scholarly materials, in east and southern Africa. The landscape of information access and of research is constantly changing, and this paper can at best provide only a snapshot of current activity and experiences. It is based on a series of detailed case studies undertaken at four universities: Chancellor College at the University of Malawi, the University of Nairobi in Kenya, the National University of Rwanda, and the University of Dar es Salaam in Tanzania. Responses from some 240 researchers (academics and postgraduates) and 23 librarians and members of ICT staff are drawn together. Strengths and weaknesses, problems and successes, challenges and opportunities are all highlighted. These are not straightforward issues to resolve. Librarians are already making substantial contributions to support their academics and students, and much has been achieved. There are naturally gaps, and things that could be done better. The findings of the study, and the ideas drawn from these, are therefore offered in the spirit of constructive discussion, not criticism.

The starting points for this study are the interlinked observations that researchers commonly complain of poor access to journals and that this is a serious hindrance to their academic work, but that librarians, with the assistance of a number of access schemes, have secured access to a wide range of journals and other resources, many of which are currently underused by their staff and students. The findings reported here relate specifically to the four case study universities, but will probably have wider currency.

The problem of *availability* – that is the provision of affordable or free journals and other resources in online form – **has been widely and successfully addressed over several years**. Taking top-20 ISI ranked journals as a proxy measure, the four universities considered have a journal availability approaching that of major European universities. The *access* problem is better understood through a deeper analysis of the complex and interwoven factors which determine the ease with which academics and students can 'get into' and make good use of electronic resources, and their reasons for doing so.

The sustainability and affordability of subscription models, piloted through existing access schemes, remains a challenge. The capacity of universities and their libraries needs to be strengthened to ensure that availability can therefore be maintained, and increased into the future.

At the level of technology, **internet connectivity is steadily improving**, notably with the installation in 2009 and 2010 of three new high-speed undersea fibre-optic cables. Substantial ICT challenges remain, not least in ensuring broadband connectivity reaches beyond major cities, and from coastal countries to landlocked neighbours. Nevertheless, the picture is undoubtedly one of an improving situation for research and communication and justifiable optimism for the future.

While most academics have reasonably good computer access, students, particularly postgraduates, do not. Many **post-graduates struggle to spend sufficient time on a computer** and lack opportunities to familiarise themselves with and explore online resources. Universities' investment in e-resources has secured significant content, but this will clearly need to be matched by associated investment in ICT facilities and training. Without this, the money spent on journals risks being wasted.

Relatively low levels of research activity, at least of a scholarly nature rather than consultancy work, go some way towards explaining the relatively low levels of journal use. This is confirmed not only by low research output figures for the continent – as measured by the number of journal articles published – but also by interviews conducted with individual academics who often struggle to find time and secure funding for their work.

Cultures of research have been eroded or have been slow to develop in some faculties, with low departmental activity not simply the result of resource constraints, but also due to the low priority given to research and postgraduate supervision. This translates directly into low demand for journals and a reduced need to access and explore them.

Awareness of the materials available amongst staff and students is low. This is related partly to low demand (for students, this can be the result of little emphasis on journals by their lecturers), partly to insufficient promotion and communication of what is available, and partly to the complexities of online access and multiple entry routes. A large number of participants in the study seemed unaware of the range of resources provided to them, with many naming titles which they thought were unavailable but were in fact available via their libraries.

Researchers' abilities to make effective use of e-resources are often underdeveloped – including their skills both to search and explore databases, and to successfully access and download full-text articles from these. While a tendency to rely on Google is to be expected, very basic search strategies mean that not only is high-quality content often not found, but also subscription resources which the university has secured access to, and often paid for, can remain unnoticed.

This reveals a clear **need for better promotion of resources, awareness raising, and skills development**. With so many users, both academics and students, this is a not inconsiderable task. Some degree of training is already widely offered; some is quite successful, and some less so. There is a clear need to approach this in new ways, not least because reaching all users will be otherwise extremely difficult. Academics are reported to insist frequently on one-to-one training by librarians, making the face-to-face approach particularly time-intensive. Outside formal sessions, online help services, more user-targeted websites, and drop-in sessions or peer assistants could all be valuable.

Libraries can make important contributions to research methods training. Information access is fundamentally about research, and the library's role needs to be set in the broader context of research training within the university.

The **management and presentation of resources through library websites is particularly critical**. Better websites undoubtedly make for better users, giving them the tools they need and reliable starting points. Changes in information behaviour and attitudes towards information are also essential. Training and skills development will not be enough, as researchers also need to adapt to an academic information and research environment which is both dependent on new technologies and much more interconnected.

Better services and facilities can only be developed with staff who are skilled, confident and motivated. This means better training and development opportunities for librarians. ICT skills are increasingly critical, as are needs analysis and pedagogical and presentational skills to enable them to understand their users' needs and to communicate better how the library can assist.

The status and recognition of librarians within the university system needs to be raised, if they are to do their jobs effectively. This will require librarians to clearly demonstrate the contributions they can or do make, and the value that they add to the work of academic colleagues and senior managers alike. But universities also need to recognise this value and support and reward it appropriately.

Developing libraries and librarians goes well beyond the library. It requires a close engagement between the library and the strategic and planning processes within the university, as well as academic departments. Librarians need to forge stronger relationships with senior managers, with faculties, and with ICT, research and postgraduate departments. This is key to making potential users more aware of how the library can support them, improving the library's understanding of the university's needs, and putting librarians in a better position to respond.

It was evident during the course of this study that **much success depends on institutional processes, structures and systems, and on the personal drive and dedication of individuals within these**. The politics of academic institutions need to be taken into account when libraries are seeking to induce any form of change, tackle problems, or develop new services. The interrelationships of people, departments and institutional processes are far from straightforward, and approaches may struggle not because the ideas are wrong, but because they encounter obstacles along the way.

1. Introduction

In early 2009, the Association of Commonwealth Universities (ACU) was commissioned by Arcadia to undertake a review of the obstacles faced by African scholars in accessing journals and other resources required for research. At the time the study was first mooted, Arcadia was considering how it might offer support to arts, humanities and social science research in African universities. Having identified access to literature as a major constraint, it was exploring the potential of a digital library initiative. After initial conversations with a number of organisations active in the field, including the International Network for the Availability of Scientific Publications (INASP) and the Open University (UK), Arcadia commissioned the ACU to undertake a background study on the current availability of electronic or digital resources in African universities, the coverage of existing access schemes, and the obstacles which universities, their staff and students encountered when seeking to access and use these in the course of their work.[1]

This paper presents the findings of a 12-month, four-country study, focused on four institutions: the University of Malawi's Chancellor College, the University of Nairobi in Kenya, the National University of Rwanda, and the University of Dar es Salaam in Tanzania.[2] It draws together comments and responses received from 240 postgraduates and academics, and a further 23 library and ICT staff. The ACU has worked closely with INASP, a long-term collaborator, throughout. This paper builds on the first phase of the study, whose earlier report, published in June 2009, helped to define the context of the study and identify the questions which it needed to address, and explored the many access initiatives which were already in place.[3]

The study was initially framed according to the interests of Arcadia, as a study of arts, humanities and social science. While this remained the focus, the subject areas consulted were broadened, partly as a result of the difficulty in reaching sufficient numbers with these fields, and partly to offer some level of comparison between the sciences and the humanities. Most of the problems identified were common to all disciplines, however.

Good libraries and access to the latest literature are essential for research, wherever in the world it takes place. For many years, a dearth of books and journals hindered African academics south of the Sahara, frustrated their research, and prevented them from getting it published – submitted articles were often not sufficiently demonstrative of current thinking or evidence in the field to be accepted. When exploring the constraints on research in African universities (defined here as sub-Saharan but excluding South Africa, which is a significantly different case), poor access to scholarly literature is commonly cited as a major impediment.[4] Nevertheless, a number of initiatives have sought to tackle this problem in recent years. More affordable access to a considerable volume of high-quality electronic (online) content has been provided by academic publishers, large and small. Ensuring the sustainability of this content is still a considerable challenge, but academics and students now have an impressive range of academic sources available to them.

From the outset, the intention of this study was to develop a series of more detailed case studies, to avoid generalising unhelpfully about the situation in Africa as a whole, and to enable a more in-depth exploration of the specific obstacles and challenges faced by individual institutions and how these are affected by their specific structures, systems, staffing, management, and resources. These four institutions were chosen for a number of reasons: their location in the same broad sub-region (anticipating that east African universities would stand to benefit collectively, albeit at staggered times, from new high-speed cable projects); the fact that they were each the principal national research institution in the country (and thus had the greatest likely need for and potential to make use of e-resources); the potential for comparisons and contrasts to be drawn between them, based on size and levels of external support; a sense of prior successes or difficulties; and their willingness to be involved.

The findings and conclusions presented here therefore apply specifically to these four universities, and more broadly to the situation in east Africa, and a part of southern Africa. The intention is not to suggest that all findings are applicable to the continent as a whole – and indeed we would expect some significant variation. Nevertheless, we expect that many of the lessons learned and the recommendations derived from these will have wider applications in universities in other regions of the continent, and will also be of potential interest to those outside Africa.

It should be noted that most of the data and observations discussed here were gathered between August and October 2009. There may therefore have been subsequent changes and improvements on each campus – notable, for example, is Chancellor College's new website, which includes a substantially improved set of library pages – which are not reflected in the survey responses and observations detailed here.

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1   Digital and electronic are used interchangeably in this paper; they may not necessarily refer to online information although, in practice, many electronic resources are accessed via the internet.
2   Tanzania straddles both east and southern Africa, as part of the East African Community (EAC) and the Southern African Development Community (SADC).
3   Jonathan Harle, *Digital resources for research: a review of access and use in African universities* (2009)
4   See, for example, Jonathan Harle, *The Nairobi Report: Frameworks for Africa-UK Research Collaboration in the Social Sciences and Humanities* (2009), or a series of articles on the SciDev.Net website at www.scidev.net/en/new-technologies/digital-divide

1.1   Approach and methodology

While initially commissioned as an investigation into access to electronic resources and the coverage of existing support initiatives, the study was deliberately framed as a broader exploration of research activities. In doing so, we sought to gain an understanding of the wider constraints facing researchers (including funding, research cultures, departmental activity and teaching loads), in order to set e-resource access and use in context and to make more widely relevant recommendations.

Surveys and desk research

Data for the study was gathered in a number of ways, including desk-based research, face-to-face interviews, and analysis of data provided by the universities. A background review of existing literature and current initiatives identified the key issues to be investigated and helped to define the parameters of the study.[5] Following this, the four case study institutions were identified and invited to take part. An initial survey was circulated to research staff and postgraduate students in the four universities, to gather some basic information on the ways in which researchers identified, accessed and used electronic materials, their broader research and publishing activities, and their use of the library in general. 201 responses were received, and these were used to inform subsequent stages of the study. The survey was also circulated more widely, generating an additional set of responses from other universities and countries. While offering some further insights into the issues, these responses are influenced by their specific contexts and have been removed from this paper for clarity. All data presented is thus drawn from the four case studies. Where figures are quoted on users' approach to e-resources, these are drawn from the survey unless otherwise noted. Observations on levels of research are drawn from interviews with academics, in addition to documents provided by the institutions.

Institutional visits, observation and interviews

One-week visits were made to each institution during August and September 2009 to work with library staff and to discuss the issues with students and academics. Meetings were conducted with library and ICT staff to explore the internal systems underpinning the acquisition and management of electronic resources, and associated ICT issues. A series of observation exercises was run with postgraduate students and junior academics. Each was set a basic information search and retrieval task, and screen-recording software was used to capture exactly how they approached it, and how they searched for and navigated to appropriate resources. This was followed by a focus group in which the problems encountered using e-resources were discussed, in addition to experiences of research and libraries more broadly. 32 additional in-depth interviews were then held with senior academics to discuss their own work and that of their departments more broadly, and to investigate the specific challenges which they face, with specific reference to libraries and information resources. Copies of institutional and library strategic plans were also gathered where available, in order to gain a sense of wider institutional support and frameworks for library and e-resource development. These are not explicitly reviewed, but provided additional material to draw on when seeking to understand contexts in each university.

Analysis of additional data

It was intended that university-level data on the availability and usage of electronic journals would be analysed to provide some sense of usage at faculty or disciplinary level. While the data was compiled, and may subsequently be analysed separately, problems in comparability as well as concerns over the accuracy of data supplied by some publishers meant that this was not possible within the timeframes of this study. However, the availability of the top 20 journals in a number of subject areas, as defined by the impact factor rankings of Thomson Reuters' Journal Citation Reports, was analysed against the current subscriptions of each library and the potential availability of journals through a number of access schemes, and this proved quite insightful. This was subsequently benchmarked against current journal availability in two European universities, who kindly made their subscription data available.

Review workshop

The findings of the four case studies were subsequently presented to librarians from each university in advance of a workshop held on 18-20 February 2010 in Nairobi, Kenya. This brought together at least two librarians from each participating university, including the PERii Country Coordinators in each case, and colleagues from the ACU, INASP and the British Library of Development Studies. It provided an opportunity to collectively review and interpret the results, to learn from each other's experience, and to help identify the steps which each library might take to address some of the issues that had been identified during the process.

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5   Harle, *Digital resources for research*

Figure 1: Survey respondents by field[6]

Other 2%

Arts and humanities 21%

Business and management 12%

Central administration 2%

Engineering and technology 2%

Environmental sciences 4%

Natural and applied sciences 11%
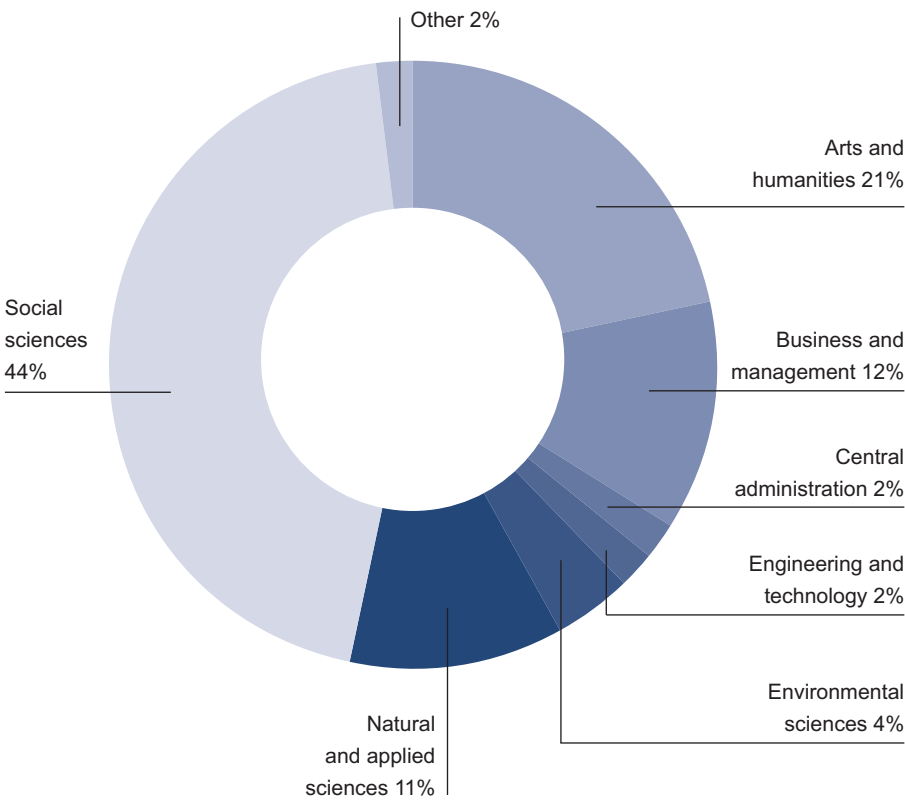
Social sciences 44%

Table 1: Interviews with senior academics by discipline

Arts and humanities	6
Social sciences	9
Business and management	2
Education	1
Environmental science	2
Engineering and technology	2
Natural and applied sciences	7
Medicine	1
Central administration	2
Total	**32**

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6   Total number of respondents = 201

2. Background: libraries, information access and connectivity – a changing picture

Difficult times but new hope

During the 1980s and 1990s, African university budgets declined substantially in real terms. Falling commodity prices led to falling growth rates and macroeconomic adjustment policies, which forced overall spending cuts across the public sector. This, alongside pressures to cut back on higher education in favour of greater investment in primary education, impacted universities heavily. During the same period, universities came under considerable pressure to expand enrolments to account for growing demand from secondary school leavers, further straining facilities and resources.[7] Insufficient budgets, coupled with the rising cost of book and journal subscriptions, made it difficult for many libraries to maintain adequate collections. Domestic and regional publishing industries also struggled to establish viable markets, with academic (as opposed to educational) publishing rates low, and locally published journals struggling to sustain themselves financially.[8] The emergence of electronic journals in the late 1990s offered the potential to begin to improve the situation, bolstered by increased numbers of titles from 2000 and the parallel development of a number of initiatives offering access to these at reduced or no cost. These include schemes from the United Nations agencies for health, agricultural and environmental research (HINARI, AGORA and OARE), the multidisciplinary Programme for the Enhancement of Research Information (PERii, established by INASP), and Electronic Information for Libraries (eIFL.net).[9] These have had a considerable impact. Until the University of Nairobi library became involved in the PERii initiative in 2001, for example, it had purchased no new journal subscriptions for around six years.[10] Its electronic journal collections are now, as this paper illustrates and like the collections of many other libraries in the region, quite impressive.

The technology challenge

Nevertheless, the advent of electronic journals generated new problems, specifically the need to upgrade ICT facilities and infrastructure, to secure good internet access, and to invest in training and familiarisation. This required substantial investment and assistance for both librarians and users to develop the skills to handle these effectively. It is important to note that the implication is not that African users required greater assistance than peers elsewhere, but that sparser ICT facilities and accordingly less time spent using them meant that familiarity and skills have posed a greater challenge. While electronic access has made a huge difference to research and teaching – and has also spurred important developments in university libraries – poor internet connectivity, with low speeds and exorbitant costs, inadequate computing facilities and a lack of adequate systems to manage online subscriptions and their access (initially via passwords, latterly via IP authentication on campus) have meant that the full potential of electronic resources has often been unrealised. Many students and academics have been unable to make good use of the wide range of material available to them, because they are often unaware of what is available, unable to get access to a computer, and thwarted by slow (and often pay-to-use) internet connections when they do.

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7   For a fuller discussion of African higher education over this period, see Damtew Teferra and Philip G. Altbach, *African Higher Education: An International Reference Handbook* (2003). For a background on some of the universities considered in this study, see Brian Cooksey, Lisbeth Levey and Daniel Mkude, *Higher Education in Tanzania: A Case Study* (2003) on Tanzania, and Kilemi Mwiria and others, *Public & Private Universities in Kenya* (2007) on Kenya.

8   See, for example, Damtew Teferra, 'Knowledge Creation and Dissemination in African Universities with Special Reference to Information and Communications Technology (ICT)', in *African Universities in the Twenty First Century: Volume II: Knowledge and Society*, ed. by Paul Tiyambe Zeleza and Adebayo Olukoshi (2004), and the essays collected in *Scholarly Publishing in Africa: Opportunities & Impediments*, ed. by Solani Ngobeni (2010)

9   See Appendix 3. The Programme for the Enhancement of Research Information was originally known as PERi. Since commencing its second five-year phase, it has been known as PERii ('PERI 2').

10 Personal communication.

New broadband developments

In the last few years, the situation has begun to improve significantly. National research and education networks (NRENs) – fibre-optic backbones dedicated to the academic and research sector – have been formed in many countries, with the sector using the collective bargaining power that these bring to negotiate improved bandwidth at a more affordable cost and to coordinate the development of national network infrastructures.[11] In 2006, a regional 'network of networks', the UbuntuNet Alliance, was formed to support the development of terrestrial broadband and interconnectivity between these national networks and with international networks outside Africa. In 2009, two new undersea fibre-optic cables were laid along the east African coast. One, SEACOM, connects Djibouti, Kenya, Tanzania, Mozambique and South Africa to Europe and India; another, TEAMs, connects Kenya to the United Arab Emirates. These operate at a bandwidth capacity of 1280 gigabits, dramatically increasing internet speeds as users connect to content which is typically hosted in Europe or North America. A further east African cable (EASSy) is due to be completed in 2010,[12] while a series of west African cables are due to be laid between 2010 and 2012. Meanwhile, the New Partnership for African Development (NEPAD)'s e-Africa Commission has initiated work on the policy and regulatory environment for broadband infrastructure, and has undertaken feasibility studies for two high-speed networks: Uhurunet, a submarine segment which will link to existing cable projects, and Umojanet, the terrestrial segment.[13]

Meanwhile, substantial investment in journal access and associated areas of training and capacity building has also borne fruit. Through the initiatives outlined above and many smaller schemes, academics in many sub-Saharan universities now potentially have access to many thousands of peer-reviewed journals, both current issues and back-issue archives. PERii has negotiated access to over 18,000 full-text journals (a further 7,000 are abstract only), while HINARI offers over 6,400, AGORA 1,278, and OARE over 2,990. Overlap between the major schemes, in addition to a myriad of other smaller programmes, makes it difficult to calculate the total number of free or discounted titles available, but it is certainly substantial. Kenyan libraries, which before the advent of affordable e-resources had collections averaging 3,000 print journals, now have an average of 35,000 titles via online access. Moreover, they have made average savings of 80% in their budget, while receiving over tenfold the number of titles.[14] Further analysis of the number of titles available to the four institutions covered in this study is given in section 4.

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11 In many cases, this entails the leasing of bandwidth for educational institutions from existing commercial network suppliers, but dedicated high-speed educational networks are envisaged. UbuntuNet lists 12 current members but, of these, only eight have websites and not all have yet reached a stage where they are able to provide internet access to member institutions. A further seven NRENs are listed as being in development. For a full list of existing and emergent NRENs, see www.ubuntu.net.

12 As of July 2010, news reports indicate that cable laying has been completed and that the cable is due to be switched on by the end of the month: http://allafrica.com/stories/201007131098.html, http://allafrica.com/stories/201007120680.html

13 See www.eafricacommission.org/projects/126/nepad-ict-broadband-infrastructure-network. For further discussion of some of these developments, see also Piyushi Kotecha, '"Dazzling technologies": addressing the digital divide in the southern African universities', *The African Journal of Information and Communication*, 10 (2009-2010)

14 Jactina Were, 'African University Libraries in Partnership', presentation at the British Institute in Eastern Africa, 18 March 2010

3.   Research in African universities: the broader context

3.1   Levels of research in sub-Saharan Africa

Researchers and research in sub-Saharan Africa face many obstacles, and research levels are commonly noted to be relatively low, both compared to other parts of the world and also relative to the number of institutions and the academics that they employ. In the social sciences and humanities, the struggle of African academics to undertake and publish their research has been recently documented in two ACU reports, and as well as in a number of other studies commissioned by university bodies and other agencies and funders.[15]

According to a recent Thomson Reuters report, the total annual research output of the continent (including north Africa in this instance) is, at 27,000 papers per year, equivalent to that of the Netherlands.[16] Figures prepared by Mouton for a SARUA study show that, over the past decade or so, sub-Saharan Africa's share of global research (measured by output, i.e. articles published rather than research undertaken), has steadily declined. From a peak in 1987, sub-Saharan Africa has lost 31% of its share in global research, such that, by 1996, its output had fallen to just 0.7% of international research.[17] Unsurprisingly, South Africa dominates this research landscape, although Kenya also performs relatively well. These figures are corroborated by the Thomson Reuters study (which also points to a substantial output, relative to the size of its research community, from Malawi).[18]

Quantifying research levels is, however, more difficult than these figures suggest, and it is particularly important to recognise the bias of ISI-derived figures, which do not include many titles produced regionally or nationally but not ranked by the ISI, which nevertheless provide an important platform for much locally-relevant research. With particular reference to the social sciences, Mouton demonstrates, through an analysis of titles included within the African Journals OnLine (AJOL) database, that the ISI results account for only a third of total social science research in the region.[19] Nevertheless, research output as measured by ISI data has also begun to increase across the continent since 2000.[20]

To put some of these percentages and global shares into more specific figures, data compiled for a SARUA study and based on universities' own submissions, is insightful. The figures displayed in Table 2 illustrate both the relatively low levels of publishing across 13 southern African countries (excluding South Africa) and the dominance of South Africa.

Table 2: Publications produced by southern African public universities[21]

	Internationally-accredited journal articles	Locally-accredited journal articles	Books
Social sciences and humanities (13 countries, excluding South Africa)	134	127	87
All fields (13 countries, excluding South Africa)	1,045	685	995
Social sciences and humanities (South Africa)	475	1,066	259
All fields (South Africa)	2,518	3,019	438

15 ACU reports: Jonathan Harle, *Frameworks for Africa-UK Research Collaboration in the Social Sciences and Humanities* (2007) and Harle, *The Nairobi Report*. Other studies include Ebrima Sall, Katri Pohjolainen Yap and Måns Fellesson, *The Social Sciences in Mozambique, Tanzania, Uganda, and Zimbabwe* (2004). For a recent summary of social science research in Africa, see essays by Ebrima Sall, Johann Mouton, Maureen Mweru, Adebayo Olukoshi and Adam Habib in UNESCO/ISSC, *World Social Science Report 2010: Knowledge Divides* (2010)

16 Jonathan Adams, Christopher King and Daniel Hook, *Global Research Report: Africa* (2010)

17 Johann Mouton, *A baseline study on science and technology and higher education in the SADC region* (2007), citing Robert Tijssen, 'Africa's contributions to the worldwide research literature: New analytical perspectives, trends, and performance indicators', *Scientometrics*, 71 (2007)

18 Adams, King and Hook; the authors attribute Malawi's comparatively high output relative to its size to a significant number of collaborations with UK academics, particularly in medicine.

19 Johann Mouton, 'The state of social science in sub-Saharan Africa', in UNESCO/ISSC, *World Social Science Report 2010: Knowledge Divides* (2010)

20 Mouton, 'The state of social science in sub-Saharan Africa'

21 Figures are taken from Neil Butcher et al, 'A Profile of Higher Education in the Region', in *Towards a Common Future: Higher Education in the SADC Region. Research Findings from Four SARUA Studies*, ed. by Piyushi Kotecha (2008). Figures are for the most recent year for which data was available, most often 2006/2007, and are based on submissions by 54 institutions rather than by indexes or other publishing data sources. SADC countries are: Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

3.2   Research activity in the four case study universities

'My use of electronic resources is not very high. It needs improvement which, I think, will be possible since I have the duty (teaching) that compels me to improve it.' (Rwanda)

The purpose of making e-journals available is fundamentally to support and stimulate research and teaching, particularly at postgraduate level and beyond. The extent to which e-resources are used, and the demand for them, therefore depends on the level of research and postgraduate activity taking place. While overall research activity at the institutional level offers some idea of this, the research objectives and needs of researchers vary significantly. A focus on the activity of individual departments is therefore important, to understand the specific contexts and constraints and the e-resource usage associated with this. While this study does not claim to present a detailed and comprehensive analysis of research activity at departmental level, it does seek to explore the nature of research within individual departments. There is significant variation in the level of research activity at the four universities studied here: considerable at some, relatively low at others. In all cases, it appeared that the low use of journals is at least partly due to, or caused by, a low level of research and postgraduate activity. Although students at lower levels may also have a need for e-journals, they are more likely to rely on textbooks and are unlikely to be motivated to use e-resources if their lecturers are not doing so.

Constraints on research

Research levels vary considerably between universities and between departments, with some attracting greater levels of external support than others or able to generate greater income locally. It should be noted that many of those consulted also have significant administrative burdens as a function of their roles as heads of department or faculty deans. Nevertheless, the impression they gave is broadly consistent with the picture painted by other recent work in this area.[22] In almost all cases, academics noted that research is constrained by time and funding, explaining that significant teaching commitments, a scarcity of research grants, and a range of infrastructural or resource impediments limit the amount of research which they are able to undertake. In some cases, academics lack office space (their own or shared) from which to conduct their research and prepare their teaching. Many also noted that they are rarely able to attend international or regional conferences, which means they feel isolated from their wider scholarly communities.

However, a number also commented that funding and time aside, a lack of a university-wide or departmental research culture is also responsible for declining or low levels of research, observing that departmental seminars are often rare, or that colleagues appear to have little interest in discussing the latest trends and developments in research. In part, this is the result of many years of underfunding, which has forced many academics to focus on income generation, in the form of additional teaching contracts or consultancy work, but it also appears to be influenced by 'perceptions of possibility' – namely perceptions of how successful they are likely to be in undertaking research. Access to literature is clearly a significant aspect of this, both in terms of the availability of material in absolute terms and the ease with which it can be accessed.

Publishing

A closely related problem is researchers' ability to publish their work. One Malawian respondent commented that 'I could not publish a lot of papers in [the] last 3 years due to [a] lack of required journals/papers even though I had the idea[s] and capacity to do it'. Submissions are often rejected because references are not up to date, or the latest literature has not been considered. Revisions often stall or take too long when academics are not able to locate the material they need to address the deficiencies highlighted by editors. In some cases, academics suggested that many of their colleagues simply do not have sufficient awareness of the key journals to follow and to which they should submit their work. Nevertheless, much of what they need to access is probably available in or via their own university library.

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22 See, for example, *Towards a Common Future* (for southern Africa), or Harle, *The Nairobi Report* and UNESCO/ISSC (for social sciences/humanities)

3.3   Contexts: the four case study universities

The four institutions are all the principal national research university in their respective countries; in the case of Chancellor College, it is the principal and cross-disciplinary college of the federal university (the other colleges being dedicated to nursing, medicine, agriculture, and technology). Figures 2 and 3 give a comparison of the relative size of each, according to student population and academic numbers. The University of Nairobi is by far the largest, almost twice the size of the University of Dar es Salaam. Chancellor College was by far the smallest institution of the four, although it is part of the federal University of Malawi. Although undergraduates are not considered explicitly in this study, the pressure of expanding numbers informs the context in which libraries and academic staff operate, and significantly distorts the provision of library services. In line with much of the continent, where student enrolments have grown from 200,000 in 1970 to over four million in 2007 (a growth of 8.6% each year, compared to 4.6% globally), the four universities have experienced considerable increases in student numbers without concurrent increases in academic staff numbers or investment in facilities and resources.[23] Furthermore, information awareness and skills developed at undergraduate level are likely to influence students' research behaviour at postgraduate level.

Figure 2: Student population at case study universities
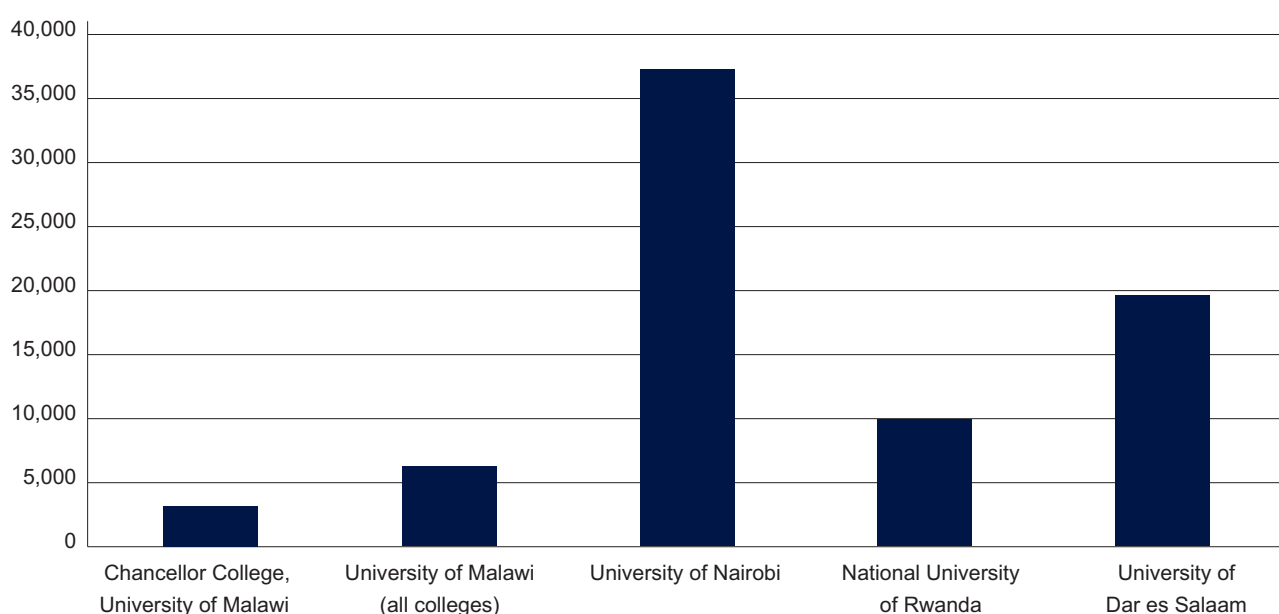
Table 3: Student population at case study universities[24]

	Chancellor College, University of Malawi	University of Malawi (all colleges)	University of Nairobi	National University of Rwanda	University of Dar es Salaam
Undergraduates	2,795	5,915	29,124	10,277	17,077
Master's students	210	342	7,445	380	2,532
PhD students	5	unavailable	422	unavailable	21
Total student population	3,010	6,257	36,991	10,657	19,630

23 Figures from UNESCO Institute for Statistics, *Trends in Tertiary Education: Sub-Saharan Africa (UIS Factsheet No. 1)* (2009)

24 Figures should be taken as a guide only, and are as reported by universities or from publications produced by them. Typically, these are headcount numbers rather than full-time equivalents. The University of Malawi and the National University of Rwanda undergraduate figures are approximated by taking the total number of students and subtracting Master's students; however, PhD student numbers in each case are not known. The University of Malawi figures are taken from a 2009 SARUA publication, and are likely from 2007; however, they are included as a useful comparison with Chancellor College figures. The National University of Rwanda figures are for 2010.

Figure 3: Academic staff at case study universities[25]

Bar chart showing academic staff numbers:
- University of Malawi (all colleges): 676
- University of Nairobi: 1,411
- National University of Rwanda: 533
- University of Dar es Salaam: 1,127
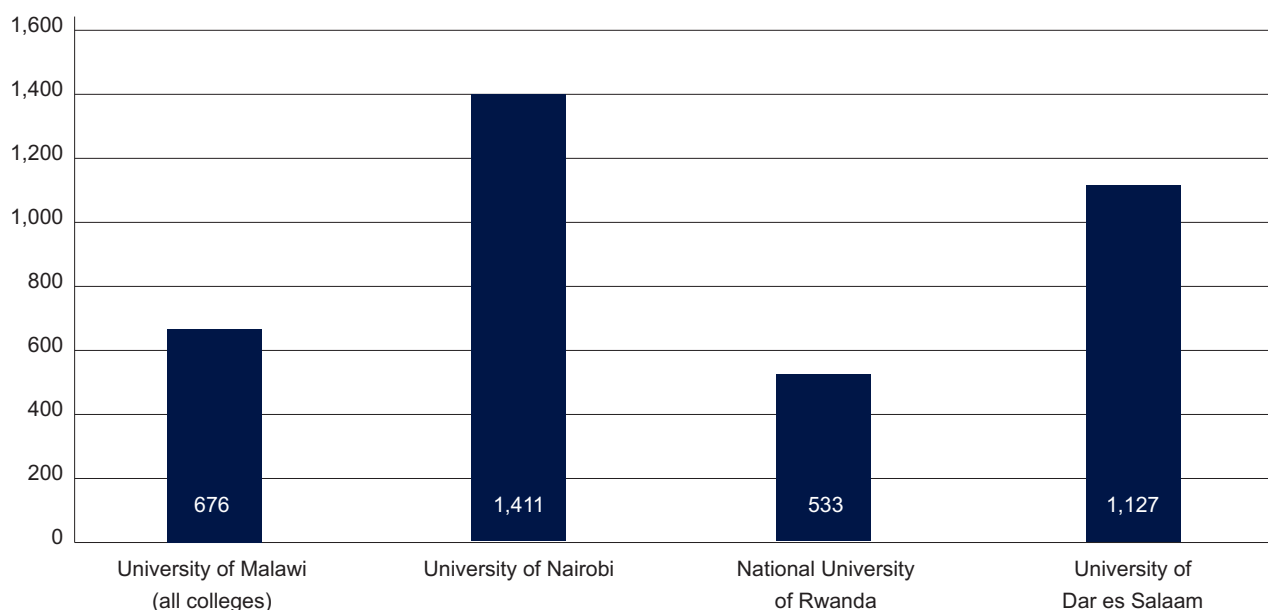
Table 4: Staff/student ratios at case study universities

	University of Malawi (all colleges)	University of Nairobi	National University of Rwanda	University of Dar es Salaam
Ratio of academic staff to students	1:9	1:26	1:19	1:17

Chancellor College, University of Malawi

Chancellor College is currently experiencing substantial pressures, but there is clearly significant potential to improve things in the future. According to the data in Table 4, the federal university has the best staff to student ratio of all four case study universities. Pockets of research exist, but these appear to rely heavily on external funding, fellowships and sabbaticals, meaning that the work often takes place away from the Chancellor campus, or through involvement in multi-institution collaborative projects. Postgraduate activity – an important feature of departmental and institutional research – appears to be relatively low: there are currently five PhD students, in economics, biology and education, out of a total of 215 postgraduates. Staff regularly emphasised the fact that research is constrained by the amount of teaching they are required to undertake, which is particularly demanding due to a large number of vacant positions across the college. The English department, for example, is 50% down in terms of actual staff numbers against teaching positions, while many members of the biology department are abroad studying, meaning that the current head has had to reprise a role which he had already held quite recently. As one academic commented, research is something you do while on sabbatical or when in receipt of a fellowship, not something which you achieve in the course of your ordinary daily activities. Another commented that 'you have to find your own way out' and 'scrounge around for all kinds of breathers [time away from your desk and duties to do research]'. Because consultancy forms the mainstay of much research, what does take place is typically in response to the interests or demands of others (mainly external agencies), rather than in pursuit of more nationally relevant research questions in the long term. Some departments have their own small fund to support academics, but this is limited and only allows for relatively modest projects or contributions to conference travel. There is also some funding available at the college level which, although small, is adequate for some activities. One academic noted that research is something that he has to undertake in his own time, while another commented that there is little possibility for carrying out any research beyond exploring literature in order to update his teaching materials.

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25 With the exception of the University of Nairobi, female staff numbers are calculated from the percentage of female staff reported by the universities.

University of Nairobi

At the University of Nairobi, research activity is strong in some areas, with good postgraduate enrolments and active departmental research cultures, including regular departmental seminars, but weaker in others. In some cases, research activity in a department is largely defined by Master's and PhD supervision, with relatively little research taking place outside this. Significant teaching loads prevent many from doing research, although with the introduction of fee-paying 'mode two' students, many academics have specifically chosen to undertake more teaching, for which they can earn an additional supplement. High administrative burdens frustrate research for some academics, although typically those performing head of department roles – a complaint echoed by academics the world over. A mixture of internal and external funding supports research. While some academics are able to secure external funding for large-scale projects, internal funding is considered insufficient to achieve much. Recently, a percentage of mode two income has begun to be devoted to research. It was noted by one interviewee that external funding is for collaborative work with colleagues elsewhere, which means that research is restricted to interests defined by others. With many international agencies based in Nairobi, consultancy is also a problem for the university, in that academics prefer to take this more lucrative option rather than undertake more scholarly research, which may be less well funded if it is funded at all. Despite a considerable level of research-orientated activity, little of it is 'captured' by the institution, and little makes its way into academic publications. Some do, however, use their consultancies to support their academic research, including travel to conferences, and the issue is thus less clear cut. There is, on the whole, an observable need to strengthen research, postgraduate training and the research culture across the university. Mentoring was noted to be a particular issue, with academics who have often not published for some time supervising postgraduate students.

National University of Rwanda

At the National University of Rwanda, research and postgraduate teaching is steadily growing following the trauma of the country's 1994 genocide (many of the university's academics and students were killed and the university has had to rebuild itself since it re-opened in 1995). Two PhDs were awarded in 2008, the first in NUR's history, while 47 Master's degrees were awarded in 2009, and 75 in 2008.[26] Many academics emphasised that the majority of their time is dedicated to teaching, preparation and assessment, and suggested little prospect of being able to dedicate more time to research with current staffing and funding levels. One interviewee commented that a particular problem is the lack of a strong culture of research and critical discussion in many departments. However, the university is making significant efforts to expand and strengthen its research base, and to develop a stronger research culture. A priority is the advanced training of academic staff. The university currently has only 114 PhD qualified staff (22% of the total); 47% require postgraduate training, while 28% are currently enrolled on PhD or Master's programmes, often sandwich courses at foreign universities.[27] An annual research conference is now held, offering staff an opportunity to present their work to colleagues, attracting researchers from outside the country, and raising the profile of research within the university as a whole. In 1998, a research commission was established to coordinate research at the university; a director was appointed in 2007, and around £213,000 in research grants was disbursed in the same year.[28] A graduate and research school is also planned, in order to build up postgraduate and postdoctoral research and training.[29] INASP's AuthorAid project is also having a particular impact, helping to improve the quality of academics' papers and ultimately making them more publishable.

University of Dar es Salaam

At the University of Dar es Salaam, as at the University of Nairobi, research activity is much greater in departments that have been able to attract substantial external support (such as economics), while consultancy activity is also considerable. Although the university specifies a rough division between teaching and research, academics stressed that most of their time is taken up by teaching, particularly where there are immediate staff constraints. Research tends to be done when the funding is available but, as several noted, consultancy proves more lucrative and additional time is thus often directed towards pursuing these opportunities instead. Most often, it falls to individual academics to secure external funding in order to pursue their work, and research activity relies heavily on personal effort and persistence, with some clearly more successful than others in attracting funding for their work. The university does, however, hold a research fund, awarded on a competitive basis and funded by the Swedish International Development Cooperation Agency (Sida), to which academics can apply. Collaborative arrangements with overseas universities are an important way for academics to access research funding, as are regional training networks, which typically combine postgraduate programmes with some research funding. Postgraduate training – which provides the basis for much of the research activity of the university – is, however, typically at Master's level.

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26 National University of Rwanda, *Facts and Figures: Current NUR statistics of staff and students* (2009)
27 Silas Lwakabamba, *Establishing a Graduate and Research School: A concept note* (2009)
28 Lwakabamba. RWF 185,080,922; research grant funding is provided as part of Sida's programme of support.
29 Lwakabamba

4. The state of electronic journals: availability, collections and use

4.1 The availability of academic journals

Having considered briefly the state of research, the following sections are dedicated to an analysis of the availability of, access to, and use of electronic journals. Measuring availability is difficult. No single university can sustain a comprehensive collection which includes all journals that its academics may wish to read, and there is no standard benchmark of what constitutes a good journal collection, since subscription decisions are made by individual universities according to their specific teaching needs and academics' research interests. It is also difficult to draw comparisons of collection breadth, coverage and quality between an African and European or North American university, since many regionally or locally published journals, which are of particular relevance to research in African universities, are not indexed internationally, nor collected by universities outside the continent.

Nevertheless, it is possible to make some observations about coverage and availability within and between the universities studied, and in comparison to those in Europe, by using the Journal Citation Reports. Taking the top 20 journals in key areas, as measured by journal impact factor, and comparing these against current journal collections (2009 subscriptions) in the four universities reveals a high degree of availability of major internationally-accredited journal titles in each discipline.[30] In all cases, a 'gold standard' of instant access to the latest issue has been used; this does not include, but is nevertheless strengthened, by the use of document delivery (British Library Direct), and the substantial back issue collections or databases (such as EBSCO) with a moving wall for some titles which releases the latest issue after a six or 12-month delay.

Overall coverage

As Table 5 and Figure 5 illustrate, all of the four universities have coverage of between 76% and 82% of the top 20 titles across 15 disciplinary areas.[31] Taken together, the four universities have an average subject coverage of 79%. This compares to coverage of 96% and 94% for the two European universities, showing that top research universities in wealthier countries are not able to maintain fully comprehensive collections, or choose not to according to their research concentrations. While the availability of top 20 titles is still better in Europe, the comparison (see Figure 4) nevertheless demonstrates that a significant volume of top-quality international journal content, which approaches European levels, is available to the four universities studied. PERii covers around 60% of the top 20 titles, with additional titles or alternative access available through HINARI, AGORA and OARE. If all potential access routes are taken into account, these four universities and others across Africa have a potential coverage of 83% of the top 20 titles.

Figure 4: Comparison of availability of top 20 titles between two European and four African universities

Africa — 79% / 21%
Europe — 95% / 5%
■ Available ■ Unavailable

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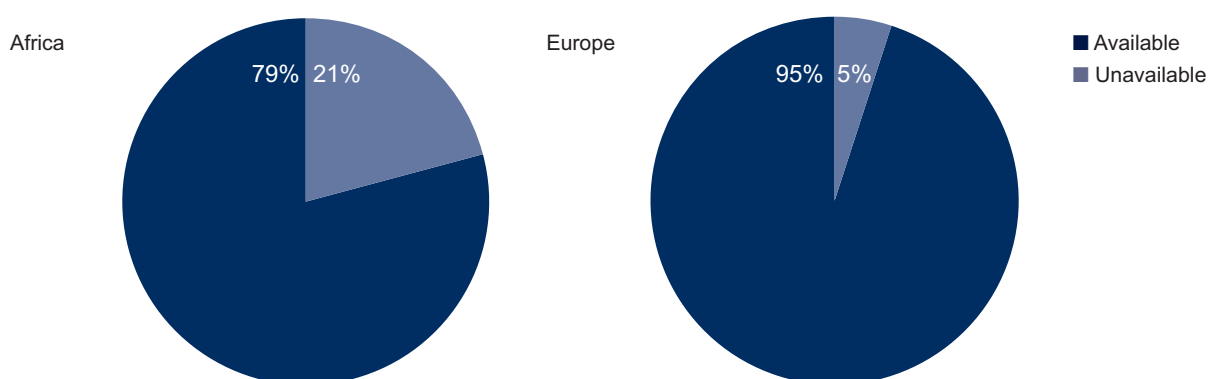
30 Produced by Thomson Reuters; see http://thomsonreuters.com/products_services/science/science_products/a-z/journal_citation_reports. The impact factor is a measure of the average number of citations to articles, and serves as a proxy for the relative importance of journals, covering science and social science journals (not arts and humanities). The impact factor is calculated by dividing the number of citations in the current year by the total number of articles published in the two previous years. So, for example, an impact factor of 1.0 means that articles published one or two years ago have been cited once. There are a number of criticisms made of the impact factor, and it is used here only as a very rough guide to enable a comparable list of top journals to be generated.

31 Journal availability for each university was calculated by checking their current (2009) subscriptions through PERii (including those aggregated through EBSCO or Project MUSE), and also availability through HINARI, AGORA and OARE. Availability through eIFL was not included, which would potentially improve this picture further; however, it was known that the University of Malawi's access to Cambridge University Press is secured through eIFL. Of course, journal subscriptions change from year to year, and titles may be available through one-off initiatives, so there will always be imperfections in such figures.

Some things to note

The figures do, however, highlight a number of exceptions or gaps which are worth discussing. All four universities have the same access to PERii subscriptions, purchasing these from their own budgets, typically as part of a national consortium (Nairobi, Chancellor) or through targeted donor funding (Rwanda and Dar es Salaam), and making subscription decisions accordingly. PERii subscription prices are negotiated annually between INASP and the respective publishers, with some countries moving towards national negotiation (which is PERii's ultimate goal).

In a few cases, the University of Nairobi has slightly fewer titles than the three other universities. This may reflect deliberate purchasing decisions, but it may also be the result of the higher prices which the Kenyan consortium pays. Malawi does very well according to these figures, which may reflect the strengths of the Malawi Library and Information Consortium (MALICO), particularly since its subscriptions are purchased without additional donor support, but may also be the result of lower pricing.

Subject strengths and gaps

Table 5 illustrates coverage through the various access initiatives. It indicates that *potential* availability (if the university or consortium is able to raise sufficient funds, or chooses to purchase the full range of publishers' packages) is particularly good in many fields. All top 20 titles are available in politics and materials science, while over 90% are available in agriculture, anthropology, biology, health policy, and sociology, and 80% or more in history, environmental studies, and physics. Coverage is still 70% or above in chemistry, engineering, and business. The slightly lower availability in business studies and economics may in part reflect the fact many of the top 20 titles appear to be very US-focused, and may thus be not be considered relevant to African universities (and thus not targeted for inclusion in developing country access initiatives); it may also reflect the higher cost of such titles. Notable gaps would appear to be geology (65%) and mathematics (40%).

As noted, this analysis used a gold standard of instant access to the latest issue. Much greater coverage is observed six or 12 months after publication, as moving walls release new content. Substantial backfiles are also provided, particularly in some subjects. It is also worth noting that, under PERii, universities have access to the British Library's document delivery service, which enables them to purchase one-off articles as needed. In theory, where a library makes use of this service, a researcher should be able to access any article they require without the library needing to purchase a full annual subscription (which may not be regularly used), thus providing a more appropriate and affordable way of maintaining good collections. At the University of Nairobi, for example, money is deposited in advance with the document delivery service, and librarians are keen to emphasise that researchers should therefore not lack access to any article they require, provided they can wait a week or so for delivery.

From availability to access and use

These figures are, of course, imperfect. They cover only the top 20 journals in each subject, and not all subjects are analysed here. In addition, the top 20 titles are defined by impact data, which is heavily biased towards northern scientific and scholarly concerns and may not accurately represent the research needs and interests of African scholars. It ignores much relevant local research which is published in national or regional journals, as already noted with reference to Mouton's recent study. The sustainability and affordability of subscription models also remains a challenge, and the availability problem has not been entirely 'solved'.

However, what these figures do suggest is that *availability* of scholarly information can no longer be claimed as the primary problem. Access initiatives over recent years have done much to address this, successfully piloting subscription models through which affordable pricing (or in some cases free access) has been provided by major publishers, serving to bring many thousands of journals within reach of African universities. If the theoretical availability of scholarly content is now much greater, and if the sustainability of these access models can be assured, the problem may need to be redefined. It seems necessary instead to consider the ways in which *available* journals are or are not being *accessed* and *used*. In doing so, attention is focused on the barriers which prevent or discourage academics and students from making use of scholarly materials for research.

Table 5: Number of top 20 titles by ISI impact factor available in full text[32]

Subject area	UK university (c. 18,000 students)	Swedish university (c. 45,000 students)	Chancellor College, University of Malawi (c. 3,000 students)	University of Nairobi (c. 37,000 students)	National University of Rwanda (c. 11,000 students)	University of Dar es Salaam (c. 20,000 students)	Available through PERii	Via all access schemes (inc. OA)	Average coverage – 4 African universities		Potential coverage in Africa (all access schemes)
Agriculture	19	19	19	18	19	19	8	19	19	94%	95%
Anthropology	20	20	19	16	19	19	15	19	18	91%	95%
Biology	20	20	19	19	19	19	10	19	19	95%	95%
Business and economics	20	20	13	13	14	14	11	14	14	68%	70%
Chemistry	19	18	16	11	16	16	14	16	15	74%	80%
Engineering	18	18	15	14	15	15	9	15	15	74%	75%
Environmental studies	16	20	16	16	16	16	8	16	16	80%	80%
Geology	19	18	13	14	14	13	9	13	14	68%	65%
Health policy and services	18	20	17	19	18	17	12	19	18	89%	95%
History	19	19	14	15	14	14	16	16	14	71%	80%
Materials science	19	20	18	16	19	18	12	20	18	89%	100%
Mathematics	17	17	2	3	8	7	8	8	5	25%	40%
Physics	19	18	15	16	17	15	13	17	16	79%	85%
Politics	20	20	18	20	19	18	19	20	19	94%	100%
Sociology	20	20	17	18	18	18	16	19	18	89%	95%
Mean coverage	18.9	19.1	15.4	15.2	16.3	15.9	12.0	16.7	15.7		83%
	94%	96%	77%	76%	82%	79%	60%	83%	79%		

32 This analysis is based on subscriptions in the period 1 January 2009-31 December 2009. Data on PERii subscriptions was shared by INASP. Information on journals accessible under HINARI, AGORA and OARE was gathered from their respective websites. Data on the two European universities was accessed with permission from the catalogues of the respective libraries of each institution.

Figure 5: Availability of top 20 journal titles in case study universities

Legend:
- Chancellor College, University of Malawi
- National University of Rwanda
- University of Nairobi
- University of Dar es Salaam
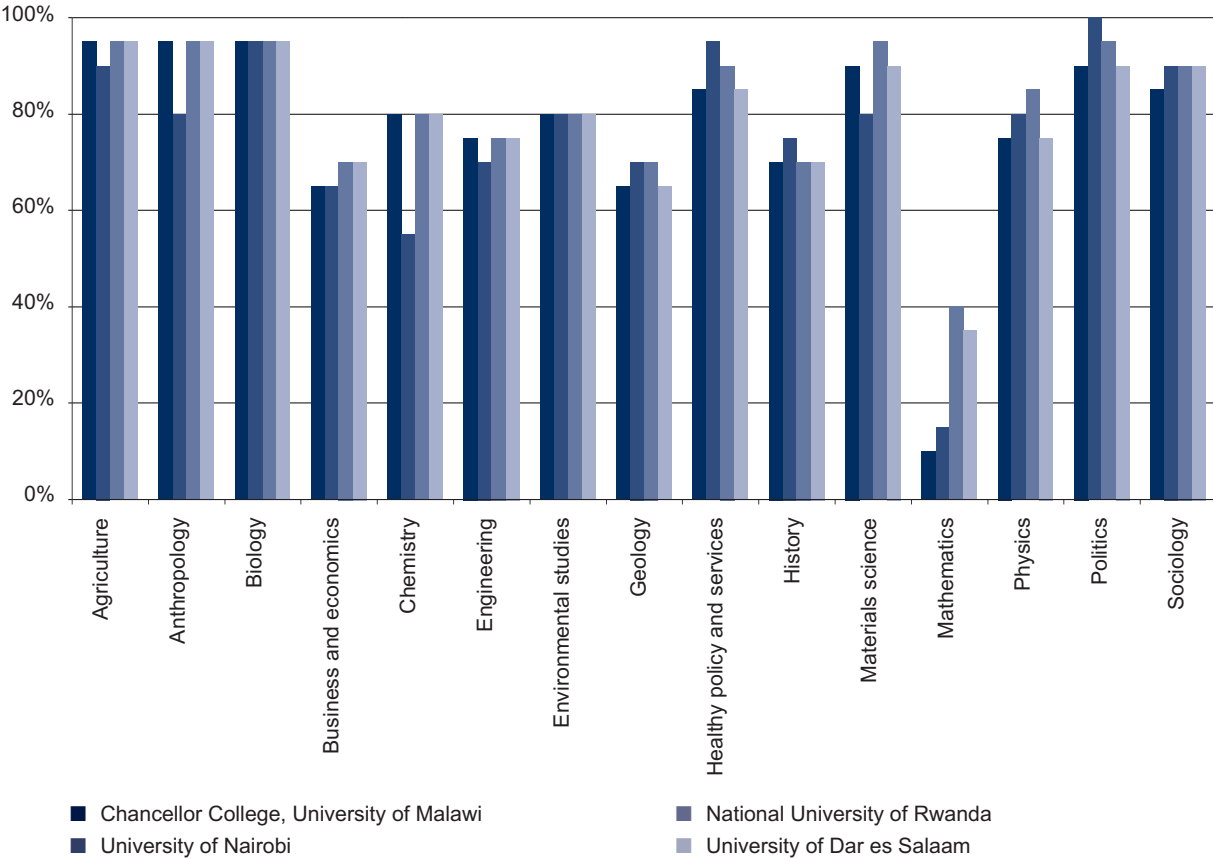
Figure 6: Availability of journal titles by subject

Legend:
- UK and Swedish universities
- Case study universities
- All access schemes
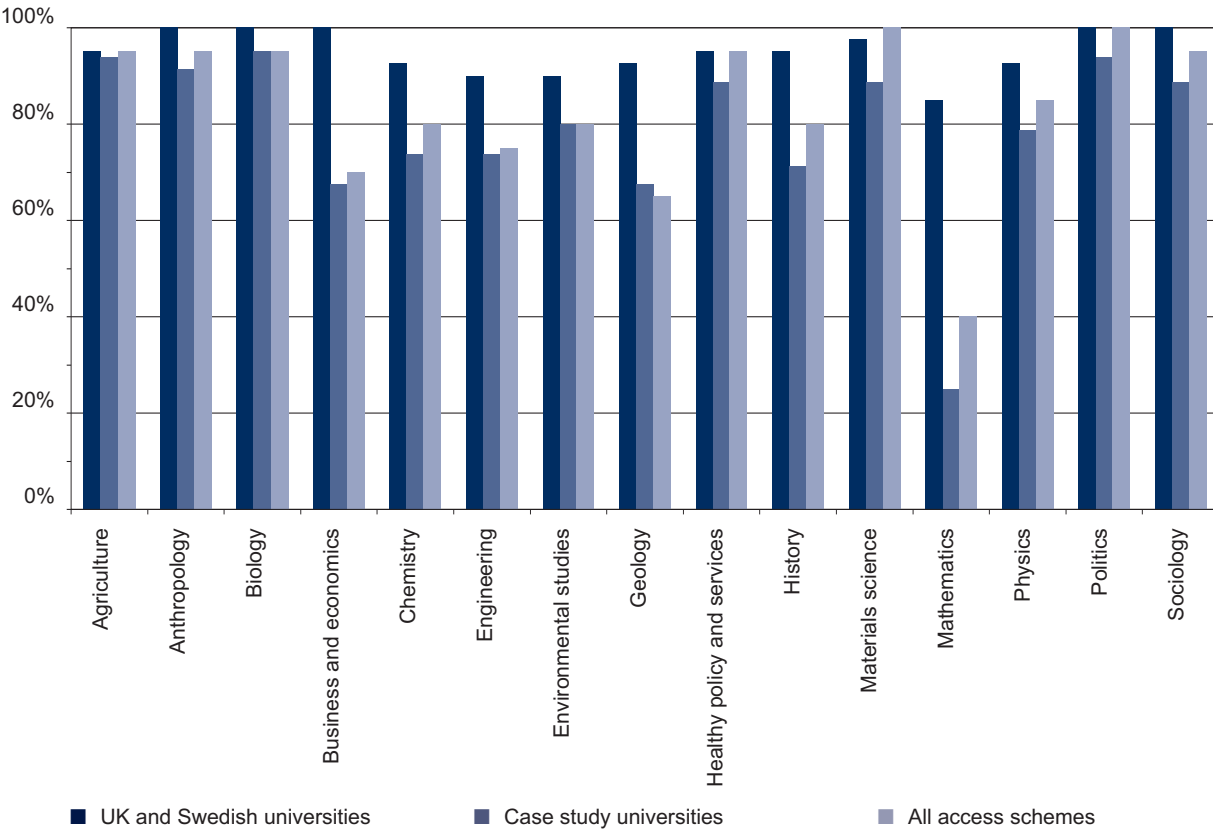
Figure 7: Access to journal titles across all subjects
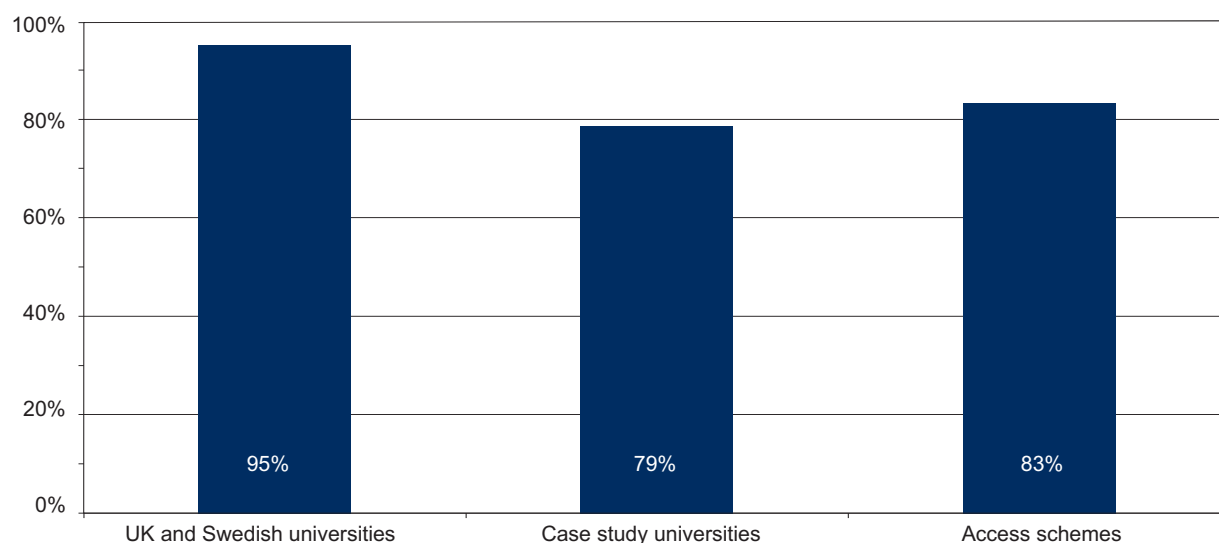
4.2   How well are journals used?

While download figures capture total usage by country, and by institution in some cases, measuring and analysing usage in a more informative and sophisticated way is difficult. Figure 8 (which is derived from Table 6) presents total 2009 downloads for all PERii resources as a function of the total tertiary student population in each country, as a proxy for the size of the higher education and research sector. Again, this is an imperfect measure, particularly as students may not be heavy journal users, and as it does not capture the size of the active research population. Kenya has by far the largest HE and research population, and made the highest number of downloads in 2009; however, when use is adjusted for the size of its tertiary population, it also has a much higher level of use relative to the three other countries. This would appear to fit with Mouton's observation and that of Adams et al, that Kenya is one of the continent's largest producers of academic research (see above).[33]

Table 6: Data on PERii use by country[34]

	Malawi	**Kenya**	**Rwanda**	**Tanzania**
Tertiary enrolments	65,000	140,000	26,000	55,000
Searches performed	8,267	284,520	3,055	14,963
Total documents obtained	18,746	351,218	12,451	61,909
Ratio of searches performed to tertiary population	0.13	2.03	0.12	0.27
Ratio of downloads to tertiary population	0.29	2.51	0.48	1.13

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33 Mouton, *A baseline study*; Adams et al
34 Figures on tertiary enrolment from UNESCO Institute for Statistics *Global Education Digest* 2009 (2009). Figures on PERii use from INASP (2009).

Figure 8: Ratio of downloads and searches performed to tertiary (student) population by country[35]

Legend:
- ■ Ratio of searches performed to tertiary population
- ■ Ratio of downloads to tertiary population

Values shown:
- Malawi: 0.13, 0.29
- Kenya: 2.03, 2.71
- Rwanda: 0.12, 0.48
- Tanzania: 0.27, 1.13
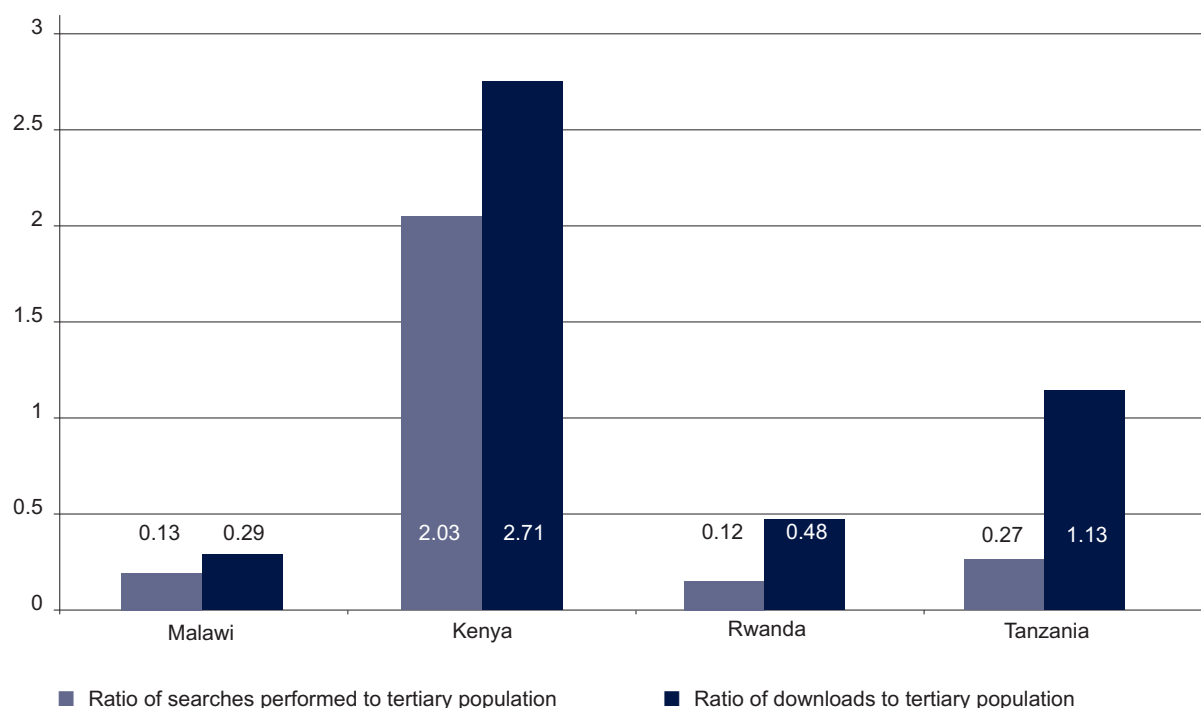
However, communication with colleagues at INASP who have reviewed usage figures over a number of years has highlighted some reservations as to the overall reliability of these figures, with significant variations sometimes linked to technical problems in the gathering of statistics by publishers. For example, in 2008, Kenya accounted for almost half of the usage of JSTOR from all of INASP's partner countries, while in 2009 Kenyan institutions had difficulties accessing Oxford Journals, meaning that figures were depressed as a result. In all countries, Wiley-Blackwell statistics do not appear to reflect usage accurately, which apparently may be due to the way in which the new platform interacts with Google, and thus how resources are discovered. Falls in full-text downloads might also feasibly be expected for some publishers, as users become more proficient at reviewing the potential value of an article from its abstract, rather than downloading the full version.[36] Usage figures are, therefore, produced here as a very rough guide and to offer some sense of relative use by country, but a one-year snapshot is of limited value in understanding real usage patterns.

35 Figures from 2009
36 PERii usage commentaries shared by Anne Powell at INASP.

5. Research, technology and connectivity

5.1 Broadband infrastructure

Accessing and using electronic journals depends on reliable and fast internet and good ICT facilities. As Kotecha suggests, this can be best conceived of in a series of layers, beginning at the bottom with campus-level infrastructure and ICT staff (a well-managed network, sufficient computers, and the optimisation of available bandwidth), national infrastructure (including fibre-optic cable networks and affordable bandwidth, secured through the development of NRENs), regional interconnectivity between national networks, and connections to international networks through undersea cables and arrangements with regional networks in other parts of the world.[37] This has both infrastructural and financial implications, as well as policy, strategic and managerial dimensions. Sufficient 'political will' is needed, and investments in facilities and staff must be prioritised and managed in order to achieve this. It also requires engagement at a range of levels, from the leadership of individual universities to national and even regional policymakers. Emphasising the huge volume of material available, if the connections and facilities are assured, may help to encourage and drive university infrastructure investment, particularly since it would result in immediate benefits.

Latest developments

As has already been noted, several substantial undersea cable projects, some already operational with further cables being laid, have the potential to transform internet access on the continent by delivering much greater bandwidth and improving connection speeds between Africa and the rest of the world. Cable developments currently benefit coastal locations most, but terrestrial infrastructure is improving in some countries; in Kenya, for example, the capital Nairobi, some 500km from the coast, has already experienced significant improvements, with Kenya having made early efforts to improve its land cabling.[38] While terrestrial infrastructure will need to be substantially upgraded, in addition to the implementation of national telecommunications regulatory policy and licensing, Kotecha notes that the continent already has a significant network of high-capacity fibre-optic cabling, laid by telecommunications operators and power utilities, which could also benefit the higher education and research sector if policy and financial barriers are addressed.[39] In addition, a European Commission-sponsored study (Africa-Connect) is investigating the potential to connect African institutions with their European counterparts through strengthened and interconnected African NRENs being linked to GÉANT, the European network.[40]
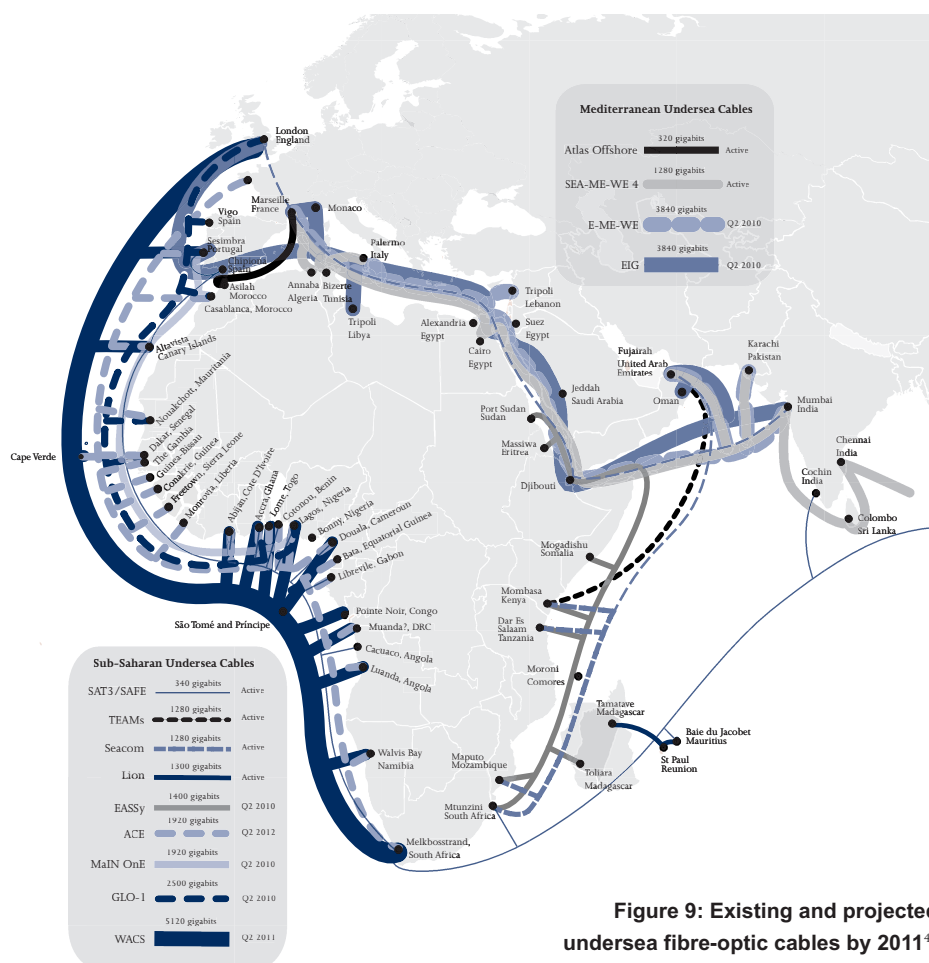
Figure 9: Existing and projected undersea fibre-optic cables by 2011[41]

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37 Kotecha, '"*Dazzling technologies*"'
38 Discussion with Josphat Karanja, KENET, 2 September 2009
39 Kotecha, '"*Dazzling technologies*"'
40 See www.feast-project.org. For a fuller discussion of some of these issues, see Kotecha, '"*Dazzling technologies*"'
41 Data as of April 2010. Credit: Steve Song – http://manypossibilities.net/african-undersea-cables

5.2   How connected are they? Internet connectivity and bandwidth

Internet connectivity and bandwidth differs significantly across the four case study universities. Personal experience at the University of Nairobi demonstrated that internet connectivity is very good and causes few problems, while connections are good but slightly less reliable at the National University of Rwanda and the University of Dar es Salaam. The visits to Nairobi and Dar es Salaam took place just after internet access had been considerably improved with the laying of the new undersea cable, but many users were still complaining of poor speeds based on their long-term previous experience of this. At Chancellor College, which relies on a VSAT (satellite) link, the situation is considerably worse. The connection is slow and, when downloading journals, data packets are frequently lost and files corrupted. Many respondents to the survey, and in the course of interviews and discussions, commented that poor connectivity, including slow speeds, dropping connections, and the related problem of intermittent power supply, frustrates their attempts to access electronic resources. One respondent commented that '[the] internet is very slow during "normal" working hours. I usually have to stay late or come during weekends to make effective use of the web'. Another complained that 'Downloading electronic resources is not easy because our internet is too slow. It requires a lot of patience. To download important resources it can take one the whole day'. This impacts on not only students' ability to access academic articles, but also critically their familiarity with the resources available to them and the chance to improve their search and navigational skills.

Comparison of broadband speeds

Figure 10 illustrates current bandwidth at the four institutions, with figures for the UK academic backbone (JANET) for comparison. Kenya and Tanzania have both benefited substantially in the last six months or so from the new undersea cables, while Rwanda is set to benefit from a link to the coastal cables, but only once ground cabling reaches it via Uganda.[42] Nevertheless, a recent US report found that Rwanda had faster broadband speeds than South Africa, and substantially faster than its neighbours Kenya and Tanzania.[43] Malawi, on the other hand, relies entirely on expensive satellite connections, and there is no current indication of plans for a ground cabling project to connect it to the coastal cables. Nevertheless, it should be acknowledged that the satellite connections, which provide dedicated access for the country's universities and research institutions, represent a major triumph, with librarians playing a large part in securing the installation of four VSAT satellite terminals in 2005, and in so doing transforming internet accessibility within the universities.

Figure 10: Total bandwidth across case study universities[44]

Chancellor College, University of Malawi	University of Nairobi	National University of Rwanda	University of Dar es Salaam	UK JANET backbone
1.7 Mb/s	45 Mb/s	6 Mb/s	10 Mb/s	10000 Mb/s
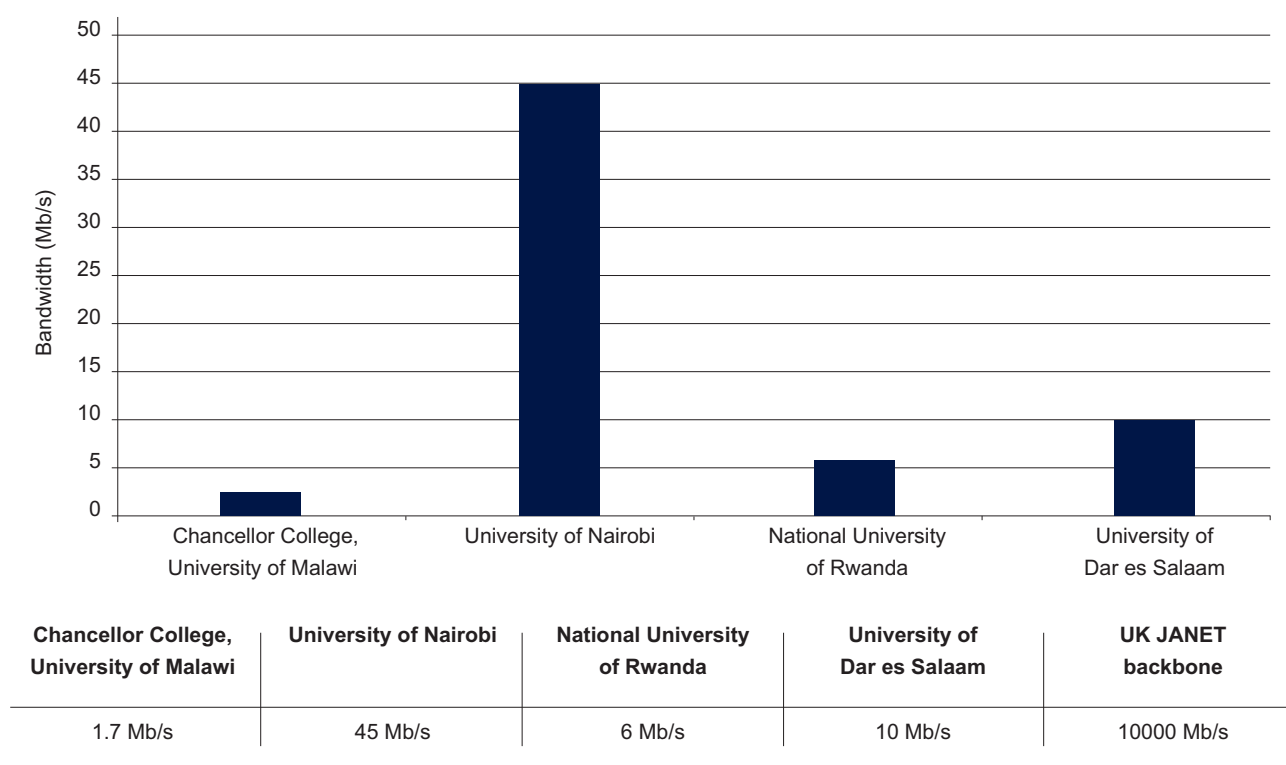
42 Currently, Rwanda has a cable connection to Mbarara in Uganda, while there is already a connection from Kampala in Uganda to Mombasa, Kenya. News reports suggest cabling from Uganda to the Rwanda border, and thence to Kigali, will be completed in early 2010. 155 Mbps will be available within Kigali in the first instance: http://allafrica.com/stories/200911130341.html; http://allafrica.com/stories/200911260047.html

43 See http://allafrica.com/stories/201007191465.html and original index prepared by Ookla based on consumer speed tests at www.netindex.com/download/allcountries

44 Data from 2009

Bandwidth per user

To understand what ICT access means for individual users, it is helpful to consider bandwidth and computing facilities in relation to the number of users. In 2008, a profile of the level of e-readiness in the east African region (not covering Malawi) compiled by KENET suggested that Rwandan universities actually had the highest computer to student ratio and the greatest bandwidth available per individual student (Table 7). These figures will have changed considerably with the laying of the coastal cable, but it nevertheless helps to show that connectivity is not simply a matter of total bandwidth available, but a function of the number of users this must serve, and the number of computers to which they have access. To illustrate what bandwidth means for an individual user using more up-to-date figures, which postdate the coastal cables, Table 8 shows the time taken to download a PDF journal article of under 1 MB in each of the case study universities. This clearly demonstrates that the University of Nairobi has by far the best connectivity, with an article available within minutes, but Chancellor College fares the worst, taking 45 minutes for an incomplete download before the connection timed out.

Table 7: Comparison of selected ICT measures for east African countries[45]

	Kenya	Rwanda	Tanzania
Number of participating HE institutions	17	7	9
Total number of students	162,319	32,450	41,816
Total bandwidth available (uplink and downlink, Mb/s)	70.8	31.5	17.2
Bandwidth per 1000 students	0.44	0.97	0.42
PCs per 100 students	5.3	7.3	2.7

Table 8: Time taken to download an article at case study universities[46]

Chancellor College, University of Malawi	University of Nairobi	National University of Rwanda	University of Dar es Salaam
45 minutes for 80% download, then timeout	3 minutes	4 minutes	4 minutes

5.3   Access to computing facilities

'The biggest challenge is access to a computer. The computer rooms are normally crowded and there is pressure of time. Since others would be waiting to use the same.' (Nairobi)

'Because of limited computers, I usually save online PDF/Word resources [on] my flash disk and use it in my laptop. It would be inconsiderate to read it in full while colleagues are in a queue.' (Nairobi)

'On my own laptop, the internet is very expensive while using my own modem and it is not easy to get always facilities at NUR because of lack of offices with internet connection!' (Rwanda)

'Limited use of computers in the library…hinders one from further exploring areas of research interest.' (Nairobi)

As the KENET figures (Table 7) show, connectivity and access depend fundamentally on adequate levels of computing facilities available to staff and students. Results from our survey suggested that computer access within the four universities is actually relatively high – 93% overall. Only 9%, 8% and 8% of respondents at the universities of Nairobi, Rwanda and Dar es Salaam respectively have no computer, with the majority of these being postgraduates and the remaining lecturers, researchers or tutorial assistants; all respondents at Chancellor College indicated that they have a computer. [47]

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45 Figures from KENET, *E-readiness Survey of East African Universities* (2008)

46 Tests undertaken using a 994 kB PDF article from Oxford University Press, at mid-morning in August and September 2009.

47 The survey was originally intended as an online exercise; however, as most responses were completed on paper questionnaires, this is unlikely to have resulted in a significant bias. A greater proportion of responses from the University of Malawi were completed online, which may explain why no non-computer owners were reported.

However, in discussions with academic staff and postgraduate students, the lack of computers was frequently emphasised. While most academics have their own computer, students encounter particular difficulties in gaining regular and sufficient access to internet-connected machines. Reliable figures for student computer access are always difficult to obtain, not least because students use internet cafés and other external access points as well as library and department computer labs, but figures obtained from the universities suggest that computer/student ratios range between one computer to every 20-30 students. The National University of Rwanda's target is one computer to every eight students by 2013, a current shortfall of some 1,244 machines, while the University of Nairobi's target is one computer to every five students. In some cases, students are charged for computer or internet time on campus, which effectively means that they must pay to access e-resources – a second level of charge, on top of what the university pays in access subscriptions. This has discouraged the use of e-resources, with limited computer time being spent on other, in many cases non-academic, activities.

While sufficient computing facilities are essential if students are to make good use of e-resources, particularly at postgraduate level, and while libraries are investing as much as possible in additional facilities, this is not a need that the library can meet alone. The university, through a central budget facility, or departments through their line budgets, supplemented accordingly by the university, will need to make substantial investments of their own if students are to access the material required for their studies. Universities are already providing considerable financial support for their electronic library subscriptions. However, if additional investment in the computers and networks needed to access these is not made, they are likely to remain largely underused – and as a result relatively much more expensive, when subscription costs are compared to actual use.

Figure 11: Computer access at case study universities

Legend:
■ Computer (owned or provided by university)   ■ No computer
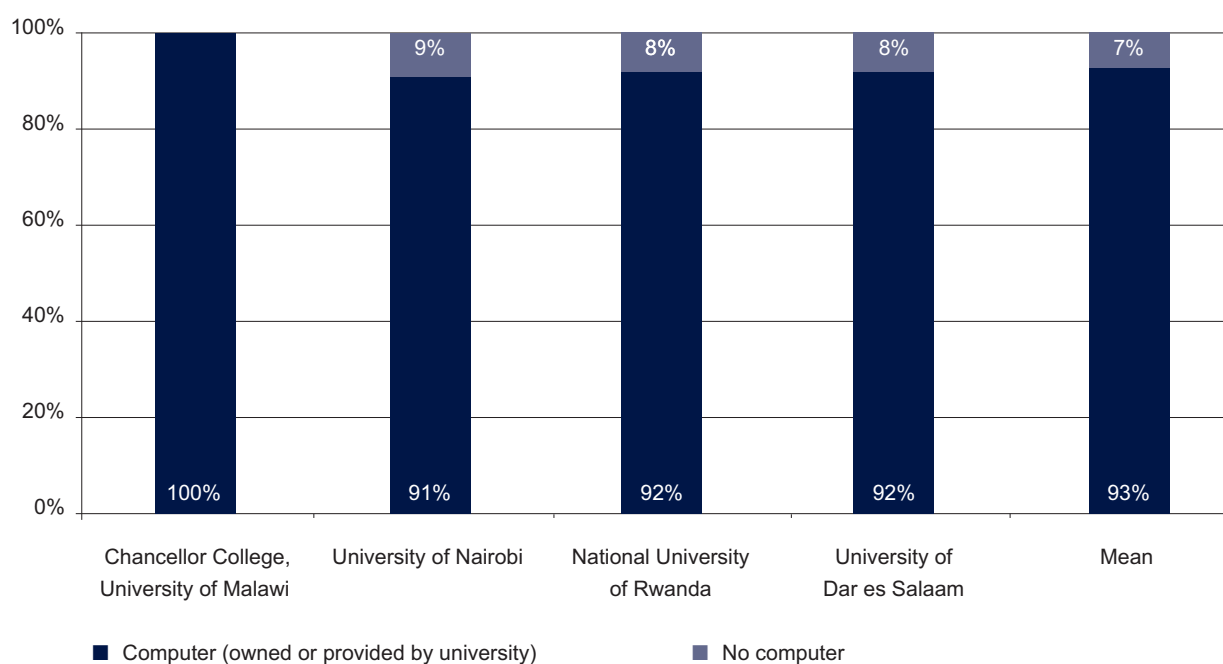
Table 9: Student computer access at case study universities[48]

	Chancellor College, University of Malawi	University of Nairobi	National University of Rwanda	University of Dar es Salaam
Total number of students	3,015	37,000	9,948	19,650
Total number of student PCs	100	1,850	365	unavailable
Computer/student ratio	1:30	1:20	1:21 (1:27)	unavailable
Computers in the library	65	200	56	30

5.4 How often do researchers use the internet?

While these figures offer a measure of campus ICT facilities, perhaps more significant is the level of access users actually have to these – a function of the number of machines available, and also time, and in some cases cost. On average, 68% of survey respondents, both academics and postgraduates, spend more than six hours a week using a computer (just over an hour a day), and 34% spend more than ten hours a week at a computer. However, a third (32%) spend less than six hours a week. These figures suggest that, while some users spend an adequate amount of time using a computer each week, the time for others to familiarise themselves with electronic resources and to use them effectively is relatively constrained.[49] Personal experience of searching and navigating e-journal sites for material, on a relatively fast connection, suggests that it can often take a considerable length of time to identify anything of value. Similarly, user observation exercises indicated that an hour is a relatively short period of time to actually locate and compile material for a particular research need; after an hour, many users had managed to locate only one or two articles, and these were often of questionable relevance or quality. All of this indicates that low use is not simply a library or ICT issue, but one which is fundamentally linked to the teaching process and course content development, and the extent to which students are required or encouraged to use and explore journals and other scholarly sources in their studies.

The frequency with which people search the internet for academic purposes appears to be relatively high. 42% of respondents reported searching the internet for academic purposes more than five times a week (thus at least once a day), and 48% between once and five times a week. However, it is not possible to say how much time is spent on each occasion, or how successful the searching was. Nevertheless, 14% spend very little time on the internet, searching for academic materials just three times a month or less, suggesting limited opportunities to familiarise themselves with online sources and obtain useful material. Less use undoubtedly results in less *effective* use.

Figure 12: Total time spent on a computer per week at case study universities

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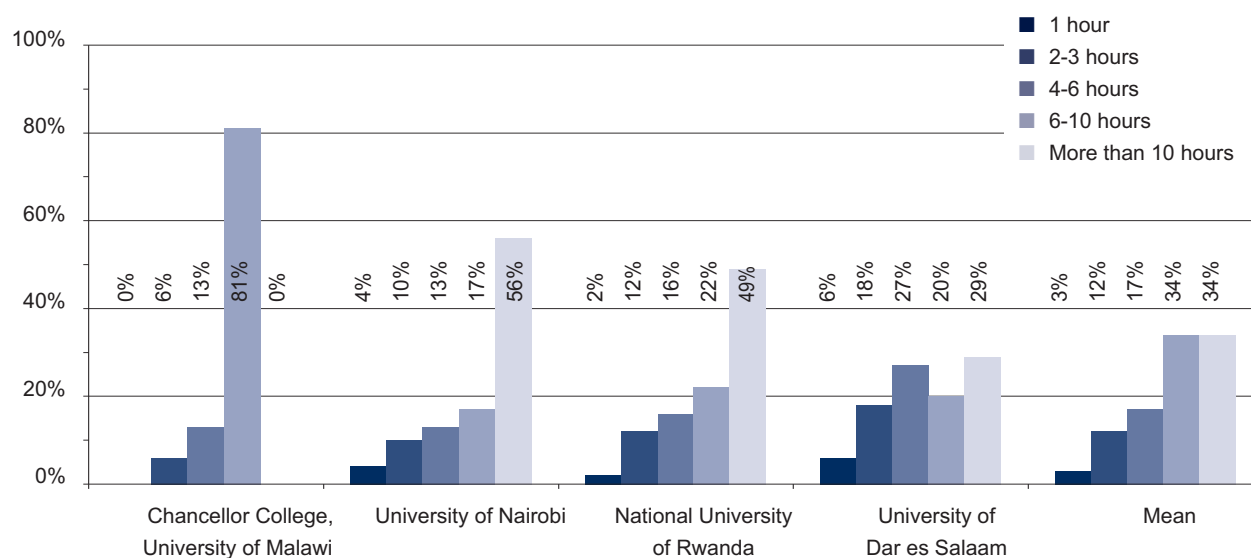
48 For Chancellor College, the total number of computers was estimated by library staff based on 65 in the library, 20 in the mathematical sciences computer lab, and scattered PCs in other departments. For the University of Nairobi, figures for student numbers and computer/student ratio were provided, and the total number of PCs extrapolated from this. For the National University of Rwanda, official figures reported a computer/student ratio of 1:21, but student and computer numbers suggest 1:27 (numbers do not match exactly the ratio provided).

49 Because the University of Malawi questionnaire was the first to run, the option of 'more than 10 hours' was not available, as this was only introduced to later surveys.

Figure 13: Frequency of internet searching for academic materials at case study universities

Chart data (percentages by category per institution):

	Chancellor College, University of Malawi	University of Nairobi	National University of Rwanda	University of Dar es Salaam	Mean
Never	0%	0%	0%	0%	0%
Less than once a month	2%	4%	2%	2%	3%
Once a month	2%	2%	6%	2%	3%
2-3 times a month	4%	2%	14%	12%	8%
Once a week	0%	8%	10%	4%	6%
Twice a week	9%	15%	20%	10%	14%
3-5 times a week	28%	30%	20%	33%	28%
More than 5 times a week	55%	40%	29%	37%	40%
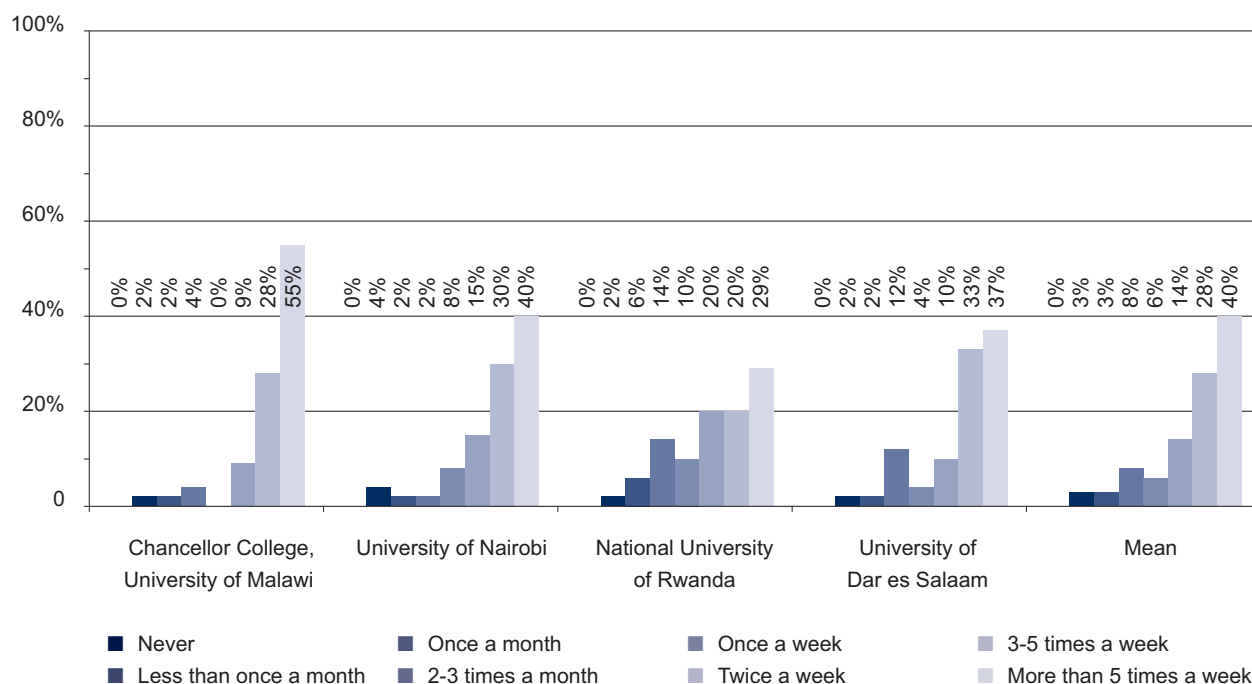
5.5   The management of local networks and internet bandwidth

While NRENs and connections to international networks through the undersea cable system can deliver greater bandwidth to university campuses, the extent to which this allows researchers to access e-journals and other scholarly content depends on the quality of local networks. Without good local infrastructure and network management, valuable resources remain locked away. A university may secure good bandwidth, but poor network management can see bandwidth easily lost, drained by users visiting football and entertainment sites, by resource-hungry webmail systems such as Yahoo! and Hotmail (often carrying adverts and graphics), or by spam and virus traffic which can easily exploit insecure systems. This then leaves little bandwidth for researchers attempting to access high-priority academic databases. The temptation is often to purchase more bandwidth – to try to increase the capacity of the connection – but this additional bandwidth is then quickly consumed. These are global challenges for libraries and ICT departments, but their impact in areas where bandwidth is absolutely more restricted and relatively more expensive is much greater. Optimising existing bandwidth, by introducing controls on its use and by prioritising some traffic – such as to named publishers' sites – over other requests, can dramatically enhance the potential of an institution's connectivity, and also means that the advantages of – and investments made in – ICT are not lost.

Bandwidth management

ICT staff at three institutions reported that bandwidth is managed to some extent; staff at Chancellor College reported that there are currently no measures in place to optimise and manage their bandwidth, meaning that its expensive satellite connectivity is not being used to best effect and its academic potential is significantly compromised. Networks can also be severely compromised (and slowed) by viruses and spam traffic. All the case study institutions suffer to some extent from viruses and spam. In most cases, students are forbidden from using external media (USB flash drives, for example) in university computers to avoid viruses being introduced, but this does not eliminate the problem. The situation is particularly bad at Chancellor College, where the network appears to suffer heavily from viruses, and there is no campus-wide policy for maintaining filtering and blocking software and few restrictions on what students can do (for example, downloading additional software). The importance of local network management was emphasised by one Malawian librarian who noted that, while the College of Medicine and Chancellor College both have the same bandwidth and have benefited from the same training, the former fares much better and its network is much more reliable.

Many users also prefer to use Hotmail, Yahoo! or Gmail-type accounts (49% of survey responses came from such addresses), which can be accessed externally. These put a relatively higher load on the network; up to 25% of bandwidth could potentially be saved through use of institutional email systems.[50] Institutional email services are provided at all the case study universities, but increasingly these are being supplied by external providers, notably Google. This is an international trend, and the University of Nairobi and the National University of Rwanda have both moved to Gmail services. As a result, institutional email in these universities still requires external traffic (although Gmail is lighter than some of the other external services available).[51]

In several cases, universities had introduced or are introducing wireless networks on campus, in order to provide internet access points for those with their own laptops, thus reducing the burden on fixed terminals. This has the potential to significantly open up internet access (many academics and increasingly some students have their own laptops) but, of course, the more computers on a network at any one time, the wider its capacity is shared, and the lower the capacity available to any single user machine. Good network and bandwidth management thus becomes of even greater importance.

Authenticating access

In all cases, electronic resources hosted on publishers' websites are accessed via IP authentication – such that a user accessing them from a campus computer is automatically given access to the full text article without requiring additional usernames or passwords. While this has the advantage of users being able to access resources more easily, without having to obtain passwords from the library and without the library having to regularly update these, it does cause problems for academic staff and students who wish to access materials off campus. This is particularly the case for researchers whose evenings and weekends are often the only real time they can devote to research. In the UK and other countries, off-campus access is typically enabled by the use of a proxy server. Users log into a server hosted at their own institution using their own unique login (usually the same as their email account login), and the server then authenticates them to access the publisher's server, redirecting them to it. A proxy server has reportedly recently been installed at the Nairobi-based International Livestock Research Institute, and librarians are keen to explore the possibility of such an approach at their own institutions.

5.6   Relationships between libraries and ICT departments

Central to the issue of ICT and electronic access are the relationships that exist between the library and the university's central ICT department. The delivery of library services relies ever more on ICT facilities, competencies and knowledge. A good understanding of ICT issues by the library, and of library needs by the ICT department, is therefore critical. ICT-library relationships vary across the four universities. At some, the link between the two is strong, with each understanding the other's needs and working well to achieve these, while, at others, it appeared that ICT colleagues do not recognise the need to work with the library on ICT-related issues beyond the provision of computer support and internet connectivity. E-learning is a priority for many universities and, in a number of cases, it seemed that the ICT department is orientated much more towards developing services to support the university's e-learning ambitions, but its potential to work with the library to strengthen e-resource access (a crucial part of e-learning) is often overlooked or poorly understood.

Varying relationships

At the National University of Rwanda, the campus network and ICT facilities are well managed, but there appeared to be some disconnect between ICT and library planning and development. At present, the expertise and skills of the ICT unit are directed principally towards e-learning and related initiatives, with support for the development of websites and portals for this. However, it seemed that the current and emerging needs of the library have been overlooked. More coordinated ICT for the library, such as in the management of e-resources and the development of better web-based access routes, would help to better realise its potential to strengthen research and teaching. The library at the University of Dar es Salaam benefits from being able to run its own ICT unit, but staff within it felt that they are not always properly involved in campus ICT planning and development as undertaken by the central ICT centre. This was observed to cause difficulties for the library and its own ICT systems and services. At Chancellor College, there was no central ICT unit at the time of the study, and responsibilities were divided amongst staff in the library and elsewhere on campus (a new director of ICT has since been appointed, along with two assistant directors). It was thus difficult for the library to develop a coordinated ICT-library strategy, which related its needs and services to ICT development on campus and ensured that it was recognised within university ICT planning. However, at national level, University of Malawi librarians through MALICO (the national consortium) have been instrumental in establishing the country's VSAT network and MAREN (the Malawi Research and Education Network). The relationship between ICT and library services appeared to be strongest at the University of Nairobi. The fact that KENET (the Kenyan NREN) is hosted in the library's directorate is undoubtedly significant, both signalling the close links between library and ICT issues, and also providing opportunities for the two to interact and learn from each other.

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50 Estimate by Aptivate; emails sent internally on an institution's own email systems would all be local traffic.

51 Martin Belcher, 'Strategic bandwidth management, enabling ICTs for optimal impact', presentation to the ACU Conference of Executive Heads, 29 November 2008

6. Discovering and accessing research: awareness, searching and skills

'So far books and websites constitute my exclusive academic sources.' (Rwanda)

'I have not tried to find out what e-journals are available in the college library.' (Malawi)

'Generally I use the internet search engines such as Google because our library does not provide access to electronic journals (to the best of my knowledge). This however is challenging and very limiting.' (Malawi)

'Our library does not subscribe to the best and most of the widely read journals worldwide.' (Malawi)

6.1 How aware are users?

As already demonstrated, east and southern African university libraries have access to a huge range of top-quality online subscription content, and a significant proportion of the top scholarly journals. But, to make use of these e-resources, staff and students need firstly to be aware that they exist and to appreciate their scholarly value, and secondly to know how to access and search them effectively. Improving researchers' awareness of e-resources is a major challenge. Despite considerable promotional and training activity, it is common to find low levels of awareness about what is available. Only 40% of respondents to our survey felt that they have a good or high level of awareness of e-resources, and almost a third (29%) felt that their awareness is either unsatisfactory or non-existent. Only 16% claimed to have a high level of awareness of the e-resources provided by the library.

Figure 14: Awareness of available e-resources at case study universities

- ■ High/good awareness
- ■ Satisfactory awareness
- ■ Unsatisfactory awareness/unaware
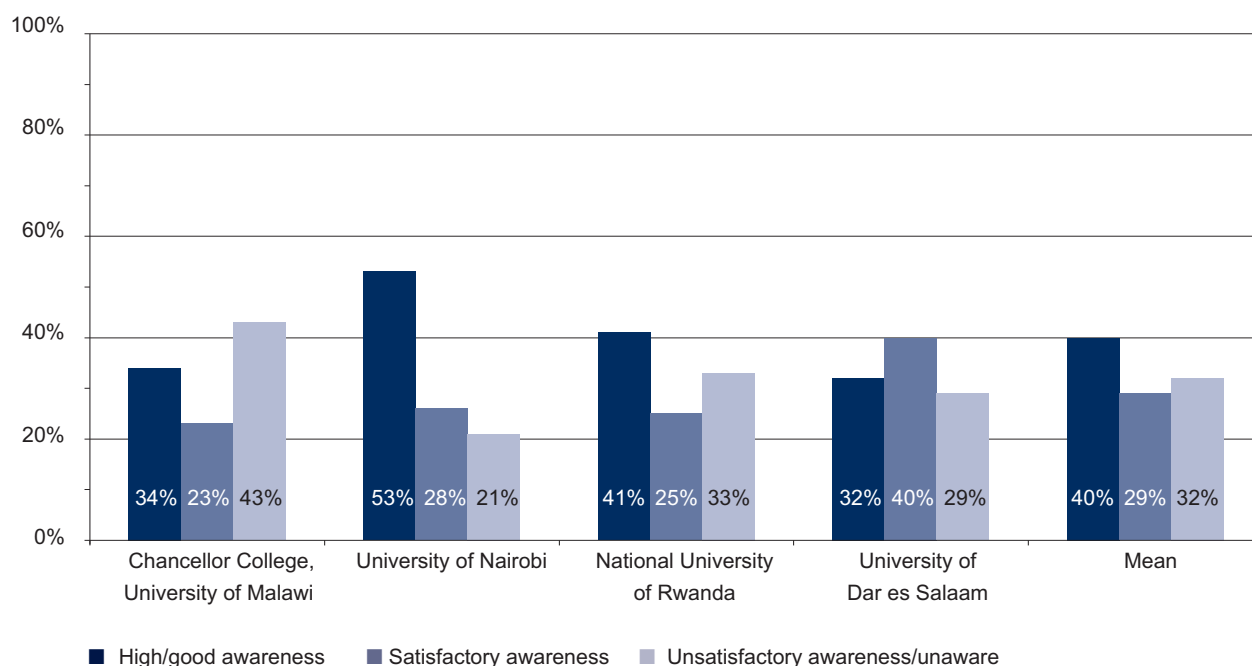
Differing levels of awareness

Levels of awareness differ fairly considerably across the case study institutions, as Figure 14 shows. Awareness is lowest at Chancellor College, generally satisfactory at the University of Dar es Salaam, good at the National University of Rwanda, and highest at the University of Nairobi. The problem is well illustrated by the number of academics and students who, in their responses to the survey, noted that specific titles which they need are unavailable – in fact, in the majority of cases, these are actually accessible via the university's existing subscriptions. On average, 72% of titles reported to be unavailable can be accessed via the university's existing e-journals collection (Table 10).

Table 10: Reported unavailability versus actual availability of titles at case study universities

	Titles reported as unavailable	Actually available	Actually unavailable	Availability (%)
Chancellor College, University of Malawi	180	128	52	71%
University of Nairobi	106	73	33	69%
National University of Rwanda	64	53	11	83%
University of Dar es Salaam	23	16	7	70%
Total	373	270	103	72%

Discussions with academics suggested a number of reasons for low awareness. As with use, awareness is related to research, postgraduate activity and departmental research cultures. If little research is being undertaken – or little research which requires academic literature and citations – then there is little reason for academics to familiarise themselves with available journals. Similarly, if there is little demand or pressure from supervisors and lecturers for postgraduates (and students more generally) to make use of scholarly journals in their work, then awareness of e-journals is likely to be low. In a number of cases, academics argued that a lack of resources for so many years, coupled with an emphasis on teaching, has led many of their colleagues to 'switch off' from the latest literature in their field, and so cultures of academic reading, debate-following and critique have been damaged.

Raising awareness and stimulating demand

The case study libraries have, in general, tried to promote e-resources through leaflets or emails, and to raise awareness through training workshops or other events. Some have made stronger attempts, and some have been more successful than others. The National University of Rwanda has produced a leaflet advertising the range of electronic resources available to library users, and held an e-resources week in February 2009 – a particularly positive initiative to raise the profile on campus – while the University of Nairobi regularly sends out emails to staff listing new acquisitions, including e-journals. However, it seems clear that, while there is still scope for libraries to improve and re-invent their marketing strategies, awareness – and use – are unlikely to improve if there is insufficient demand and appreciation of the importance of journals over less scholarly online content. In many disciplines, journals are important as not only a source of information, but also a way to follow and engage in the debates of the research community. The AuthorAid programme (run by INASP), working with the National University of Rwanda, has experienced some success through publishing workshops showing academics how citing better literature (and thus using e-journals) can significantly improve the quality of their papers.[52] One Kenyan academic also commented that, while they appreciate circular emails advertising recent acquisitions, and can see the library working hard, what they really want is an email saying 'here's what we have in your field'.

In some cases, students, and even some academics, appeared to be unfamiliar with what constitutes a scholarly source. In their responses to the survey, many researchers named non-academic sources when asked to list the most important journals for their work, and a worrying number listed simply 'Google' or other search engines, suggesting a lack of awareness of not only academic e-resources in general, but also relevant journals in their field. The same was true of the observation exercises. While some participants seemed to have an idea of the journals or types of journals in mind, others simply searched Google for very broad terms such as 'journals in finance'. A librarian at the University of Dar es Salaam commented that, while academics know that online databases are available, they do not know what they contain and are discouraged from exploring them. A number of librarians felt that there is a key role for the library to play in delivering research methods teaching across the university. While undergraduate students in some universities receive information skills training as part of a compulsory course, postgraduates often do not receive any such training (see below for a discussion of training).

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52 See www.authoraid.info

6.2 Discovering and locating e-resources

'Not aware how I would access them [journals]. I just use Google search machine to get access to the topic which I want to read about.' (Rwanda)

'Just Google but I fail to get what I want. Mostly I spend too much time wasted with no satisfactory results.' (Malawi)

'I have a major challenge because I am not equipped with the skills/knowledge on how to access or to use electronic resources. Is there a way someone can be trained?' (Nairobi)

'In most cases I use books and dissertations because using electronic [resources] I find difficult and a waste of time. I spend a lot of time [trying] to search for material and in most cases I don't find what I want.' (Dar es Salaam)

'I normally use a trial and error approach which has proved very unrealistic and unsuccessful.' (Malawi)

'Honestly my search skills are very poor. I would love to be drilled in this useful skill.' (Malawi)

How users find what they need

A critical dimension of e-resource use is the ease with which they can be discovered and located by users. This typically depends on users' ability to search for relevant resources effectively or to search within collections of resources. This is in turn both a function of the tools available to them – namely general and academic search engines, such as Google or Google Scholar, scholarly databases, and bibliographic or citation indexes – and their individual approaches to and skills in using these. The ability to search for and locate appropriate material appears to be one of the greatest barriers facing users. The survey asked users about the tools available to them (rather than their own perception of how well they are able to search), while the observation exercises provided a glimpse of the way they approach finding and accessing full-text articles, and some rich examples of the specific obstacles they encounter.

In general, responses were mixed. 37% felt their access to search tools is poor or unsatisfactory compared to 34% who felt it is satisfactory, and just 30% who felt that they have good or very good tools available to them (Figure 15). Users at Chancellor College were the most negative about the tools to which they have access, with 61% feeling these are unsatisfactory or poor. University of Nairobi users were most positive – almost half felt they have good or very good access to the necessary search tools. Interviews suggested that, while some academics are fairly content with their ability to find material, others feel the need for better information and advice on where and how to look for material online.

Figure 15: Access to search tools at case study universities

Legend:
- Very good access to search tools
- Good access to search tools
- Satisfactory access to search tools
- Unsatisfactory access to search tools
- Poor access to search tools
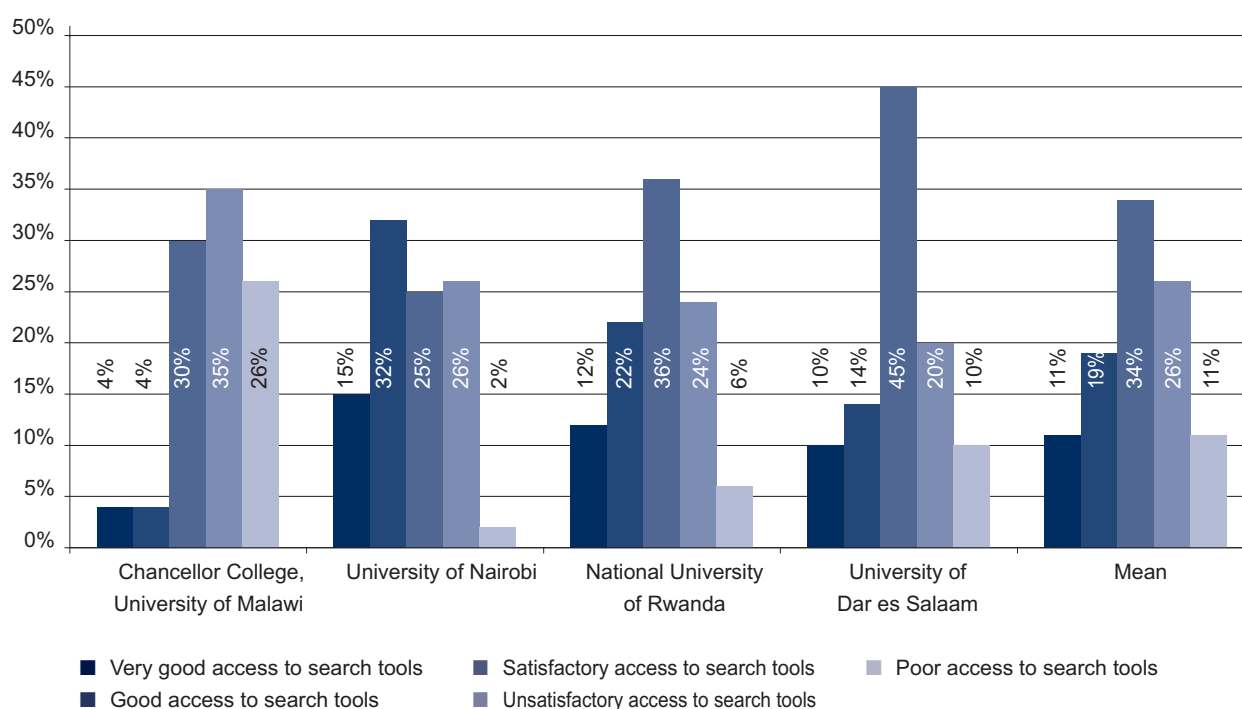
Relying too much on Google?

As was evident from discussions and from the observation exercises, users typically rely heavily on Google or other general search engines for searching. They may not, however, be well skilled at using these effectively, unable to refine the many results returned or assess their quality. One academic at the National University of Rwanda commented that it can take a whole day of searching for material just to get two or three papers. 73% noted that they use Google or a similar search engine to identify journals, while just 32% use bibliographic databases (Figure 16).[53] Recommendations or reading lists from supervisors are used by around a third, and just under a quarter use newsletters or mailing lists from networks or other research associations. Access to suitable search tools was felt to be best at the University of Nairobi, good at the National University of Rwanda, satisfactory at the University of Dar es Salaam, but least satisfactory at Chancellor College.

Figure 16: Methods of identifying relevant journal articles at case study universities

Legend:
- Search the library catalogue (OPAC)
- Ask a librarian
- Check the library website for details
- Consult a library list of resources by subject area
- Ask a colleague
- Browse library physically
- Other

Hesitant and unskilled searching

The observation exercises revealed much about users' individual search habits. In some cases, they were very hesitant, and often appeared unsure of how best to approach the task. One student entered their full essay title into the search field, rather than breaking it down into a series of key words, and as a result returned no results. Often, very general terms were used, such as 'mathe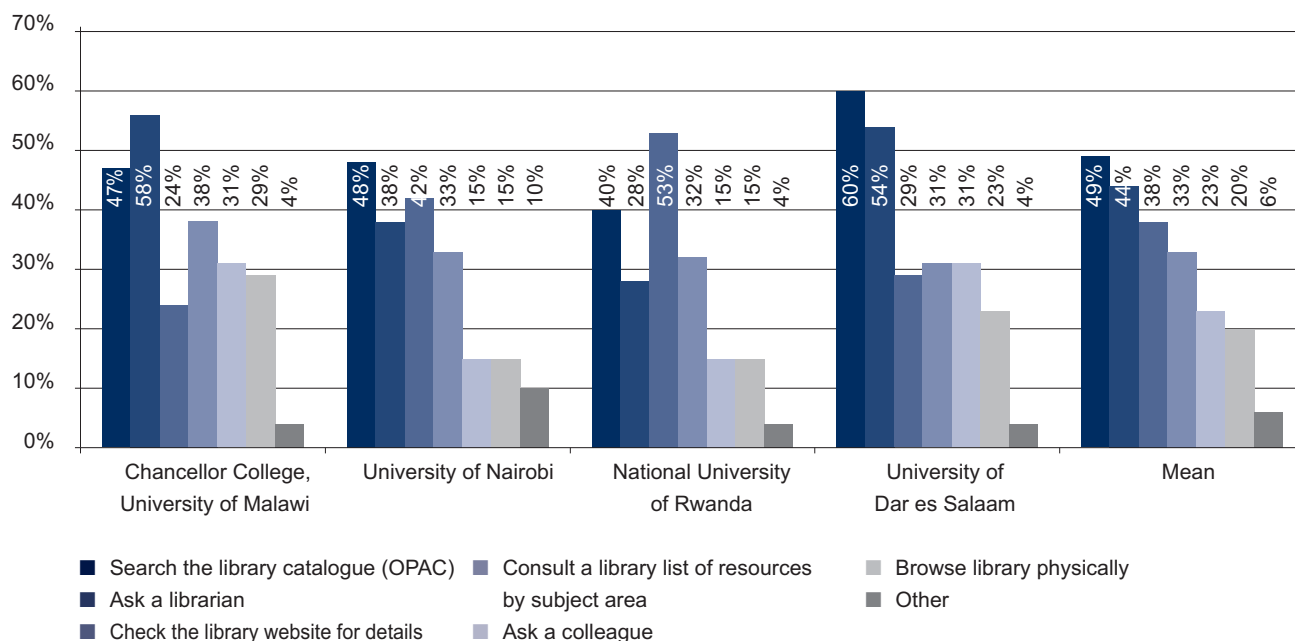matics', 'science education' or 'flavour chemistry', which returned very many unhelpful, elementary and un-academic results in a Google search. These very general searches suggest that users would benefit from training in search techniques. But, while there is clearly a need for improved information skills, these are at root the core skills of any researcher – the ability to understand and frame a research question and to identify and source material and approaches accordingly. Many of the difficulties which users encountered therefore suggested that better research training was needed – something which would potentially involve the graduate school or research directorate, individual faculties and the library. Users did, however, begin to refine their search terms through the course of a particular search exercise. The Google approach led on a number of occasions to a reference to a suitable paper, but on a site which aggregated information on particular subjects but did not offer a link to the full text version. Users who did not appreciate that the name of the journal and volume numbers would allow them to track this down via Google or via the relevant publisher database thus did not proceed any further.

When searching publisher databases, the same difficulties encountered with Google surfaced. In one instance, a user returned no results from the first search for 'epistemology', but then chose to refine this further for a second search ('naturalised epistemology'), which of course did not reveal any further articles. In several cases, users appeared uncertain of the difference between searching Google, searching a publisher's database, and searching the sub-section of a specific journal. The fact that a publisher database was searched in a similar way to Google but, being smaller, was less likely to return any or as many results for a given query, seemed to lead some researchers to conclude that Google was the more useful tool.

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53 It may be that users were unfamiliar with the term 'bibliographic databases'. In hindsight, it would have been useful to include an option of 'publishers' databases', since the observation exercises suggested that some users go directly to publishers' sites with which they are familiar and then search within them.

The under-discovery of subscription-paid resources

'Most of the electronic sources are not free, as such this makes me not [able] to access the most useful information for my studies in time. For example, Blackwell Synergy and Springerlink have useful information but it's not for free.' (Malawi)

'Some of the resources are protected and can only be accessible after paying money.' (Rwanda)

'Most journals which I need I cannot access them because most of the sites on which they are available should be subscribed to and the library has not subscribed to these. Only free sites are available and these do not have many useful journals.' (Malawi)

The quotes above suggest that users frequently come across material which appears to be inaccessible unless a fee is paid – yet Malawi subscribes to both Springer and Blackwell Synergy, and Rwanda has subscriptions to a wide range of publisher databases. The comments above, therefore, are not an accurate reflection of true availability, but do highlight the misconceptions which often surround availability and access. It appears that the under-discovery of subscription resources is in part due to the considerable reliance on Google, which does not always direct users to the correct access points. In some cases, where a Google search reveals a journal from a database to which the library subscribes, a user will be able to click straight through to a full-text version (assuming they are accessing it from a campus and thus authenticated machine). However, Google will also turn up resources to which the library does not subscribe, as well as resources which may not be directly accessible through the publishers' platforms but are nevertheless available through alternative access points, such as the HINARI, AGORA or OARE portals, or the EBSCO database (all libraries subscribe to this, but users must access resources via the EBSCO platform rather than directly through the publishers' sites).

Many survey respondents suggested that they often find useful material but a fee is required to access it, one user in Rwanda commenting that 'Whenever I try to access article[s] in Google, [it] tells me to subscribe first'. In one case, a Nairobi user was directed by Google to a Harvard Business Review page through which they were not able to access the full text publication, and thus gave up – yet the same title was part of the university's EBSCO subscription and would have been accessible had they followed the library links to the EBSCO platform. Searching in this manner means that academics are more likely to be frustrated by what is unavailable to them, than if they searched using the subscription databases provided by the library. In many cases, researchers do not seem to have a specific journal title in mind, and thus the approach of access via specific databases would both reduce likely frustrations and perceptions of unavailability and conversely emphasise what is actually available to them (see section 6.5 on library websites).

Simple misunderstandings

In some cases, basic misunderstandings or a lack of information thwarted users. One user who decided to explore AGORA first struggled to log in, and then chose to search it for maths articles, clearly not appreciating, due to inadequate information on the library website, that it is intended for agricultural research. In a number of instances, postgraduates were not able to open downloaded articles simply because a PDF reader was not installed on their machines. To an inexperienced user, it therefore appears that the file is useless. In one instance, a user was not able to download articles at all, trying to save one page at a time through JSTOR's page-by-page preview. Many users also did not appear to understand the difference between current issue and back-file or archive collections – there were a number of complaints that JSTOR does not give access to the latest issue, for example, or users utilised JSTOR heavily and thus did not gain from the most up-to-date literature. One Malawian respondent commented that 'Most of the free journals do not provide the required materials. So far it is only JSTOR which is reliable, although most of the articles which are accessed through JSTOR are old' (JSTOR's moving wall is between three to five years depending on the journal). Similarly, users were often slowed in their searching by opening pages which turned out to be worthless, but still took time to load. If students and researchers were better able distinguish a good or bad source by recognising URLs (publisher sites or scholarly-looking sources), they might be more selective when choosing those to explore further. All of this comes, of course, from experience, but undergraduate years are important in helping to develop this.

Unfamiliarity with the information landscape

Overall, the surveys, interviews and observation exercises suggested that, while some researchers are comfortable finding what they need, a sizable number are unfamiliar with the general landscape of online academic material and sources – what might be found where, what would not, and what the advantages or limitations of particular sources or sites might be. Younger researchers appear to be less familiar with what constitutes a scholarly source, while more experienced academics more often know what they want to use but are less comfortable navigating online environments. In discussions with librarians and with some researchers, the issue of an aggregated search tool was raised – a facility which would enable users to search across the full range of subscription resources available to them, without having to familiarise themselves with each publisher's platform and content. The technical difficulties of aggregating such metadata aside, while this is no doubt an appealing solution, it may actually distract from the real issue, which is that researchers, in an increasingly online world, need to become much stronger at searching for and finding the material that they need, and developing the skills to do so with the full range of available tools.

6.3   Developing skills and training users

'I'm always unable to access day to day articles produced worldwide due to lack of enough high training on the use of e-resources.' (Rwanda)

'I have a major challenge because I am not equipped with the skills/knowledge on how to access or to use electronic resources. Is there a way someone can be trained?' (Nairobi)

The unmet training need

The preceding section on the 'discovery' skills of researchers, and earlier considerations of awareness and use, emphasises the need for better training. Although libraries are actively engaged in training their users, 78% of those responding to the survey had not received any form of e-resource library training (Figure 17). One Tanzanian academic commented that 'Most of the staff and students are not aware of the availability of electronic sources and how they could be accessed. I have never heard about any seminar or workshop on the same. There are no efforts to educate library users on such sources'. The issue appears to be partly the low take-up of or attendance at training which is offered, and partly the success of training itself. In a number of instances, librarians felt that group sessions do not work as a mode of delivery, because users lack the foundational ICT skills required to benefit from them, or because groups are of too mixed an ability range for them to work well. One Tanzanian student commented that 'More information [workshops] should be provided because that [which] I attended was provided in a very short time, a single class having large number of students sitting at a single computer. And it was [at the] very beginning of my study, while I was unfamiliar with computer[s]'.

In several cases, the need to train more users was well recognised, but staff felt unable to deliver the volume of training needed within current staffing levels and expertise. At the University of Dar es Salaam, for example, there is a regular training programme for students with a good number signing up each time. However, librarians commented that in the time offered by a single training session – often only an hour – it is difficult to give users a sufficient grasp of the available resources and the skills to interrogate them effectively. This is especially true when many are not confident computer users to begin with. Restricted opportunities to spend time exploring new resources following training sessions, as a result of insufficient computer access, further limits its impact. Comments by staff in a number of institutions suggested that ICT and e-resource training needs to be better linked, as the latter cannot be successfully achieved without the former.

Figure 17: E-resources training received at case study universities

	Workshop attended	Workshop not attended
Chancellor College, University of Malawi	9%	91%
University of Nairobi	21%	79%
National University of Rwanda	35%	65%
University of Dar es Salaam	22%	78%
Mean	22%	78%

■ Workshop attended ■ Workshop not attended
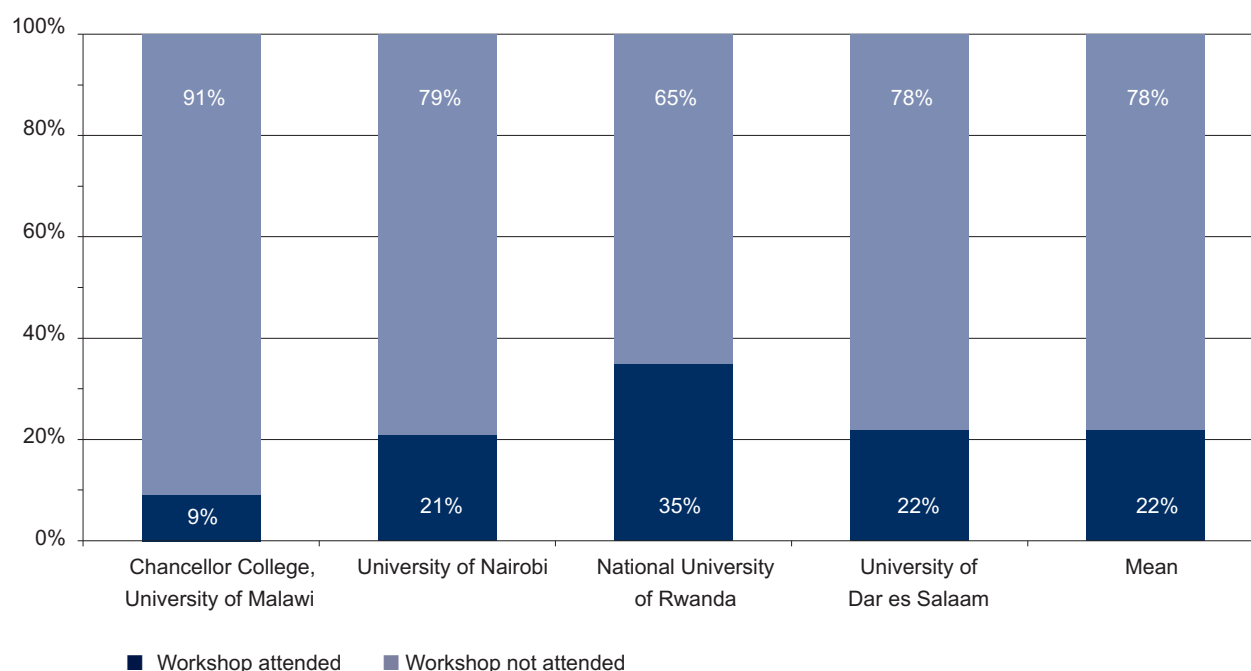
Focusing training

Being able to reach a sufficient proportion of the potential user population is clearly a challenge at each of the case study universities. One librarian commented that 'while we have the databases we haven't yet reached many users to train them in how to locate and use them'. Academic staff, too busy or reluctant to attend workshops, are commonly felt to be hard to reach, requiring a one-on-one approach which is particularly time-consuming when there are limited library staff available to demonstrate e-resources. This suggests that there would be particular value in trying to develop advocates and representatives in departments, so that those who do attend workshops or interact with the library can help to spread awareness more widely. It may also suggest that training should be focused on those most likely to benefit from it. A proportion of users may be sufficiently adept or possess a strong enough research drive to effectively train themselves, while a proportion may demonstrate little interest in research or training which supports this. If this is the case, then it would make more sense to concentrate training efforts on the proportion who actually do research and demonstrate a real interest in furthering their skills.

Changing behaviour and generating demand

Developing skills is not always, or only, a matter of training. Instead, it is relies on changing users' behaviour, so that they not only know how to access e-resources but also see a reason to do so. In part, this requires training to be offered at the right time – such as immediately before students embark on final projects or dissertations (this was frequently suggested in the case of undergraduates) – or in such a way as to more effectively match individual users' needs. Training might, for example, be more explicitly tailored to a specific area of research. It also means that *demand* must be created for e-resources before training is delivered. Without this, training is likely to be poorly attended, not to grab the attention of a researcher, or not to link to their actual needs. This might, for example, involve a training session around using e-resources in historical research or languages, or e-resources for studying particular topics or themes.

In some cases, such as at the University of Dar es Salaam, departments are already approaching libraries directly to run training sessions. At the University of Malawi, one librarian noted that they had approached a lecturer directly and discussed e-resources, the outcome of which was that the lecturer explicitly required citations of e-resources in a subsequent assignment. This had in turn encouraged students to come to the library and seek support. It is important that training focuses not just on instructing users on what is available, but also on how to search it better, navigating the search tools of individual publishers' platforms, bibliographic engines and indexing services. There is a clear need, therefore, to integrate e-resource training into research methods training in graduate schools, and to work with individual departments and faculties to raise awareness and demonstrate how to use e-resources which correspond to a particular subject area or discipline.

New approaches

Ensuring users have the skills to make effective use of e-resources will also require approaches beyond formal training sessions. Peer assistants, on hand to help their postgraduate colleagues when they encounter difficulties in the ICT lab, might be one approach, and libraries might also consider running drop-in e-resource clinics, specifying certain times when an experienced librarian or librarians would be on hand to assist researchers in achieving specific tasks. Ensuring that training is of value also means ensuring that users actually have decent ICT access once they have been introduced to online resources. During discussions, librarians observed that poor ICT facilities mean that, for some researchers, training in e-resource use seems a pointless exercise.

6.4   How e-resources are managed

Keeping catalogues up to date

Increasing researchers' awareness of e-resources, and ensuring that they are able to identify and navigate successfully to the right resources at the right time, relies on access being managed effectively. Almost half of respondents (48%) identify what their library holds by searching its online catalogue (OPAC), yet electronic journals are rarely included on library catalogues (Figure 18). As Figure 19 illustrates, when researchers have a particular title in mind, they are more likely to opt for Google than the library's own website. Because e-journal subscriptions tend to change from year to year, according to what is included in publishers' packages or what libraries can afford, maintaining up-to-date catalogues and other records is time-consuming. However, it is vital that there is a comprehensive, reliable and up-to-date source of information on all library collections, and it would seem to make sense to use the library's existing database to achieve this. It ought, in theory, to be possible for libraries to simplify this process by using database uploads to update their catalogues each year, rather than manually adding and removing individual titles, but it is unclear how straightforward this may or may not be. The UK's Research Information Network has, for example, published a report on the creation of shared bibliographic catalogues between networks of libraries and publishers, to avoid the significant duplication of effort currently witnessed in catalogue creation.[54] Advocating the creation of a shared UK higher education catalogue, with dynamic links to local holdings, the report nevertheless recognises the many obstacles to enabling free access to shared bibliographic data, with some organisations resistant. In the meantime, libraries will need to explore how they can ensure that their e-journal collections remain as discoverable as their print collections.

Figure 18: Methods of identifying what the library holds at case study universities
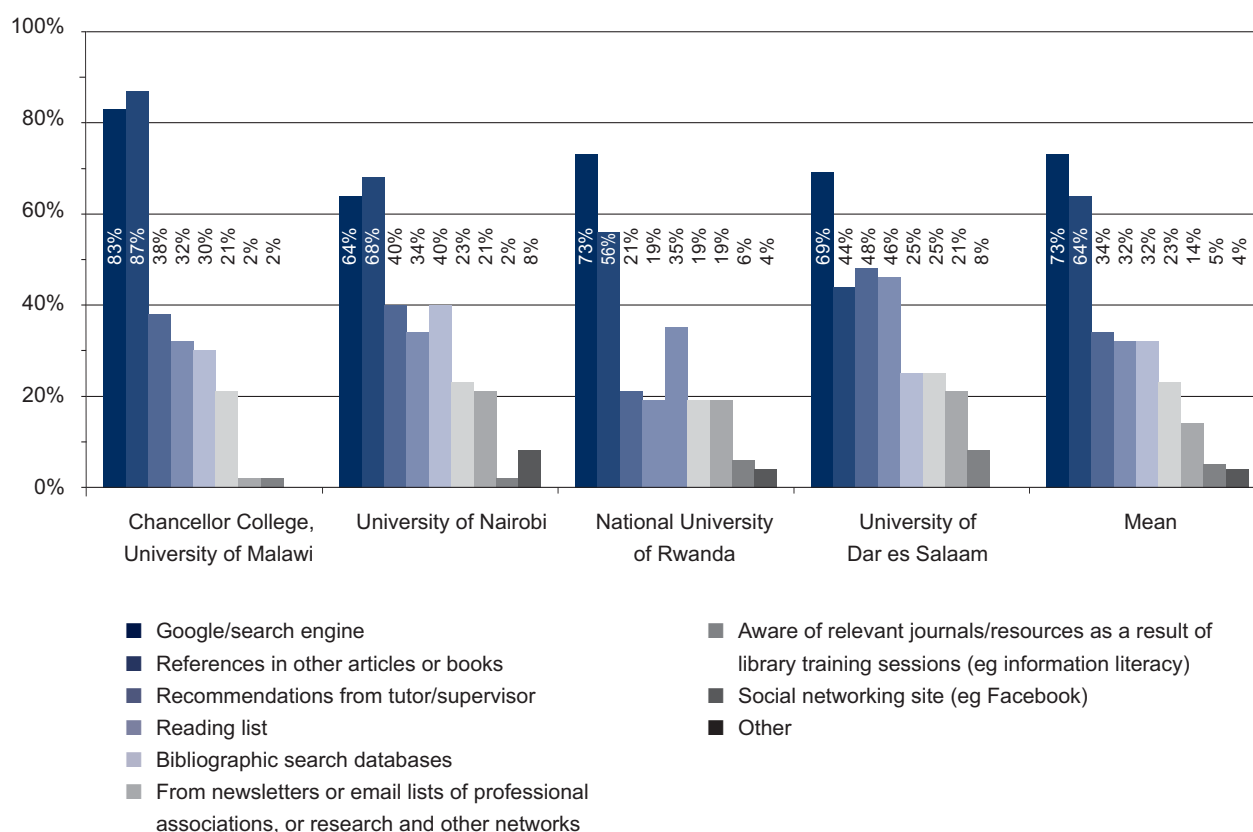
54 Research Information Network, *Creating catalogues: bibliographic records in a networked world* (2009)

Managing resources to serve different needs

As has been noted, academics' complaints of gaps in journal provision are often because they are not fully aware of what is available or, if they cannot find something easily, they simply assume it is not there. As one Kenyan academic commented, 'Sometimes when I request an article [from a friend] I find that it was actually available on one of the databases'. Making it more straightforward for researchers to navigate and locate e-resources through library websites is therefore critical. Academics, depending on their area of research, are likely to adopt different strategies for identifying journals. In some fields, such as the humanities or social sciences, researchers may typically consult a relatively defined number of journals, following debates through these, while on occasion seeking articles on specific topics from other journals outside this core group. In other fields, typically the natural sciences, researchers may not have a core set of journals which they regularly consult, but may instead browse a much wider range of titles. As a result, some may wish to go directly to specific journals and to browse or search within them, while others may prefer to search across a wider range of journals via larger databases or cross-platform searches. In the case of the former, the lack of a facility in most libraries to generate comprehensive title lists, either in A-Z format or by subject area, appears to be a particular issue. In the case of the latter, better guidance on how to execute such searches, and appropriate online signposts to these, would be valuable.

Current issues and back-file archives

A further complication with the way in which e-resources are supplied, and thus the way in which access to them must be managed, is the distinction between current issue and back-file access. Many journals are available through a number of different routes, but a common problem appears to be confusion, as noted above with reference to JSTOR, around the difference between a moving-wall archive (where there is an embargo, often of a few years, on the latest issue being available) and a publishers' platform (which offers instant access to the current issue). It should be possible to manage this effectively through a library's online listings, such as the EBSCO A to Z services used by some libraries which enable the various alternative access routes to a particular journal, by content years, to be clearly linked.

6.5   Library websites

Good library websites are critical to providing access to electronic resources. Without an easily navigable and well-presented website, users have no means of identifying what the library provides and will struggle to gain access to the subscription resources which the library has purchased. 38% of survey respondents said that they use library websites to identify what the library holds (Figure 18). However, library websites are relatively underused as access points to actual resources: just a third (34%) use the library website to access journals, compared to 70% who use Google (Figure 19). The low use of library websites is likely to be responsible for the under-discovery and under-use of subscription resources already noted. Observation exercises suggested that users at the University of Nairobi, which has a clear, up-to-date and easily navigable website, are more likely to make use of the databases and journal packages to which the library has subscribed, whereas, in other institutions, researchers make use of these only when they stumble across them via Google searches, or because they have prior knowledge of them (notably JSTOR). As one Rwandan academic commented, referring to his colleagues and students, 'they know Google but don't know how we have access to e-journals'.

Figure 19: How journal articles are accessed at case study universities

■ Search for journal in Google/other search engine   ■ Use the library's website to get access to an electronic copy
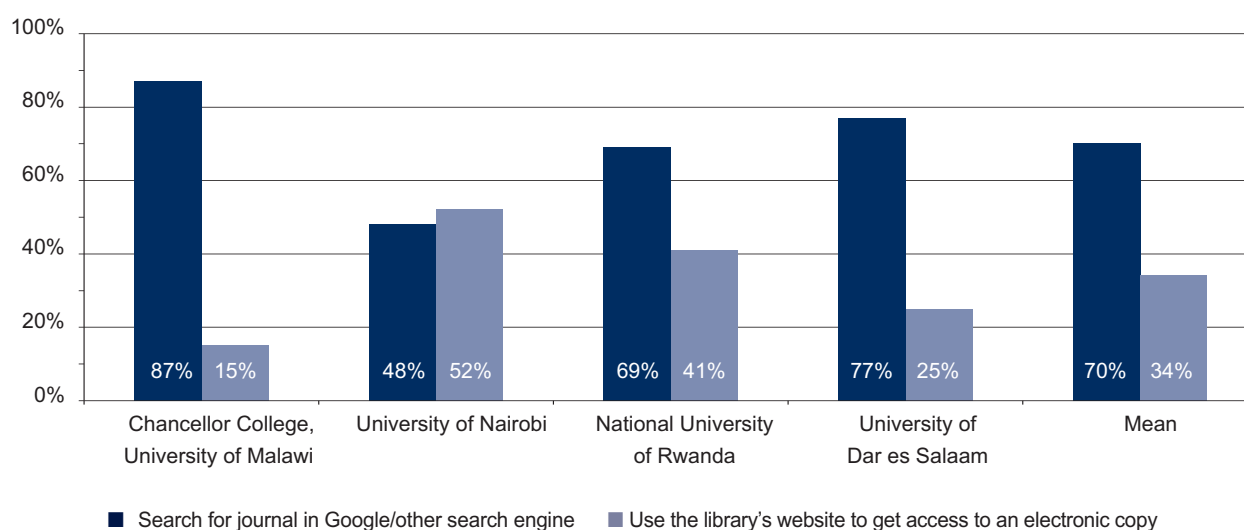
From websites to information portals

Library websites vary from 'About us' pages, which simply present the library, to well-developed and more user-centred resource portals. Survey respondents at the University of Nairobi more often reported visiting the library's website to access journals than using Google. At the time of the study, Chancellor College had a relatively underdeveloped website, which linked to its online catalogue but did not act as an e-resource portal, and this was reflected by a much greater use of Google being reported in the survey. The library's site has now been dramatically improved, and should become a more valuable access point as a result. Both the National University of Rwanda and the University of Dar es Salaam have relatively well-developed websites, providing access to their electronic resources and catalogues, although they still do not appear to be as well used as they might be. In some cases, e-resource pages are not sufficiently prominent – at the University of Dar es Salaam, for example, it takes five steps for a user to reach the relevant page from the university's homepage, something which one librarian felt is an obstacle. Of note, perhaps, is that both operate simple lists of the database to which they subscribe, while Nairobi's site instead provides A-Z and subject area listings and links to its e-journals, making it easier for users to discover what they need. Although the National University of Rwanda does provide the ELIN service, this does not include all journals to which the library subscribes, due to licensing arrangements.[55] There could be considerable value in exploring the future development of needs-based websites from the perspective of users, and perhaps even different types of user.

University of Nairobi librarians commented that their aim is to make their website the 'portal of choice' for their users, and as a result they are considering how Web 2.0 tools might be deployed to make the site a better starting point for their users. In all institutions, there is clearly room to develop websites in order to better meet the discovery and access needs of their users. Library websites in many institutions tend to have been developed by librarians and ordered according to a librarian's approach to collections. Approaching web design from the perspective of the user and providing multiple access points according to the differing needs or preferred strategies of researchers of different levels or in different disciplines – such as tailored listings of key resources and search tools by subject – would undoubtedly be valuable, and might help to draw users more towards the library's site and away from an automatic recourse to Google. Integrating advice and troubleshooting information directly into library websites and e-resource access pages could also directly support libraries' training and awareness work, helping users to solve problems as and when they encounter them, rather than giving up in frustration at a relatively minor obstacle. Significantly, website design is an issue with considerable unrealised potential, and one with which libraries across the world are only really just beginning to grapple.[56] African libraries could thus get to be very much ahead of the curve in this regard.

6.6   Working with academic staff

A postgraduate student at the University of Dar es Salaam said tellingly 'if you're going to offer training, don't forget our doctors and professors', while an academic at the same institution commented that 'If instructors have limited awareness then students are in a critical condition – in an intensive care unit… If you give students a journal article, sometimes it's the first time they've seen one'. Improving e-resource use thus requires lecturers to encourage – or demand – that their students use and cite academic journals in their work; this in turn requires librarians to work with academics to ensure that they are confident in their own abilities and familiar with the full range of resources available. As already noted, one University of Malawi librarian has worked closely with individual academics to ensure that they push students to use e-resources when producing particular assignments. Other librarians commented that making contact with individual heads of department is important in order to gain their support, and for them to encourage their colleagues and students to attend training sessions. The University of Nairobi has recently established a graduate research library with a dedicated librarian on hand to assist postgraduate researchers and academic staff, offering them a separate area of the library in which to work, and making an implicit statement about recognising and valuing their needs.

Numerous responses to the surveys suggested that students, and in some cases academics, are sometimes uncertain of the distinction between scholarly and non-scholarly resources, and even what an academic journal really is. When asked to list the ten most essential journals for their work, many indicated electronic sources of a much more general nature – often listing Google or other search engines, or listing publisher databases and collections rather than individual titles. When asked to name important titles, many responded with comments such as 'any journals with the knowledge in the African economy and development' rather than specific titles. In the print era, the handling of journals, like books, enabled readers to develop a greater familiarity with the ideas and purposes of specific academic publications, seeing a collection of articles, reviews and bibliographies, perhaps organised around a particular theme. In the electronic era, articles are often encountered in isolation as free-standing papers. While curricula design has typically been the preserve of academic departments, where reading lists or other course guides are concerned, there is a clear role for the library to work with academic staff to help them to identify and to integrate suitable e-resources into their course material.

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55 See www.lub.lu.se/en/about-lub/organisation/lund-university-libraries-head-office/information-about-elin.html
56 This comment is based on general observations of university library websites.

7. Leading libraries, developing people

7.1 Developing the skills and confidence to assist users

Training and professional development

If universities are to improve the use of e-resources amongst their researchers, they will depend heavily on the skills, expertise and creativity of their librarians. All of the libraries involved in the study have a good number of professionally qualified librarians, typically holding MSc or higher qualifications in library and information science. The University of Dar es Salaam is particularly notable for having a cadre of PhD-qualified academic librarians, although one librarian speculated that this often draws people out of the day-to-day running of library systems and into information science teaching and research. On the other hand, Malawi currently has only one PhD-qualified library and information specialist in the university sector, at Mzuzu University. Librarians involved in the study felt a lack of human resource capacity is a major issue in many cases, with many staff under-trained. Academic qualifications in librarianship are popular and sought by many staff, particularly as career advancement within the university system is often dependent on higher formal qualifications. Nevertheless, other forms of training beyond, or instead of, academic qualifications are vitally important. Librarians have access to a range of training opportunities, often supported through donor initiatives or organised by international partners, such as INASP. This includes training in key areas such as bandwidth, monitoring and evaluation of e-resources and information literacy, and opportunities to attend conferences and events.

One Tanzanian researcher commented that 'some librarian assistants are poorly informed about [the] accessibility of electronic materials. Sometimes only one person is fully aware and you have to wait. Otherwise the rest may give you outdated information'. There is still a strong case for the development of subject specialist knowledge – not necessarily through academic study, but through a long-term engagement with the needs of specific faculties and departments and the research interests of their academics and students. In the contemporary library, this translates into an understanding of relevant electronic resources.

Managing ICT-dependent services

As ICT becomes increasingly central to service delivery and collection development in libraries, and to the ways that teaching is delivered and research undertaken, librarians' ICT skills will also matter even more. While ICT skill levels are fairly good amongst some librarians, particularly at more senior levels, this is not always the case, meaning that the duty to assist users and troubleshoot resources often falls to already busy staff members. As staff in the ICT unit at the University of Dar es Salaam complained, e-resource queries are often deemed to be ICT rather than library issues and referred to them. While all libraries have an ICT librarian post (although this was vacant at the National University of Rwanda at the time of the study), the library at the University of Dar es Salaam has its own dedicated ICT unit with several technical staff (eight, two of whom are on study leave). This puts it in a much stronger position to develop the library's ICT-dependent services, and to provide user support. The University of Nairobi has two senior librarians with ICT qualifications. In addition to these more specialist staff, all staff need some degree of familiarity and confidence with ICT and e-resources. For example, because the library at the National University of Rwanda has relatively few staff who are skilled and comfortable in the use of e-resources, considerable additional pressure is placed on the deputy director, who has overall responsibility for this area. Many of the troubleshooting and training tasks related to e-resources could no doubt be delivered by more junior colleagues.

7.2 New skills for new services

It is essential that libraries are able to continually upgrade the skills and expertise of their staff, to equip them to meet changing user needs and new methods of information delivery. New needs also need to be taken into account when recruiting new staff. Developing the curricula of library training schools or MSc programmes in library and information science will be essential to ensure that the next generation of librarians are equipped with the skills they need, but ways will also be needed to re-tool existing staff to deal with new information needs.[57] As new, more sophisticated information services come to be developed and deployed, further expertise may be required by some staff in specific technical areas. However, while some librarians will undoubtedly need higher-level ICT skills, it would seem to make more sense for them to work more closely with ICT departments, or with their own internal ICT units where these exist, rather than seeking to make librarians ICT as well as information experts.

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57 INASP's library development programme is worth noting: www.inasp.info/file/d823e4728f59bedea7b975aba08e66cd/perii-library-development.html

In order to serve their users better, and to ensure that the importance of libraries continues to be recognised by academics and senior management, librarians must increasingly demonstrate how they can add value to their collections. Online environments and digital information, while removing the tasks associated with physical creation, add new duties, but more importantly also create new opportunities for delivering information in more sophisticated and user-tailored ways. Physical libraries have only one layout, whereas their digital equivalents can have many ways in and many navigation routes, tailored to particular subject areas or to particular types of user.

New skills are needed not just in ICT, but also in teaching and presenting, so librarians can deliver training more effectively, and in project management, so they can deal with the new types of services and facilities which libraries are now beginning to provide or will need to in the future. Leadership is also critical, to ensure that libraries are properly positioned as strategic services within the institution, and recognised by university managers. The issue is not simply one of skills, but also of confidence, in making the case for the library, engaging with academics, and training students and staff. As several participants in the study commented, librarians would need to be more aggressive and proactive.

7.3   Motivation and reward

Strengthening library services and improving the way that they are delivered is not, however, just a matter of skills. Skills will not be acquired – or put to good use – if library staff are not motivated in their work, rewarded appropriately for what they do, and supported to develop their careers. Incentives and motivation are, of course, issues common to all university departments. With limited financial resources, paying staff more is often not possible, even if desirable. But rewarding staff need not only be a financial issue. Providing appropriate training and opportunities for staff to develop their careers, and working to raise the status of and respect for library staff and their expertise within the institution, would undoubtedly go a long way to improving how library staff feel about their roles. Happier staff, with a greater sense of future opportunities and clearly defined career paths, and who felt that their work was valued by the university and by their academic colleagues, would also no doubt be easier to retain.

8. Developing relationships and understanding needs

8.1 The need for strong relationships

Many, if not all, of the challenges identified rest fundamentally on the strength of the relationships which exist between librarians and other key figures within the university. Librarians have a critical skill set to offer to the contemporary university. Today's research community is increasingly overwhelmed by information. Librarians not only manage access at the administrative and technical level (ensuring subscriptions are arranged and that online access is authenticated), but also have the expertise to assist busy researchers to find and access what they need, and to do so more efficiently. Collaborations with technically-skilled colleagues also enable them to harness the potential of the latest technologies to develop targeted information services, which can improve the ways in which researchers make use of scholarly resources. Libraries are, for example, assisting – and in some cases leading – the development of new online publishing platforms for scholars (the Public Knowledge Project and Open Journals System is a good example), digitising otherwise inaccessible or hidden collections, such as theses or special archives, and advancing the potential for research in the process (several of the case study universities have or are planning to embark on digitisation projects).[58] Libraries are also investigating new ways of delivering content via mobile phone to users without regular computer access, or to make information searching more convenient (UNISA in South Africa, for example).[59] There are also suggestions of librarians being 'embedded' within faculties and research teams, providing specialist services and supporting virtual research and learning environments. In some institutions, the library as a space is also being reconsidered and redesigned, using space freed up by a shift from print to digital resources to provide collaborative or individual work areas.[60]

Understanding and responding to need

To deliver good quality services, and to understand the needs and concerns of their user groups, libraries need to be well connected to, and to communicate regularly with, academic faculties and departments and the various central administrative and support offices. The need for good relationships with ICT departments has already been noted above, but links with research offices and various levels of the management and decision-making structures of the university are also vital. University affairs tend to be governed by a series of committees, and this is certainly the case in the four institutions in this study. For the research system to work, and for libraries to be able to support this effectively, a good understanding of needs, capacities and skills is needed between the library and these various committees and offices. In most cases, formal channels exist for such communication: library heads sit on university management boards and senates, there are library committees with representatives from the faculties attending, and librarians are invited to sit on other committees such as research or postgraduate training. Yet despite these formal structures, communication does not always seem to be working as well as it might. In many universities, people gain their committee responsibilities because of their position, not as a result of particular interest or enthusiasm in the issues within their remit. Conversations with individual academics and librarians did not always suggest strong practical links between them, and library-ICT relationships often seem to be under-developed. New courses have been introduced in a number of cases without the library being informed in sufficient time to acquire the necessary resources. This is evidenced, for example, by relatively low levels of awareness of what e-journal collections the library has, or how these are accessed.

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58 The Public Knowledge Project and its Open Journals System are led by Simon Fraser University Library in Canada; see http://pkp.sfu.ca. The platform is used to operate the Journals OnLine programmes established by INASP, including African Journals OnLine (AJOL); see www.ajol.info

59 See, for example, Mohamed Ally and Gill Needham, *M-libraries: libraries on the move to provide virtual access* (2008) for papers from the First International m-libraries Conference held in 2007. A subsequent conference in 2009 (http://m-libraries2009.ubc.ca) included a presentation from Dr Buhle Mbambo-Thata on the University of South Africa's experiences.

60 See ACRL, '2010 top ten trends in academic libraries: A review of the literature', *College & Research Libraries News* 71 (2010) for a useful overview of many emerging issues. David Staley and Kara J. Malenfant, *Futures Thinking for Academic Librarians: Higher Education in 2025* (2010) presents a series of possible scenarios for future higher education and library development.

8.2   Getting to know research and building informal networks

In some cases, relationships are strong. The head of the graduate business school at the University of Nairobi, for example, spoke very highly of his campus librarian, and demonstrated how close and supportive links have been forged between the library and an academic unit. In the University of Malawi, a former college librarian has actively kept up to date with the research interests of academics and tracks new journal issues as they come in to alert them to relevant articles (while it is unlikely to be feasible for librarians to scan all new journals for relevant articles, publisher alerting services might allow them to produce digests of latest articles in certain fields, or to assist researchers to access these services directly). This and other good relationships have been built not through formal committees, but through librarians proactively responding to the needs of individual academics, who in turn come to appreciate the library better and work with them to jointly secure the resources and access needed by their departments. Informal channels may be of considerably greater value than 'enforced' committee links in improving academics' understanding of the library and its services, and in enabling the library to be more attuned and responsive to the needs of individual faculties. Of course, the onus also falls onto academics to engage with the library themselves – since it is their research and teaching which stand to benefit. As one librarian commented, 'if researchers are stagnating [in their research] it is difficult for the library to move with the times'.

8.3   Engaging university leadership

Relationships also need to be built at senior levels. University managers are only likely to offer adequate support to the library if they understand its needs and the services it seeks to deliver properly. This clearly requires the library to make its case clear, and to engage strategically on well-defined issues. Proactively briefing university managers on new library developments, the scale of resources available, or the types of services they are delivering (or have the potential to deliver) has helped the University of Nairobi to develop much stronger relationships. It has also demonstrated new ways in which librarians can assist the university in managing core activities, assisting its research committee to track publications arising from research grants that have been awarded. A UK librarian who participated in a final workshop for the study noted that their library has sought to preempt new needs, by tracking new developments across the institution and going forward to suggest how the library might assist. Institutional leaderships, as one participant commented, respond to facts and not abstract ideas: the more that libraries are able to make their case with the support of hard evidence, the more likely university managers and policymakers are to take notice. Libraries already collect statistics on a range of areas, with growing monitoring and evaluation work on the services they provide and the use of journals and other online resources. Using the data available to them to analyse needs and research levels at faculty and department level, and using this to strengthen their case with institutional managers, could be valuable.

Universities tend to be driven and guided, as most large organisations, by a series of strategy and policy documents. Libraries are increasingly recognising the need to make sure that they are well positioned within these, since resource and budgetary allocations are often defined according to the priorities that these set out. Libraries deliver services across the full spectrum of a university's activities and thus need to be recognised in the planning processes for all of these, including strategies in areas such as research, teaching and learning, postgraduates and ICT. All of the universities involved have plans to work more closely with other units within the institution to ensure that the material and human resource needs of the library are reflected in subsequent strategic documents. At the University of Nairobi, existing policy and strategic documents already make reference to the library and ICT; however, there is still room for some of the issues raised during the study to be better defined within this. At Chancellor College, a draft ICT policy has already been developed, providing a timely opportunity for the library, which is well placed to contribute to the final drafting process and ensure its concerns are addressed. At the National University of Rwanda, the policy process has yet to begin, meaning that the library has an excellent opportunity to marshal its expertise and engage from the outset.

9.   Conclusions and recommendations

The headline conclusion of this study is clearly that academics and students in east and southern Africa – and across the wider continent – have an impressive range of high-quality peer-reviewed material available to them, including many of the leading journals from major international publishers. Overall, this amounts to around 80% of the top journals, not far off what is found in major European universities. This offers great potential for both research and teaching. However, getting this material used in the day-to-day research and teaching activities of universities remains a challenge.

This report has argued that 'information access', as it is broadly termed, can be better understood as the interrelationship of availability, access and use. The issues are nevertheless complex and interwoven, and the case studies have firmly emphasised that these are far from technical problems. It is increasingly evident that connectivity is steadily beginning to improve. While good, reliable high-speed broadband connections are still not assured in all countries or in all parts of each country, improvements in technology have begun to highlight that 'e-readiness' is the real challenge – influencing change in attitudes and behaviours surrounding technology access and the uses to which it is put.[61]

Put simply, providing access is not enough – libraries, in partnership with academic departments, also need to influence the behaviour and approach of their users. Recent work on information seeking behaviour and the 'Google generation' has challenged assumptions about the ways in which people navigate and use online resources, and offers some suggestions of how librarians might approach user behaviour in new ways.[62] Substantial barriers to e-resource access and use lie beyond the library, in the research activities and cultures of faculties and departments. But, while libraries and librarians do not have it in their power to improve the use of e-resources on their own, it is likely that they can have a powerful and catalytic effect within their institutions by trying to stimulate demand and raise awareness, assist users and make access points more easily navigable, and making e-resources and the changing nature of university libraries a concern for researchers, ICT staff and senior managers alike.

To avoid echoing the executive summary, and to provide more practical thoughts on possible ways forward from this study, some of the conclusions arising are presented below as a series of recommendations or actions, addressed to specific groups: librarians, university leaders and managers, ICT staff, and organisations seeking to support universities, libraries and research. These recommendations are drawn from both the analysis offered in this report and three days of discussions at a review workshop held in Nairobi in February 2010. It is not an exhaustive list. Situations change rapidly, and these can therefore offer only a current snapshot of what the next steps might look like. The nature of the study is reflected in the fact that there are more recommendations for libraries and librarians than for other constituencies.

Librarians have been at the forefront of information access work in the region, and have achieved considerable success with the support of external organisations and the international publishing community. The actions below are suggested both by the evidence compiled through this research, and from inputs from librarians and researchers in developing and emerging countries.

9.1   For libraries and librarians

You support excellence in research and teaching at your institution when you:
- **go beyond availability and access and tackle the complex issue of use**. Libraries have proved themselves good at getting hold of information, but ensuring that this gets to those who need it must now be a priority.
- **engage with academics and students and find new ways of delivering training and advice**. Libraries have tended to broadcast what they have and expect users to come to them. Modern information environments require a new approach.
- demonstrate expertise, but also a **commitment to understanding and responding to the needs of different faculties and disciplines**. Providing input to course reading lists may be a valued and practical contribution. Crucially, messages will need to be tailored to users.
- **cultivate relationships with a greater number of people, and identify those most willing or able to support and guide the library in its endeavours**. Nurturing informal library 'champions' or 'friends' may be more effective than 'official' liaison officers.
- **become more actively involved with the teaching and learning process**. Show how the goals and ambitions of the university as a whole depend on the strength of the library and the resources and services it can offer.
- **ensure the library is up to date with digital environments and new tools, in order to show leadership to your universities**. Technologies are developing fast, opening up new possibilities for information delivery, and requiring much more rapid skill development. Website development and ensuring easily navigable access routes to resources will be important.

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61 This observation comes from Professor Meoli Kashorda, Executive Director of KENET
62 CIBER, *Information Behaviour of the Researcher of the Future*, 2008; for the full background papers see www.ucl.ac.uk/infostudies/research/ciber/downloads/

- **encourage and support existing involvement in digitisation and publishing projects and use this to show the new ways in which they can support research across the region**. The visibility of locally produced research is a key concern for many academics.
- **help ICT staff to understand the remit and objectives they share with libraries and demonstrate the strength of a cooperative approach**. While libraries will benefit from working with ICT departments, they will need to make the case for collaboration more effectively.
- **consider ways to continue to share knowledge and expertise**. Africa has many excellent libraries and librarians, and some strong national, regional and continental networks and consortia. Learning from the successes of others through national and regional collaboration and networks will help to strengthen libraries across regions and the continent. There may be opportunities for shared cataloguing and collaborative website or portal development.
- **recognise the need to invest in individuals, particularly promising younger staff**. Rewarding dynamism, encouraging creative thinking and building confidence will help to transform the contexts in which libraries work.
- **seek to develop skills in analysing user needs and seeking more evidence-based librarianship**. This study and prior reports have pointed towards the value of bringing evidence to bear on library policy and planning.
- **build an evidence base to help demonstrate the effectiveness and efficiencies of the library to senior managers, and to engage their support and interest**. Providing concise and timely briefings, preempting needs and responding to new developments could help to strengthen the position of the library within the wider university.
- **ensure that library concerns and needs are echoed within university strategy documents so that the library is given the necessary support and funding**. There are many examples of libraries successfully engaging with university policy and planning processes, particularly those related to ICT, research and teaching.

9.2   For university leaders and managers

You support the development of a strong, forward-looking university built around first-rate research and teaching when you:
- **invest in libraries to ensure the sustainability of research and learning**. Although much information is online, it is not for free. Securing and sustaining access to it requires skilled librarians.
- **ensure that funding for associated investment in ICT facilities is included in library budgets, so that e-resources are accessible and used**. Universities are investing significant resources, financial and human, in securing access to e-resources, but additional funding must be targeted to key areas if their full potential is to be realised.
- **invest in the professional development of librarians to ensure that the university makes the greatest use of the potential offered by information and technology**. Librarianship is an established profession, but its needs and skillsets are changing. World-class universities need world-class libraries.
- **encourage academics to do research, and to make better use of the resources and technologies available to them**. Much depends on wider research systems and cultures. This means changing the rewards and incentives which underpin this. It is clear that providing the resources and technology is not enough.
- **recognise and support consortia and other library networks, as this is likely to deliver greater dividends to a university than its library can achieve on its own**. Universities can lever much greater resources by encouraging national and regional collaborations between libraries.

9.3   For ICT departments

You make vital contributions to the information needs of researchers and students when you:
- **work with libraries and bring the expertise of the ICT department to bear on the information challenges that they seek to address**. ICT departments and libraries have shared aims and make natural partners in the creation and promotion of new digital resources, environments and tools.
- **ensure the case for ICT investment is more effectively made by working with libraries to raise the profile of information issues**. Enabling and increasing the value and use of e-resources offers a powerful argument for encouraging greater investment in ICT systems.

9.4   For external supporters of universities, libraries and research

You help to strengthen the research base and improve the research communication cycle when you:
- **work with universities and libraries to ensure that availability and access remain sustainable and recognise e-resource access as an important aspect of overall research capacity building**. Strengthening research, and the information services which underpin this, is not a short-term endeavour.
- **continue to support librarians to share expertise within Africa or through exchanges with colleagues elsewhere**. Peer exchange and networking between librarians has proved to be of great value and could be further harnessed to strengthen information access and use.

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Appendix 1
Background to the four case study universities

University of Malawi and Chancellor College

The University of Malawi is organised into five colleges: Chancellor College (in Zomba), the College of Medicine and the Polytechnic (in Blantyre), and Kamuzu College of Nursing and Bunda College of Agriculture (in Lilongwe). Chancellor College, which is the largest constituent college, has five faculties: education, humanities, science, social science and law. In 2007, the University of Malawi had a student population of approximately 6,257, with 342 Master's students; currently (2010), Chancellor College has 3,015 students enrolled (2,800 undergraduates and 215 postgraduates). At present, there are five registered PhD students at Chancellor: two in economics, two in biology, and one in education. A number of staff are studying for PhDs abroad. Academic staff number some 676.[64]

Chancellor College houses both the central university library (an administrative structure, rather than a distinct library, composed of the university librarian and four assistant librarians) and the college library, with a college librarian and three assistant librarians. There are additional ancillary library staff responsible for circulation and book-binding. There is thus some overlap in responsibilities and duties between the university and college librarians. The three other colleges each have their own college librarian and assistants.

University of Nairobi

The University of Nairobi (UoN) has a student population of almost 37,000, with 422 PhD students and 7,445 Master's students. Just under 40% are female. Academic staff number some 1,411, delivering around 200 academic programmes, including 119 Masters' degrees.[65] The university is organised into six colleges across seven campuses, spread across Nairobi and its outlying suburbs.

UoN has a library system which includes a central library (Jomo Kenyatta Memorial Library) and 11 branch libraries across its various campuses. These currently offer a total of 3,000 study spaces. The central library has recently established a graduate research library, to specifically serve researchers. The library is part of the Kenya Library and Information Consortium, through which e-resources are nationally licensed (through INASP's PERii scheme) for all universities and research institutions in Kenya.[66]

National University of Rwanda

The National University of Rwanda (NUR) is organised into seven faculties, two schools and 11 centres. It has a student population of 10,657, with 380 of these Master's students. Less than 30% of students are female. Two PhDs were awarded in 2008, the only in NUR's history, while 47 Master's degrees were awarded in 2009, and 75 in 2008. 3,166 and 1,274 Bachelor's degrees were awarded in 2008 and 2009 respectively. Academic staff number some 533, delivering 31 undergraduate and 14 postgraduate programmes. In 2009, there was a shortage of 221 teaching staff, according to a target staff/student ratio of 1:20; without further recruitment, it is projected that this shortage will grow to 418 in 2010, based on an expanded intake. 78% of academic staff are male.

The university library is located on NUR's main campus in Butare. Faculty libraries exist but these are staffed independently; there is a plan to make a new Faculty of Arts, Media and Social Sciences library. The library currently only has seating space for 2% of NUR's current student population (206 places for 9,948 students).[67] The library's collections are a mixture of French and English texts, although acquisitions have been increasingly in English since 2009. Collections and subscriptions include some 33,000 electronic journals and 28 printed periodicals (Rwandan titles), plus electronic copies of dissertations and theses which have been collected since 2008.

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64 Figures from 2007 data in SARUA, *SARUA Handbook 2009: A Guide to Public Universities of Southern Africa* (2009).
65 Figures from University of Nairobi data: www.uonbi.ac.ke/statistics/?page=university-population
66 Figures from 2007 data in SARUA, *SARUA Handbook 2009: A Guide to Public Universities of Southern Africa* (2009).
67 National University of Rwanda, *Facts and Figures*

University of Dar es Salaam

The University of Dar es Salaam (UDSM) has around 19,650 students. Of these, 2,552 are postgraduates, including around 20 PhD students (in 2006/2007). Around a third of students admitted in 2007/2008 were female (35% of undergraduates and 28% of postgraduates). The university has 1,127 academic staff who deliver some 150 academic programmes at undergraduate, Master's and PhD level. 20% of staff are female and its staff-student ratio is currently around 1:19. The university currently publishes 18 of journals of its own, while the number of journal articles published across the university in all journals (local and international) totalled around 279 in 2007/2008, with a further 167 conference papers and 122 research reports. In addition, university staff published 28 book titles.[68]

The library is a fully independent unit, with equivalent status to a faculty. An academic member of (library) staff oversees each area. The LIS Master's programme and library services are currently run in parallel, but there are plans to establish a separate 'fully-fledged' LIS programme. This might help to raise the status of the library with academic departments, although, if this becomes an independent unit, it may also risk sucking staff out of the library. A few faculties also have a faculty/college library, but not all appoint librarians to run these – some are run by administrative staff, and this can be a problem. Two well-established ancillary libraries include those of the School of Business and the Institute for Development Studies. In 2007/2008, UDSM figures indicated that there were 744,869 library visitors, 695,253 to the main campus library.

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68 2007/2008 figures from University of Dar es Salaam data: www.udsm.ac.tz/about_us/facts.php. 2006/2007 figures from SARUA, *SARUA Handbook 2009: A Guide to Public Universities of Southern Africa* (2009).

Appendix 2
Breakdown of responses to the survey

Table 11: Responses to survey by field and department

Field	Department	Responses
Arts and humanities	Arts and social sciences (unspecified)	1
	History and archaeology	4
	Journalism	1
	Languages, literature and linguistics	32
	Philosophy and religious studies	5
Business and management	Finance, business and management	24
	Marketing	1
Central administration	Administration/non-academic	3
	Consultancy / research office	2
Engineering and technology	Engineering management	1
	ICT and computer science	4
Environmental sciences	Environmental science	3
	Geography and earth sciences	5
Natural and applied sciences	Agriculture	2
	Biology	2
	Chemistry	6
	Mathematics	1
	Medicine (all fields)	4
	Pharmacy	1
	Physics	4
	Science (unspecified)	1
	Zoology/veterinary science	1
Other	Extra mural studies	1
	Unknown	4

Field	Department	Responses
Social sciences	Demography	4
	Development studies	11
	Economics	15
	Educational administration and planning	9
	Educational psychology	7
	Information science	1
	Law	5
	Politics and public administration	15
	Psychology	3
	Social sciences (unspecified)	3
	Sociology, anthropology and gender studies	12
	Statistics	3

Appendix 3
Existing support programmes for African university libraries

Support programmes for African libraries

In recent years, a number of organisations have developed programmes or initiatives designed to support libraries in developing countries more broadly. Many of these have focused on providing access to scholarly information, particularly academic journals, although a number have also addressed other areas of library development, ICT and user training. The following tables summarise firstly the major support programmes, and secondly journal access schemes. It is worth noting, however, that compiling and interrogating the information presented below was a time-consuming and often confusing exercise, despite being undertaken with full access to the internet and with a relatively good starting knowledge; it is likely to be a much more demanding exercise for the average university librarian with a poor connection and other demands on their time.

Table 12: Programmes supporting African university libraries

INASP (International Network for the Availability of Scientific Publications) www.inasp.info	Established in 1992, INASP's work focuses broadly on access, use, management and communication of research information in developing countries. Its core Programme for the Enhancement of Research Information (PERii) has a particular emphasis on training librarians and ICT professionals, and comprises four strands: • Information delivery: working with publishers and library consortia to enable access to research materials. • Library development: working with librarians to develop digital libraries, focusing on enhancing the skills of librarians. Includes work on information literacy, developing curricula in library and information schools, supporting national library consortia and professional associations, and implementing digital repositories and library automation systems. • Publishing support: working with editors, authors and publishers to support writing, publishing and communication of research from developing and emerging countries. Include an online journals programme (see AJOL below), training for journal editors, and the AuthorAid mentoring programme for researchers (see below). • ICT training: working with ICT professionals and NRENs to support the development of infrastructure, facilities and skills needed to provide access to scholarly information. Includes work on bandwidth management and optimisation and ICT training in technical and policy areas.
eIFL (Electronic Information for Libraries) www.eifl.net	Established in 1999, eIFL works to increase access to electronic information in transition and developing countries. Its principal areas of activity include: • licensing negotiations: for discount subscriptions to academic journals and databases (see below) • consortium building and development: delivering training, advice, troubleshooting visits, fundraising workshops and advocacy • open access: work to support libraries to publish locally-produced information through a network of open access repositories hosted by libraries. eIFL have been involved in a southern African project to pilot the use of Greenstone software to create institutional digital repositories • intellectual property: advocacy on balanced copyright laws and access to knowledge • free and open source software: installing integrated library systems and providing training in their use
BookAid International www.bookaid.org	BookAid's principal focus is on supporting reading at lower educational levels, but it also provides support to a number of university libraries in Africa, in the form of regular book donations. Applications for support are coordinated at a national level by the national library services. It currently supports university libraries in Cameroon, Ethiopia, Malawi, Namibia, Somalia, Tanzania, Uganda and Zimbabwe.

Publishers for Development (ACU/INASP) www.inasp.info www.acu.ac.uk	Publishers for Development was launched in 2008 and is a joint initiative of the ACU and INASP. It is a forum for information and discussion aimed at exploring some of the challenges that developing country libraries, researchers and publishers experience. In doing so, it seeks to improve publishers' knowledge of the specific needs of developing country colleagues, and generate a greater level of discussion amongst publishers about the issues of access, connectivity and software.
AuthorAid www.authoraid.info	Managed by INASP, this initiative focuses on supporting academics in developing countries to publish their work, thereby increasing the volume of developing country research accessible via scholarly journals and other publications. It provides an online mentoring service designed to connect senior and junior researchers, and in so doing to help researchers in developing countries to publish and otherwise communicate their work.
Information Training and Outreach Centre for Africa (ITOCA) www.itoca.org	ITOCA is a training hub and user support centre in Africa which supports the HINARI, AGORA, OARE and TEEAL access initiatives (see below). Training is provided to librarians, researchers and students through workshops at African institutions. ITOCA also supports the development of ICT programmes, and offers technical assistance.

Journal access schemes

The number of schemes and initiatives seeking to support African universities to gain access to academic materials, in print or online, is so great as to make a comprehensive listing impossible. While there are some major and well-known schemes, there are many more smaller initiatives, supporting specific countries or institutions or focusing on specific fields. The details below do not include open access initiatives, since these are not specific to African or other developing country universities.[69] There are also many smaller schemes delivering individual journals, or specific to the journals of a particular publisher, such as Oxford University Press' developing countries offer. Further information on access schemes is provided by INASP's Directory of Resources.[70]

Table 13: Access schemes available to African libraries

HINARI www.who.int/hinari	**Access to academic journals** Led by the World Health Organization (WHO) with Yale University Library, plus other donors and publishers. Provides access to 6,200 journals in health and medical fields to developing country libraries and researchers. Access is free for the poorest countries (most of Africa), and is reduced for others. Training in information skills is now also offered, via ITOCA (see above). See Appendix 4.
AGORA www.aginternetwork.org	Led by the Food and Agriculture Organization (FAO) with Yale University Library, Cornell University Mann Library, plus other donors and publishers. Provides access to 1,278 journals in agricultural subjects to developing country libraries and researchers. Access is free for the poorest countries (most of Africa), and is reduced for others. Training in information skills is now also offered, via ITOCA (see above). See Appendix 4.
OARE www.oaresciences.org	Led by the United Nations Environment Programme (UNEP) with Yale University Library, plus other donors and publishers. Provides access to 2,990 journals in environmental subjects to developing country libraries and researchers. Access is free for the poorest countries (most of Africa), and is reduced for others. Training in information skills is now also offered, via ITOCA (see above). See Appendix 4.

69 eIFL and the Directory of Open Access Journals both maintain listings of free and open access e-resources; see
     www.eifl.net/cps/sections/services/negotiations/free-e-resources/other and www.doaj.org
70 See www.inasp.info/file/26280b439d6e401131b8c9eb0077f2b8/file732-inasp-directory-of-resourceshtml.html

Programme for the Enhancement of Research Information (PERii) www.inasp.info/perii	Run by INASP, with the support of major publishers. Negotiates national licenses on behalf of partner countries, with reductions of around 98% available to educational and research institutions in developing countries. Includes access to over 25,000 online journals (18,000+ full-text), 11,000 e-books, citation and bibliographic databases and document delivery from the British Library. National country coordination teams make selections, with subscriptions paid by national consortia, through INASP support and sometimes the support of other agencies. The overall aim is to move to sustainable funding in country. Access is through institutional libraries. See Appendix 4.
eIFL access scheme www.eifl.net/cps/sections/ services/negotiations	eIFL negotiates affordable prices for member countries with publishers and aggregators. Resources are available to educational and research institutions in developing and transition countries. eIFL's broader programme is described above. See Appendix 4.
JSTOR African Access Initiative www.jstor.org/page/info/ participate/new/fees/african Access.jsp	An initiative of JSTOR, the online journals archive established by the Mellon Foundation, to make its collections (in arts, humanities and social sciences) freely available to African universities. Archives contain over 1,000 academic journals across these fields, as well as select monographs and other materials. Contents are full-text searchable and the archive begins with the first issue of each journal and runs to a moving wall of 3-5 years (the most recent issues of journals are thus not included). Includes ALUKA (see below).
TEEAL (LAN) http://teeal.cornell.edu	Run by Cornell University's Albert R Mann Library, with the support of major publishers. Provides a digital library 'in a box', by means of an external network drive containing over 130 agricultural full-text journals. Libraries purchase an annual package of journals at a heavy discount. Between 1993 and 2007, TEEAL cost USD 7,500 with annual updates supplied for USD 1,000; the estimated value of the journals on the current version is over USD 2 million. The package includes a searchable database. No internet or phone line required is required; the drive can be used on a standalone PC or shared across a local area network. Training provided by ITOCA in Harare, Zimbabwe (see above).
African Journals OnLine (AJOL) www.ajol.info	Originally established by INASP as an online journal hosting platform for Africa. Over 340 journals are available in full-text form online or via document delivery free of charge to African universities, and services are provided to enable existing journals to publish online or new online journals to be established. Supported by fees charged to non-African libraries.
Electronic Journals Delivery Service (eJDS) www.ejds.org	An initiative of the Abdus Salam International Center for Theoretical Physics. Supplies full-text maths and physics articles via email to scientists in developing countries where insufficient bandwidth or unaffordable connections prevent access.
Project MUSE via the Global Development Network http://muse.jhu.edu www.gdnet.org	Managed by the Johns Hopkins University Press. Developing country researchers registered with the Global Development Network can access 400 full-text titles from 100 publishers.
Protecting the African Library www.acu.ac.uk	Run by the ACU, with the support of publishers. Enables ACU member universities to purchase discounted print subscriptions to journals from over a dozen academic publishers. Subscriptions are typically 25% or less of original cover prices and 14 publishers are involved.
Journal Donation Project www.newschool.edu/centers/jdp	Run by The New School, New York. Provides free journals to a number of Nigerian universities, either on the basis of donations from publishers or by paying for subscriptions with donor funding.
eGranary www.widernet.org/digitalLibrary www.egranary.org	Run by the University of Iowa. Creates copies of digital educational materials, including journals and educational websites, on a hard drive which can be connected to a university's local area network. Updates are delivered 2-3 times a year. Also organises ICT and technical training for Nigerian universities.
Elsevier, AAU http://libraryconnect.elsevier. com/lcn/0603/lcn060304.html	A collaboration to offer the ScienceDirect and Scopus databases on a highly discounted basis to universities in central, east and west Africa. Will encompass the African Virtual University, headquartered in Kenya.

Social Science Library www.ase.tufts.edu/gdae/ education_materials/ssl.html	Will contain around 3,000 full-text journal articles and book chapters in anthropology, economics, history, philosophy, social psychology, sociology and political science on CD, distributed free of charge to libraries in 137 developing countries. Will also include bibliographic references to approximately 9,000 articles. A first volume has been distributed to eIFL members, while it is also reportedly being tested in Ghana and Nigeria.
African e-Journals Project http://africa.msu.edu/AEJP	Collaborative effort of Michigan State University with the Association of African Universities and the African Studies Association. Offers two major resources: a directory of journals about Africa provides information on where to find tables of contents and abstracts, full text of articles online and journal webpages, where they are available; and a full-text archive of back issues of 11 scholarly journals published in Africa in the social sciences and humanities.
Database of African Theses and Dissertations (DATAD) www.aau.org/datad	Initiative of the Association of African Universities to develop a digital repository of African university research theses and dissertations, and to make these freely available online to African institutions.

Access to other research materials

Aluka www.aluka.org	Online digital library of scholarly resources from and about Africa, now part of JSTOR (see above). Ranges from archival documents, periodicals, books, reports, manuscripts, and reference works, to three-dimensional models, maps, oral histories, plant specimens, photographs, and slides. Access is free to all institutions within Africa.
African Online Digital Library (AODL) www.aodl.org	Developed by the MATRIX unit and the African Studies Center at Michigan State University, in partnership with universities and cultural heritage organisations in Africa. A portal to multimedia collections on and about Africa to support research.

Appendix 4
2009 subscriptions of the four case study universities

Table 14: PERii subscriptions at case study universities[71]

University of Malawi

Acoustical Society of America	Mary Ann Liebert, Inc., publishers
American Chemical Society	Mineralogical Society of Great Britain & Ireland – MinAbs Online
American Institute of Physics	Nature Publishing Group
American Physical Society	NPG (Nature and Palgrave Macmillan Journals) (as subscribed)
American Society of Civil Engineers	NRC Research Press Journals Online
Annual Reviews	OSA – Optical Society of America
Beech Tree Publishing	Oxford University Press – Oxford Journals
British Psychological Society (BPS)	Policy Press
Cochrane Library	Royal Society for Chemistry – RSC Journals Archive
EBSCO Host	Royal Society for Chemistry – RSC Journals Online
Emerald Publishing Group Limited	Sage Online Journals
Gale (Thomson Learning) – Academic ASAP and Health & Wellness Resource Center	Taylor & Francis E-Books, Agropedia or Europa World Plus
Geological Society	University of California Press – Caliber
Institute of Electrical and Electronics Engineers	University of Chicago Press
Institution of Chemical Engineers	Wiley-Blackwell – former Interscience content
IOP Publishing	Wiley-Blackwell – former Synergy content
JSTOR	

University of Nairobi

Acoustical Society of America	Nature Publishing Group
American Institute of Physics	OSA – Optical Society of America
American Physical Society	Organisation for Economic Co-operation and Development – Source OECD
Annual Reviews	Oxford University Press – E-Books (as subscribed)
Beech Tree Publishing	Oxford University Press – Oxford Journals

71 2009 data from INASP.

British Psychological Society (BPS)	Project MUSE
CABI Publishing – Global Health Database	Royal College of Physicians
Cambridge University Press – Cambridge Journals Online	Royal Society – Royal Society Journals Online
Cochrane Library	Royal Society for Chemistry – RSC Journals Archive
EBSCO Host	Royal Society for Chemistry – RSC Journals Online
Emerald Publishing Group Limited	Springer
Gale (Thomson Learning) – Academic ASAP and Health & Wellness Resource Center	Taylor & Francis Journals
Geological Society	University of California Press – Caliber
IOP Publishing	University of Chicago Press
Institute of Electrical and Electronics Engineers	Wiley-Blackwell – former Interscience content
JSTOR	Wiley-Blackwell – former Synergy content
Mary Ann Liebert, Inc., publishers	World Bank Africa Development Indicators
Mineralogical Society of Great Britain & Ireland – MinAbs Online	World Bank Global Economic Monitor
NPG (Nature and Palgrave Macmillan Journals) (as subscribed)	World Bank Online Resources (as subscribed)

National University of Rwanda

Acoustical Society of America	Mary Ann Liebert, Inc., publishers
American Chemical Society	Mineralogical Society of Great Britain & Ireland – MinAbs Online
American Institute of Physics	NPG (Nature and Palgrave Macmillan Journals) (as subscribed)
American Physical Society	Nature Publishing Group
American Society of Agricultural and Biological Engineers	OSA – Optical Society of America
American Society of Civil Engineers	Oxford University Press – E-Books (as subscribed)
Annual Reviews	Oxford University Press – Oxford Journals
Beech Tree Publishing	Policy Press
British Psychological Society (BPS)	Royal Society – Royal Society Journals Online
CABI Publishing – Global Health Database	Royal Society for Chemistry – RSC Journals Archive
Cambridge University Press – Cambridge Journals Online	Royal Society for Chemistry – RSC Journals Online

Cochrane Library	Sage Online Journals
EBSCO Host	Springer
Emerald Publishing Group Limited	Taylor & Francis Journals
Gale (Thomson Learning) – Academic ASAP and Health & Wellness Resource Center	University of California Press – Caliber
Geological Society	University of Chicago Press
IOP Publishing	Wiley-Blackwell - former Interscience content
Institute for Operations Research and Management Sciences (INFORMS)	Wiley-Blackwell - former Synergy content
Institute of Electrical and Electronics Engineers	World Bank Africa Development Indicators
Institution of Chemical Engineers	World Bank Online Resources (as subscribed)
JSTOR	

University of Dar es Salaam

American Chemical Society	Institution of Chemical Engineers
American Physical Society	JSTOR
American Society of Civil Engineers	Mary Ann Liebert, Inc., publishers
Annual Reviews	NPG (Nature and Palgrave Macmillan Journals) (as subscribed)
Beech Tree Publishing	Nature Publishing Group
Bentham Science Publishers – Bentham Science Journals Online	Oxford University Press – Oxford Journals
Cambridge University Press – Cambridge Journals Online	Royal Society for Chemistry – RSC Journals Archive
Cochrane Library	Royal Society for Chemistry – RSC Journals Online
EBSCO Host	Sage Online Journals
Emerald Publishing Group Limited	Springer
Gale (Thomson Learning) – Academic ASAP and Health & Wellness Resource Center	University of California Press – Caliber
Geological Society	University of Chicago Press
IOP Publishing	Wiley-Blackwell – former Interscience content
Institute for Operations Research and Management Sciences (INFORMS)	Wiley-Blackwell – former Synergy content
Institute of Electrical and Electronics Engineers	

Resources available to African universities through other access initiatives

Table 15: Publishers and aggregators participating in HINARI, AGORA and OARE[72]

Adis, a Wolters Kluwer business	Guttmacher Institute
Akadémiai Kiadó	Health Affairs
American Academy of Family Physicians	HFSP Publishing
American Academy of Orthopaedic Surgeons	Histochemical Society
American Academy of Pediatrics (AAP)	Hogrefe Publishing Group
American Anthropological Association	Horizon International
American Association for Cancer Research, The (AACR)	ICDDR,B: Centre for Health and Population Research (Bangladesh)
American Association for Clinical Chemistry	IFIS Publishing
American Association for the Advancement of Science	Informa Healthcare
American College of Chest Physicians	Institute of Physics
American College of Physicians	International Association of Hydrological Sciences (IAHS)
American Dental Association	International Medical Press
American Dental Education Association	International Mire Conservation Group
American Diabetes Association	International Peat Society
American Fisheries Society	International Union of Geological Sciences Publications
American Heart Association	IOS Press
American Medical Association	IWA Publishing
American Meteorological Society	John Libbey Eurotext
American Physiological Society	John Wiley & Sons
American Psychiatric Publishing, Inc.	Johns Hopkins Bloomberg School of Public Health
American Psychological Association	Johns Hopkins University Press
American Society for Biochemistry and Molecular Biology (ASBMB)	Journal of Bone and Joint Surgery, Inc.
American Society for Clinical Nutrition	Journal of Neurosurgery Publishing Group
American Society for Clinical Pathology (ASCP)	Landes Bioscience
American Society for Investigative Pathology	Lippincott, Williams & Wilkins

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72 For websites and further details, see Appendix 3.

American Society of Animal Science (ASAS)	Liverpool University Press
American Society of Clinical Oncology (ASCO)	Longwoods Publishing
American Society of Hematology	Makerere University Medical School
American Society of Nephrology	Maney Publishing
American Society of Neuroradiology	Mary Ann Liebert, Inc.
American Society of Plant Biologists	Massachusetts Medical Society
American Society of Tropical Medicine and Hygiene	MDPI
American Speech-Language-Hearing Association	Medical Education Cooperation with Cuba (MEDICC)
Annual Reviews	Medical Journal of Australia, The
ARKAT USA, Inc.	MedKnow Publishers
Association of American Veterinary Medical Colleges	MIT Press
Association of Learned and Professional Society Publishers	Morion (Ukraine)
Australasian Medical Publishing Company	Multimed Inc.
Australian Academic Press	National Academy of Sciences
Australian Physiotherapy Association	National Institute of Environmental Health Sciences
Australian Society of Anaesthetists	National Institute of Mental Health
Berkeley Electronic Press	National Research Council Canada
Bioline International	National University of Singapore, Centre for Biomedical Ethics
BioMed Central	Nature Publishing Group
BioOne	Oxford University Press
BioScientifica	Pharmaceutical Press
Blackwell Publishing	Portland Press Limited – publishing subsidiary of the Biochemical Society
BMJ Publishing Group	Public Library of Science
Botanical Society of America	Radcliffe Publishing
Brill	Resilience Alliance
British Editorial Society of Bone & Joint Surgery	Revista Cubana de Anestesiología y Reanimación
CABI International	RMIT Publishing
Cambridge University Press	Rockefeller University Press
Canadian Medical Association Journal	Royal College of General Practitioners

Canadian Psychological Association	Royal College of Physicians of London
Co-Action Publishing	Royal College of Surgeons of England, The
Cochrane Collaboration, The	Royal Society of Chemistry
Cold Spring Harbor Laboratory Press	Royal Society of Medicine Press, The
College of Occupational Therapists	Royal Society, The
Company of Biologists, The	Sage
Conference Archives, Inc.	Schattauer Publishers
Copernicus Publications	School of Nursing, Fluminense Federal University
Core Medical Publishing	SciELO
Croatian Cardiac Society	SCN (United Nations System Standing Committee on Nutrition)
CSA-ProQuest	Shiraz Institute for Cancer Research
CSIRO Publishing	SLACK Incorporated
Dansk Psykologisk Forlag	Society for Endocrinology
De Gruyter	Society for General Microbiology
Deutscher Ärzte-Verlag	Society for Neuroscience
Dove Medical Press	Society for Personality Research
Duodecim EBM Guidelines (Finland)	Society for the Study of Reproduction
Earthscan	Springer
EBSCO Publishing	Taylor & Francis
Ecological Society of America	Thieme Verlag
EDP Sciences	Thomson Reuters Scientific
Elfos Scientiae	Ukrainian Medical Association of North America
Elsevier	United Kingdom Serials Group
Environmental Information Coalition (EIC)	Universidad de La Sabana
European Respiratory Society	Universidad Politécnica de Valencia
Facultad de Medicina, Universidad Autónoma de Bucaramanga	University of California Press
Faculty of 1000	University of Chicago Press
Faculty of General Dental Practice (UK)	University of Toronto Press
Faculty of Medicine Siriraj Hospital, Mahidol University	Update Software

Finnish Institute of Occupational Health, Finland	WHO Eastern Mediterranean Regional Office
Freie Universität Berlin, International Academy, Institut für Qualitative Forschung	World Health Organization
Future Science Group	Worldwatch Institute
Guilford Publications, Inc.	

Table 16: Publishers and aggregators participating in the eIFL programme

Agricola	JSTOR
Agris	Keesing's
Alexander Street Press	Medline
American Association for the Advancement of Science (AAAS)	Morgan & Claypool Publishers
American Physical Society	Multi-Science Journals Collection
American Psychological Association	Nature Publishing Group
Anthropological Index Online	New England Journal of Medicine
BioOne	Ovid Linksolver
Britannica Online: Academic Edition	Ovid Nursing Database
Burgundy Information Services	Ovid Technologies
CSIRO Publishing	Oxford English Dictionary
Cambridge Journals Online	Oxford Journals Collection
Computing Reviews	Oxford Reference Online
ebrary	Oxford Scholarship Online
EBSCO Publishing	Palgrave Macmillan Journals
Emerald Group Publishing Limited	Project MUSE
Eric	RMIT Publishing
Future Science Group	Royal Society
GALE – A Cengage Learning Company	SAGE
IBSS – International Bibliography of the Social Sciences	SPIE Digital Library
IOP Publishing	Taylor & Francis Databases
ISD – International Science Database	Taylor & Francis Encyclopedias
Institution of Civil Engineers	Wiley InterScience Journals